Tahun 2026 [JURNAL KREATIVITAS PENGABDIAN KEPADA MASYARAKAT (PKM), P-ISSN: 2615-0921 E-ISSN: 2622-6030 VOLUME 9 NOMOR 2 TAHUN 2026] HAL 217-229

EMPOWERING ELDERLY PEOPLE AT RISK OF STROKE THROUGH HEALTH EDUCATION, PHYSICAL ACTIVITY, AND COMMUNITY-BASED TECHNOLOGY

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Disubmit: 14 Desember 2025 Diterima: 07 Januari 2026 Diterbitkan: 01 Februari 2026
Doi: https://doi.org/10.33024/jkpm.v9i2.24004

ABSTRACT

Stroke is one of the leading causes of disability and death in Indonesia, especially in the pre-elderly and elderly groups with risk factors for hypertension, diabetes, obesity, and a sedentary lifestyle. This community service program aims to increase public awareness, knowledge, and skills in stroke prevention through health education, physical activity, dietary management, and clean, healthy living behaviors (PHBS). Implementation includes socialization, health counseling, physical activity training, healthy eating support, and optimization of Posbindu and Elderly Posts. The activity results showed increased knowledge among cadres and the elderly about stroke risk factors, increased participation in physical activity, changes in healthy eating behaviors, and greater compliance among the elderly with routine health check-ups. The use of simple technologies, such as WhatsApp groups, gymnastics videos, and applications of the Ministry of Health's Posbindu information system, supports the program's sustainability. The elderly have a moderate stroke risk of 62%, which is the highest risk of stroke. Cadre knowledge increased from 57.5 to 84. Systolic and diastolic blood pressure decreased after interval walking training (IWT). Community-based empowerment through educational approaches, physical exercise, and simple technology has been shown to increase the capacity of people at risk of stroke and to improve health and productivity. It is recommended that this community-based empowerment model be integrated into public health programs on an ongoing basis to expand its impact on stroke prevention and productivity.

Keywords: Stroke Risk, Elderly, Education, Physical Activity.

1. INTRODUCTION

Stroke remains one of the leading causes of disability and mortality worldwide, including in Indonesia. Data from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia/SKI) indicate that stroke prevalence continues to rise, particularly among older adults and individuals with major risk factors such as hypertension, diabetes mellitus, obesity, and sedentary behavior. This growing burden poses significant challenges to public health systems and community well-being. Importantly, a substantial proportion of stroke cases are preventable. Community-based strategies that emphasize health education, early risk detection, and sustainable lifestyle modification

play a crucial role in reducing stroke incidence and improving population health outcomes. (Sari et al., 2022).

Community empowerment is one of the effective strategies in stroke prevention efforts. This approach emphasizes improving people's knowledge, skills, and attitudes in managing stroke risk factors independently. Through proper health education, people can understand the importance of implementing a healthy diet, doing regular physical activity, and undergoing regular health checkups. In addition, active community involvement in prevention programs can increase the effectiveness of interventions, as individuals feel responsible for their own health and are encouraged to sustainably maintain healthy living behaviors (Bogic et al., 2025). Regular physical activity plays an important role in stroke prevention efforts through various physiological mechanisms. Physical exercise has been proven to be able to lower blood pressure, increase insulin sensitivity, and improve lipid profiles in the blood, so that it can reduce the risk of cardiovascular disease. Exercise programs that are structured and tailored to individual conditions, such as moderate to high-intensity aerobic exercise, balance training, and strength training, can provide significant benefits for individuals with stroke risk factors. However, most people, especially older people and pre-elderly, still face limited access to safe, precise, and easy-to-apply physical exercise information and guidelines in daily life. (Chugh et al.).

In an effort to reduce the incidence of non-communicable diseases (NCDs) such as stroke, the Ministry of Health of the Republic of Indonesia has launched a Health Transformation consisting of six main pillars. One of the pillars that has a strategic role is the Transformation of Primary Services, which aims to strengthen health services at the community level to be able to detect and prevent diseases early. Through this approach, primary health services are directed to be promotive and preventive. The Primary Service Transformation Program includes strengthening the role of the Non-Communicable Disease Integrated Development Post (Posbindu PTM) as a means of early detection of NCD risk factors, routine health monitoring, and providing sustainable health education to the community to increase awareness and healthy living behaviors. (Bam et al., 2022)

As part of efforts to support government programs in the prevention of non-communicable diseases, especially stroke, community-based interventions that integrate health education and physical exercise sustainably are needed. This approach is considered effective because it involves the active participation of the community in maintaining and improving their own health. Community empowerment programs not only have a positive impact on reducing stroke risk factors in individuals but also contribute to improving the overall quality of life of the community. This community service program aims to increase public awareness, knowledge, and skills in stroke prevention efforts. The activities carried out include health education about risk factors and stroke prevention, safe and appropriate physical exercise training, healthy eating arrangements, and the implementation of clean and healthy living behaviors (PHBS). Through this program, the community will be able to implement a healthy lifestyle independently and sustainably.

