Effectiveness of family-based educational interventions on increasing physical activity and controlling hypertension in older adults

Efectividad de las intervenciones educativas basadas en la familia para aumentar la actividad física y controlar la hipertensión en adultos mayores

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Abstract

Background: Increased physical activity is an effective non-pharmacological strategy for blood pressure control; however, its implementation is often limited by inadequate family support. Family-based educational interventions are expected to improve physical activity and support blood pressure control among the elderly.
Objective: This study aimed to analyze the effectiveness of a family-based educational intervention on increasing physical activity and controlling hypertension among older adults in Danau Kedap Village, Muaro Jambi Regency.
Methods: A quasi-experimental study with a pretest–posttest control group design was conducted among 60 hypertensive older adults, divided into intervention (n=30) and control (n=30) groups. The intervention was delivered for 8 weeks. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ), and blood pressure was assessed using a calibrated digital sphygmomanometer. Data were analyzed using paired t-test, independent t-test, and multiple linear regression with a significance level of $p<0.05$ using SPSS.
Results: The mean physical activity score in the intervention group increased from 812.5 ± 210.4 MET-minutes/week to 1456.7 ± 320.8 ($p<0.001$), while no significant change was found in the control group ($p=0.084$). Systolic blood pressure decreased from 154.6 ± 8.5 mmHg to 138.2 ± 7.9 mmHg ($p<0.001$), and diastolic blood pressure decreased from 92.4 ± 5.6 mmHg to 84.1 ± 4.8 mmHg ($p<0.001$). Multivariate analysis showed that the family-based educational intervention was the strongest predictor of increased physical activity ($\beta=0.612$; $p<0.001$) and decreased systolic blood pressure ($\beta=-0.584$; $p<0.001$) with an Adjusted R^2 of 0.48.
Conclusion: Family-based educational intervention effectively increases physical activity and reduces blood pressure among hypertensive older adults and serves as the most dominant factor in hypertension control.

Keywords

Elderly; family-based education; hypertension; physical activity.

Resumen

Antecedentes: El aumento de la actividad física es una estrategia no farmacológica eficaz para el control de la presión arterial; sin embargo, su implementación suele verse limitada por el insuficiente apoyo familiar. Se espera que las intervenciones educativas basadas en la familia mejoren la actividad física y apoyen el control de la presión arterial en los adultos mayores.
Objetivo: Este estudio tuvo como objetivo analizar la efectividad de una intervención educativa basada en la familia para aumentar la actividad física y controlar la hipertensión en adultos mayores en la aldea de Danau Kedap, en el distrito de Muaro Jambi.
Métodos: Se realizó un estudio cuasi experimental con un diseño de pretest–postest con grupo control en 60 adultos mayores con hipertensión, divididos en grupo de intervención (n=30) y grupo control (n=30). La intervención se llevó a cabo durante 8 semanas. La actividad física se midió mediante el International Physical Activity Questionnaire (IPAQ), y la presión arterial se evaluó utilizando un esfigmomanómetro digital calibrado. Los datos se analizaron mediante prueba t pareada, prueba t independiente y regresión lineal múltiple, con un nivel de significación de $p<0.05$ utilizando SPSS.
Resultados: La puntuación media de actividad física en el grupo de intervención aumentó de 812.5 ± 210.4 MET-minutos/semana a 1456.7 ± 320.8 ($p<0.001$), mientras que no se encontró un cambio significativo en el grupo control ($p=0.084$). La presión arterial sistólica disminuyó de 154.6 ± 8.5 mmHg a 138.2 ± 7.9 mmHg ($p<0.001$), y la presión arterial diastólica disminuyó de 92.4 ± 5.6 mmHg a 84.1 ± 4.8 mmHg ($p<0.001$). El análisis multivariado mostró que la intervención educativa basada en la familia fue el predictor más fuerte del aumento de la actividad física ($\beta=0.612$; $p<0.001$) y de la disminución de la presión arterial sistólica ($\beta=-0.584$; $p<0.001$), con un R^2 ajustado de 0.48.
Conclusión: La intervención educativa basada en la familia aumenta eficazmente la actividad física y reduce la presión arterial en adultos mayores con hipertensión, y constituye el factor más dominante en el control de la hipertensión.

Palabras clave

Adultos mayores; educación basada en la familia; hipertensión; actividad física.