2. PROBLEM

The priority problems faced by pre-elderly and elderly community groups in RW 07 Pekayon village are 1) The low level of awareness among the elderly about stroke prevention and lack of understanding of the importance of early detection through periodic health check-ups; 2) Lack of involvement of the elderly and the elderly in the health programs that have been provided and the lack of activity of the elderly and the elderly in carrying out physical activities; 3) Unhealthy diet and lack of clean and healthy living behaviors (PHBS); and 4) Posbindu and Poslansia services that are not optimal.

With this program, it is hoped that older people can better understand stroke risk factors, increase participation in safe physical activities, and adopt a healthy diet as a preventive measure against stroke. This program will also form a community of older adults who care about stroke as an effort to maintain the sustainability of the results of interventions, so that it can provide long-term benefits for the people of Pekayon Village, especially RW 07, namely, the community becomes healthy. With a healthy community, it can reduce the cost of treating stroke patientx

3. LITERATURE REVIEW

Hypertension is a significant risk factor for ischemic and hemorrhagic stroke, as it contributes to atherosclerosis and microvascular dysfunction. This condition causes the artery walls to weaken, increasing the chances of rupture of blood vessels in a hemorrhagic stroke. In addition, hypertension affects the permeability of the blood-brain barrier through pathways such as the release of vascular endothelial growth factor (VEGF), resulting in cerebral edema. Effective blood pressure management can reduce the risk of stroke by up to 41%, highlighting the importance of hypertension control in prevention (Saifullah et al., 2024). Hypertension is a significant modifiable risk factor for stroke, contributing to cerebrovascular damage and cognitive decline. Studies show that normal high blood pressure can increase the risk of developing atrial fibrillation (AF) by up to 60%, and the coexistence of hypertension and AF can increase the risk of stroke by more than fivefold. Effective management strategies, including individualized blood pressure control and early detection of AF, are essential to reduce the incidence of stroke in hypertensive patients, as emphasized by current European Society of Cardiology guidelines. (Sędek et al., 2025)

Hypertension significantly increases the risk of stroke, as highlighted in a literature review. The study analyzed 16 articles that revealed that high blood pressure is a major risk factor for cardiovascular disease, including stroke. Unhealthy lifestyles, genetic predispositions, and other medical conditions contribute to hypertension. Effective control strategies, such as dietary changes, increased physical activity, and antihypertensive medications, can lower blood pressure and further reduce the risk of stroke, emphasizing the need for awareness and intervention. (Thalib, 2025). Hypertension is a significant risk factor for stroke, as it contributes to the development of atherosclerosis and increases the likelihood of rupture of blood vessels or blockages. The literature shows that patients with hypertension often lack adequate knowledge about stroke risk factors and symptoms. A review of studies indicates that many individuals with

hypertension are unaware of their increased risk of stroke, highlighting the need for increased education and awareness to improve prevention strategies and reduce the incidence of stroke among this population. (Maniatunufus & Nursiswati, 2024).

4. METHODS

This community service activity was carried out in RW 07 Pekayon Village by involving the Integrated Development Post for Non-Communicable Diseases (Posbindu PTM) and the Elderly Post as the main partners in the implementation of the program. The selection of the location of the activity was based on the results of a preliminary survey, which showed the high prevalence of hypertension and the low level of awareness of the public, especially the pre-elderly and elderly groups, on the importance of stroke prevention. These conditions demonstrate the need for targeted and sustainable community-based interventions. Participants in this program amounted to 50 people, consisting of PTM Posbindu cadres, Elderly Post cadres, and members of the general public with pre-elderly and elderly age ranges. The involvement of cadres is expected to strengthen the sustainability of the program. At the same time, the participation of the target community is the key to success in improving knowledge, attitudes, and behaviors on stroke prevention at the community level.