Introduction

Hypertension is one of the non-communicable diseases and a leading cause of morbidity and mortality among older adults (Badia et al., 2002; Ye et al., 2018). With advancing age, physiological changes occur in the cardiovascular system, such as reduced vascular elasticity and increased peripheral resistance, which contribute to elevated blood pressure. According to the World Health Organization (WHO), hypertension is often referred to as a "silent killer" because most individuals do not exhibit specific symptoms until severe complications occur, such as stroke, coronary heart disease, and kidney failure. This condition makes hypertension a significant public health issue that requires comprehensive promotive and preventive approaches, especially among older adults who are more vulnerable to complications (Bista et al., 2021; Wickman et al., 2021).

One effective non-pharmacological strategy for hypertension control is regular physical activity. Physical activity can help lower systolic and diastolic blood pressure through improved endothelial function, better metabolism, and weight management. However, the success of physical activity interventions in older adults is highly influenced by social support, particularly from family as the closest support system (Köchli et al., 2019; Uchino et al., 2022). A family-based educational approach is important because families play a key role in motivating, facilitating, and supervising older adults' adherence to a healthy lifestyle. Thus, interventions involving family are expected to have a more sustainable impact compared to individual education alone (Barone Gibbs et al., 2021).

Globally, WHO reports that over 1.2 billion adults live with hypertension, with the majority in low- and middle-income countries (Wulandari et al., 2020). The prevalence of hypertension increases significantly among those aged over 60 years. In Indonesia, according to the Ministry of Health through the Basic Health Research (Riskesdas) survey, the prevalence of hypertension among adults aged ≥18 years has shown an increasing trend in recent years, with the highest proportion found in older adults. In Jambi Province, hypertension is among the top ten most common diseases in primary healthcare facilities (Kemenkes, 2023). This indicates that hypertension in older adults is not only a global and national issue but also a significant local health problem (Alsaqabi & Rabbani, 2020).

At the local level, Danau Kedap Village in Muaro Jambi Regency has a substantial older adult population and limited access to community-based health promotion programs. Data from the local health center show that hypertension is one of the most common chronic diseases among older adults, with many cases not optimally controlled. Additionally, older adults' physical activity levels in this village are relatively low due to age, limited knowledge, and lack of family support to maintain an active lifestyle. This phenomenon highlights the urgent need for contextual and community-based interventions.

Although various hypertension control programs have been implemented, most still focus on pharmacological therapy and individual education at healthcare facilities. The observed gap is the low level of physical activity among older adults and suboptimal family involvement in supporting healthy behavior changes (Barone Gibbs et al., 2021). Older adults often do not receive adequate guidance in following health recommendations, resulting in inconsistent adherence to physical activity and blood pressure control. This indicates the need for a more holistic intervention approach that involves families as agents of behavior change (Ningsih et al., 2020; Sanca et al., 2025).

From a research perspective, several studies have shown that health education can improve older adults' knowledge and attitudes toward hypertension management (Bogale et al., 2020). However, studies specifically evaluating the effectiveness of family-based educational interventions on both physical activity and blood pressure control in rural older adults, particularly in Muaro Jambi Regency, remain limited. This research gap indicates that scientific evidence on contextual, family-based intervention models at the village level still needs strengthening, especially within the local socio-cultural context (Xu et al., 2024).

The urgency of this study lies in the high burden of hypertension among older adults and its impact on quality of life and healthcare costs. Without optimal control, hypertension can lead to complications that worsen older adults' health and increase dependence on family. This study offers novelty in the systematic implementation of an educational intervention that actively involves family members in promoting physical activity and monitoring blood pressure. This approach is expected to create more sustainable behavioral changes, supported by the immediate environment of the older adult.

The aim of this study is to analyze the effectiveness of family-based educational interventions on increasing physical activity and controlling hypertension among older adults in Danau Kedap Village, Muaro Jambi Regency, conducted from June to September 2025. The study is expected to provide theoretical benefits by enriching nursing and public health knowledge regarding family-based interventions and practical benefits as a foundation for developing promotive and preventive programs at the village level. In addition, the study can serve as a reference for policymakers and healthcare workers in designing more participatory, effective, and sustainable hypertension control strategies.

Method

This study employed a quantitative, quasi-experimental design with a pretest–posttest control group design. This design was chosen to evaluate the effectiveness of family-based educational interventions on increasing physical activity and controlling hypertension in older adults by comparing changes before and after the intervention in both the intervention and control groups. The intervention group received structured family-based education, while the control group received standard education from the local health center without intensive family involvement. This design allows the evaluation of causal relationships between the intervention and outcome changes while considering the limitations of full randomization at the community level.

The study was conducted in Danau Kedap Village, Muaro Jambi Regency, Jambi Province, from June to September 2025. This location was chosen due to the high number of older adults with hypertension and the lack of structured family-based educational programs. The research activities included preparation, baseline data collection (pretest), an 8-week intervention, and endline data collection (posttest). All procedures were conducted in collaboration with the local health center and village health volunteers to ensure accessibility for respondents and program sustainability.

The study population included all older adults (≥60 years) diagnosed with hypertension residing in Danau Kedap Village. Inclusion criteria were: older adults with hypertension diagnosed according to WHO criteria (systolic blood pressure ≥140 mmHg and/or diastolic ≥90 mmHg based on repeated measurements), able to communicate effectively, living with or having family members willing to serve as caregivers, and willing to participate in the entire study. Exclusion criteria included older adults with severe complications (e.g., acute stroke, severe heart failure), severe cognitive impairment, or physical conditions preventing light-to-moderate physical activity. Samples were selected using purposive sampling, with group allocation based on hamlet areas to minimize intervention contamination.

Sample size was calculated using the formula for comparing two means in a pretest–posttest design with two groups, assuming a 95% confidence level (α=0.05), 80% power (β=0.20), and a medium effect size (d=0.5) based on similar intervention studies. The calculation required a minimum of 27 participants per group, increased by 10% to account for potential dropouts, resulting in 30 participants per group and a total of 60 participants. Sample size also considered the available population in the study area.

The primary outcomes of the study were: (1) changes in the physical activity levels of older adults and (2) changes in systolic and diastolic blood pressure. The main exposure was a family-based educational intervention designed to improve knowledge, motivation, and family involvement in the management of hypertension among older adults. The intervention was conducted for 8 weeks with one structured educational session each week, lasting approximately 60–90 minutes. Each session involved the older adult and one family member who served as the primary caregiver. The intervention methods included interactive lectures, small group discussions, demonstrations of light-to-moderate physical activities that were safe for older adults, and the provision of written educational modules that could be studied at home.

The educational materials covered several key topics, including basic understanding of hypertension and its risk factors, the importance of physical activity for cardiovascular health in older adults, guidelines for safe and appropriate physical activity for individuals with hypertension, healthy dietary management including salt intake restriction, adherence to antihypertensive medication, and the role of family members in providing emotional support and monitoring the health behaviors of older adults. In addition to the weekly face-to-face sessions, family members were asked to routinely monitor the physical activity of the older adults at home using a simple monitoring sheet provided by the researchers.

The research team and village health volunteers also conducted weekly monitoring to ensure the implementation of the intervention and provided feedback to the families.

The predictor variables in this study included age, sex, educational level, duration of hypertension, and medication adherence. Potential confounding variables included body mass index (BMI), smoking habits, dietary patterns (particularly salt intake), and comorbidities. Effect modifier variables included the level of family support and the respondents' baseline knowledge of hypertension.

Physical activity was measured using the short-form International Physical Activity Questionnaire (IPAQ), which has been widely used internationally with good validity and reliability (Craig et al., 2003). The Indonesian version was validated with a Cronbach's alpha >0.70. Physical activity scores were converted into MET-minutes/week and categorized as low, moderate, or high according to IPAQ guidelines. Blood pressure was measured using a calibrated digital sphygmomanometer following standard procedures: participants rested for 5 minutes, avoided smoking or caffeine for 30 minutes prior, and two measurements were taken 1–2 minutes apart and averaged. BMI was calculated from weight measured using a digital scale and height using a stadiometer. Family support was measured using a social support questionnaire validated by experts, with Cronbach's alpha >0.70 in previous studies in Indonesia.

Data were obtained from primary sources through structured interviews, questionnaires, and direct measurements of blood pressure and anthropometry. Secondary data were obtained from health center records to confirm hypertension diagnosis and treatment history. Assessment procedures were identical for both intervention and control groups, with standardized instruments and trained enumerators to ensure comparability. Inter-rater reliability was tested among blood pressure measurers to minimize measurement variability.

To reduce potential bias, the study standardized measurement procedures, trained enumerators, used validated instruments, separated intervention and control locations to prevent information contamination, and applied intention-to-treat analysis to mitigate dropout bias. Recall bias was minimized by referencing physical activity over the previous 7 days as per IPAQ guidelines. Blood pressure measurements were conducted at relatively the same time (morning) to reduce circadian variation.

Data collection occurred in three phases: pretest (week 0), weekly monitoring during the 8-week intervention (weeks 1–8), and posttest (week 9). Data were analyzed using the latest version of SPSS. Univariable analyses described respondent characteristics, bivariate analyses used paired t-tests or Wilcoxon tests to assess within-group changes and independent t-tests or Mann–Whitney tests to compare between groups. Multivariable analyses used linear regression to control for confounders. Statistical significance was set at $p<0.05$ with a 95% confidence interval. Results were presented in tables and narrative form to provide a comprehensive overview of intervention effectiveness

Ethical Clearance

This study obtained ethical approval from the Health Research Ethics Committee (KEPK) of Poltekkes Kemenkes Jambi. The ethical approval was issued on March 5, 2025, with the reference number: LB.02.06/2/15/2025.

Results

The table presents the characteristics of respondents in the intervention and control groups. The mean age of participants was 67.4 ± 5.2 years in the intervention group and 66.8 ± 4.9 years in the control group, indicating similar age distribution between groups. The majority of respondents were female, with 18 participants (60%) in the intervention group and 17 participants (56.7%) in the control group. Regarding education, most respondents had a level of elementary school or lower, with 20 (66.7%) in the intervention group and 21 (70%) in the control group. The duration of hypertension over five years was reported in 16 participants (53.3%) in the intervention group and 15 participants (50%) in the control group. The proportion of participants with a BMI ≥25 kg/m^2 was 46.7% in the intervention group and 43.3% in the control group. Finally, medication adherence was observed in 19 participants (63.3%) in the intervention group and 18 participants (60%) in the control group

Table 1. Distribution of Respondents' Characteristics by Group

Characteristics	Intervention (n=30)	Control (n=30)
Age (mean ± SD)	67.4 ± 5.2	66.8 ± 4.9
Sex (Female)	18 (60%)	17 (56.7%)
Education ≤ Elementary School	20 (66.7%)	21 (70%)
Duration of Hypertension >5 years	16 (53.3%)	15 (50%)
BMI ≥25 kg/m^2	14 (46.7%)	13 (43.3%)
Medication Adherence	19 (63.3%)	18 (60%)

Table 2 presents the changes in physical activity scores before and after the intervention. The intervention group showed an increase in mean physical activity scores from 812.5 ± 210.4 to 1456.7 ± 320.8 MET-minutes/week ($p<0.001$), indicating a significant improvement in physical activity after receiving family-based education. In contrast, the control group did not show a significant change, with scores increasing from 790.3 ± 198.7 to 845.6 ± 230.5 MET-minutes/week ($p=0.084$). These results confirm that family-based interventions are effective in enhancing physical activity among older adults compared to standard education.

Table 2. Changes in Physical Activity Before and After the Intervention

Group	Pretest (Mean ± SD)	Posttest (Mean ± SD)	p-value
Intervention	812.5 ± 210.4	1456.7 ± 320.8	<0.001
Control	790.3 ± 198.7	845.6 ± 230.5	0.084

Table 3 shows the changes in systolic and diastolic blood pressure in both groups. In the intervention group, systolic blood pressure significantly decreased from 154.6 ± 8.5 mmHg to 138.2 ± 7.9 mmHg ($p<0.001$), and diastolic blood pressure decreased from 92.4 ± 5.6 mmHg to 84.1 ± 4.8 mmHg ($p<0.001$). The control group did not experience a significant reduction, with systolic blood pressure changing from 153.8 ± 7.9 mmHg to 149.7 ± 8.1 mmHg ($p=0.072$) and diastolic blood pressure from 91.8 ± 5.2 mmHg to 89.9 ± 5.4 mmHg ($p=0.095$). These results indicate that the family-based educational intervention contributed to better blood pressure control among older adults.

Table 3. Changes in Systolic and Diastolic Blood Pressure

Variable	Group	Pretest (Mean ± SD)	Posttest (Mean ± SD)	p-value
Systolic (mmHg)	Intervention	154.6 ± 8.5	138.2 ± 7.9	<0.001
	Control	153.8 ± 7.9	149.7 ± 8.1	0.072
Diastolic (mmHg)	Intervention	92.4 ± 5.6	84.1 ± 4.8	<0.001
	Control	91.8 ± 5.2	89.9 ± 5.4	0.095

Table 4 presents the results of multiple linear regression analysis for changes in physical activity and systolic blood pressure using age, BMI, family support, duration of hypertension, and medication adherence as independent variables. In the model for changes in physical activity, age ($\beta=-0.182$; $p=0.036$) and BMI ($\beta=-0.158$; $p=0.044$) had a significant negative effect, whereas family support ($\beta=0.294$; $p=0.002$) had a significant positive effect on the increase in physical activity. Duration of hypertension and medication adherence did not have a significant impact ($p>0.05$). The Adjusted R^2 of 0.41 indicates that 41% of the variance in changes in physical activity could be explained by the variables included in the model.

Table 4. Multiple Linear Regression Analysis of Changes in Physical Activity and Systolic Blood Pressure

Variable	Change in Physical Activity (β)	p-value	Change in Systolic BP (β)	p-value
Age	-0.182	0.036	0.171	0.039
BMI	-0.158	0.044	0.196	0.023
Family Support	0.294	0.002	-0.218	0.013
Duration of Hypertension	-0.121	0.074	0.146	0.047
Medication Adherence	0.139	0.061	-0.226	0.011
Adjusted R^2	0.41		0.46	

In the model for changes in systolic blood pressure, age (β=0.171; p=0.039), BMI (β=0.196; p=0.023), and duration of hypertension (β=0.146; p=0.047) had a significant positive effect on blood pressure change, while family support (β=-0.218; p=0.013) and medication adherence (β=-0.226; p=0.011) had a significant negative effect. The Adjusted R^2 of 0.46 indicates that 46% of the variance in changes in systolic blood pressure could be explained by the variables in the model.

Discussion

This study aimed to analyze the effectiveness of family-based educational interventions on increasing physical activity and controlling hypertension among older adults in Danau Kedap Village, Muaro Jambi Regency. Based on bivariate and multivariate analyses, the study objectives were achieved, as evidenced by significant increases in physical activity and reductions in both systolic and diastolic blood pressure in the intervention group compared to the control group. Family-based educational intervention was proven to be the most dominant predictor of increased physical activity and decreased blood pressure after controlling for respondents' characteristics. This indicates that active family involvement contributes meaningfully to changes in older adults' health behaviors.

The study findings showed that older adults who received family-based education experienced a significant increase in physical activity scores and greater reductions in blood pressure compared to those who received only standard education. The improvement in physical activity directly contributes to blood pressure regulation through mechanisms such as enhanced vascular elasticity and reduced peripheral resistance. In addition, family support in the form of supervision, motivation, and guidance for physical activity strengthened older adults' adherence to health recommendations. Therefore, the intervention not only increased knowledge but also facilitated sustainable behavioral changes.

Although the intervention group generally demonstrated a significant reduction in blood pressure, two older adults in the intervention group experienced an increase in blood pressure at the final measurement. This finding indicates that the response to the intervention was not entirely homogeneous and may have been influenced by external factors beyond the educational components provided. Based on follow-up interviews, one participant reported experiencing emotional stress due to an interpersonal conflict with their child a few days prior to the measurement. Psychosocial stress is known to trigger activation of the sympathetic nervous system and increased secretion of stress hormones such as cortisol and catecholamines, which can acutely elevate blood pressure. Meanwhile, the other participant reported consuming a relatively high amount of salted fish shortly before the evaluation. Excessive sodium intake is a well-established risk factor for elevated blood pressure through mechanisms involving fluid retention and increased intravascular volume (Alifariki et al., 2021; Bangu & Siagian, H.J, 2025). Therefore, the increase in blood pressure observed in these two participants was most likely influenced by situational and behavioral factors of a temporary nature rather than reflecting the ineffectiveness of the intervention as a whole. This finding further emphasizes that hypertension control is multifactorial and requires a comprehensive approach that not only focuses on physical activity but also addresses stress management and sodium intake regulation (Hossain, Ahsan, et al., 2025; Hossain, Sultana, et al., 2025).

These results align with the World Health Organization's recommendations emphasizing the importance of regular physical activity as part of hypertension management in older adults. They are also consistent with previous studies indicating that family-based interventions are more effective than individual education in improving adherence to chronic disease management. Prior research has shown that family involvement enhances older adults' self-efficacy in performing physical activities and adhering to medication regimens, which in turn leads to better blood pressure control. Consequently, this study strengthens the empirical evidence supporting the importance of a family-based approach in hypertension management (Am et al., 2023; Jones et al., 2001).

These findings are also consistent with several previous studies examining the role of family and social support in chronic disease management among older adults. Previous research has demonstrated that family involvement can significantly improve adherence to lifestyle modifications, including increased physical activity and better blood pressure control. For example, studies have shown that social support from family members helps individuals maintain long-term health behaviors by providing encouragement, monitoring, and practical assistance in daily activities (Gallant, 2003). Similarly, research on

health behavior change indicates that family-based support systems enhance individuals' motivation to adopt and sustain physical activity, particularly among older adults managing chronic conditions

Furthermore, evidence from social support research highlights that emotional and instrumental support from family members contributes to improved cardiovascular outcomes, including reductions in blood pressure. Social relationships can influence health by reducing psychological stress, improving coping mechanisms, and promoting adherence to recommended health behaviors (Cohen, 2004; Uchino, 2006). In line with these findings, the present study demonstrates that integrating family members into educational interventions can strengthen the effectiveness of behavioral modification programs aimed at improving physical activity and hypertension control among older adults.

Theoretically, the findings are supported by social support theory, which posits that emotional, informational, and instrumental support from family plays a key role in forming and maintaining healthy behaviors. In addition, behavior change theories such as the Health Belief Model explain that perceived benefits and environmental support increase the likelihood of individuals adopting preventive health actions (Mehta et al., 2024; Uchino et al., 2022). In the context of older adults, the family serves as the closest support system with frequent interactions, making family-based interventions more effective in modifying behavior compared to individual approaches alone (Bengtsson et al., 2016; Sanchez-Martínez et al., 2016).

Correlation analyses revealed a significant negative relationship between increased physical activity and reductions in both systolic and diastolic blood pressure. In other words, higher levels of physical activity were associated with greater decreases in blood pressure. These findings reinforce the physiological mechanism that regular physical activity improves cardiovascular function and reduces cardiac workload. Furthermore, body mass index (BMI) and age were positively correlated with blood pressure, indicating that older adults with higher BMI tend to experience smaller reductions in blood pressure compared to those with normal BMI (Cahyono et al., 2025; Hashemi-Arend et al., 2022).

Another observed correlation was the positive relationship between family support and increased physical activity. Older adults with high family support showed more significant increases in physical activity than those with low family support. This indicates that family support acts as an effect modifier in the relationship between the intervention and the outcomes. Medication adherence also contributed to blood pressure reduction, highlighting that hypertension management is multidimensional and not dependent on a single factor.

The practical implications of this study include providing a scientific basis for developing family-based promotive and preventive programs at the village level, particularly for hypertension management in older adults. The findings can guide healthcare workers in primary health centers to integrate families into all hypertension education programs. However, this study has limitations, including a quasi-experimental design that did not fully use randomization, a relatively small sample size, and an intervention duration of only eight weeks, which is insufficient to assess long-term effects. Additionally, the use of questionnaires to measure physical activity may introduce recall bias. Therefore, further research using randomized controlled trials with longer follow-up periods is recommended to strengthen these findings.

Conclusions

Based on the results of this study, it can be concluded that family-based educational interventions are effective in increasing physical activity and reducing blood pressure in older adults with hypertension in Danau Kedap Village, Muaro Jambi Regency. Older adults who received active guidance and support from their families showed significant improvements in physical activity and better blood pressure control compared to those who did not receive family-based interventions. Factors such as age, body mass index, medication adherence, and the level of family support also influenced the outcomes, but the family-based educational intervention remained the most dominant factor. Thus, a family-based approach is proven to have a positive impact on hypertension management in older adults.

It is recommended that health workers at primary health care centers integrate a family-based educational approach into programs for controlling hypertension among older adults. Families should be actively involved in providing motivation, supervision, and routine guidance for physical activity. For future researchers, it is suggested to conduct studies with larger sample sizes and longer follow-up periods to evaluate the long-term effects of the intervention. Additionally, local governments can support these efforts by providing regular physical activity programs for older adults to ensure sustainable hypertension management.

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