The method of implementing activities uses a community-based participatory approach. This is intended so that the community is not only an object, but also a subject that plays an active role in every stage of the activity. The program began with the socialization and coordination stage with the Chairman of RW, Posbindu cadres, and PKK administrators to convey the goals, benefits, and activity plans, as well as mapping the needs of partners. Furthermore, health counseling was carried out regarding risk factors for stroke, hypertension prevention, early detection of non-communicable diseases, and clean and healthy living behaviors (PHBS). Counseling is carried out interactively with lecture methods, group discussions, and simulated health checks using media in the form of leaflets, posters, videos, and training modules.

The next stage in this community service activity is the implementation of training and physical activity assistance for participants, especially the elderly and pre-elderly groups. The physical activities provided were in the form of hypertension gymnastics and interval walking training (IWT), which was guided directly by physiotherapists with local health cadres. This activity aims to encourage participants to be able to do physical exercise regularly, safely, and independently according to their respective conditions. In addition to physical activity training, this program is also equipped with nutrition training through healthy food cooking demonstration activities. The training material emphasizes reducing salt and saturated fat intake, as well as increasing fruit and vegetable consumption. Participants were then assisted in developing a balanced daily diet that is in accordance with the nutritional needs of older people, so that it can support comprehensive stroke prevention efforts.

Optimizing the role of Posbindu PTM and Pos Ansia is carried out through strengthening routine and integrated health check-up services. The examination carried out included the measurement of blood pressure, blood

sugar levels, cholesterol, and body mass index (BMI) as the main indicators of risk factors for non-communicable diseases. All examination results were recorded systematically using the Posbindu Information System (SIP) developed by the Ministry of Health of the Republic of Indonesia. This digital-based recording allows for continuous monitoring of participants' health conditions, facilitates data analysis, and supports early detection and follow-up efforts that are more targeted at the public health service level.

The evaluation of this community service program is carried out comprehensively to assess the effectiveness of the interventions that have been implemented. Evaluation includes measurements of cognitive, clinical, and behavioral aspects of participants. Knowledge assessment was carried out through pre-test and post-test methods to determine changes in participants' level of understanding related to risk factors and stroke prevention. In addition, health parameters were measured, including blood pressure, blood sugar levels, and cholesterol, as objective indicators of changes in participants' health conditions. Monitoring physical activity behavior is also an important part of the evaluation, in order to assess the level of participation and consistency of participants in performing physical exercise regularly. The indicators of program success were determined quantitatively, namely an increase in participants' knowledge scores of at least 20%, an increase in physical activity participation in at least 75% of participants, and a decrease in systolic blood pressure of at least five mmHg in the elderly with hypertension

5. RESULTS AND DISCUSSION

a. Result

The results of data collection showed that most of the respondents were in the medium category, which was 62% (Figure 1). These findings indicate that the majority of people have a sufficient level of condition or understanding, but still need improvement through ongoing interventions. Furthermore, as many as 29% of respondents were included in the low category, which indicates that there are still community groups with a low level of condition or understanding and need more intensive attention and assistance. Meanwhile, only 9% of respondents were in the high category, showing that the proportion of people with optimal conditions or understanding is still relatively small. Overall, this data confirms the need to strengthen education and empowerment programs to encourage the shift of the low and medium categories towards the better category.

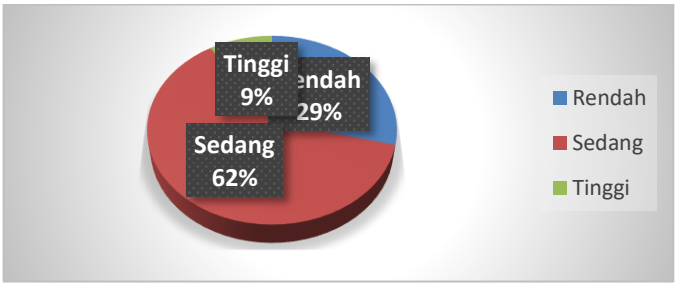

Figure 1. Stroke Risk Diagram

The results of the evaluation of the knowledge of the PTM and Elderly Post cadres showed a significant increase after the implementation of the debriefing. The average value of knowledge at the pre-test stage was recorded at 57.5, which illustrates that the understanding of cadres before the debriefing is still in the medium category. After being provided with debriefing through structured education and mentoring, the average knowledge score increased to 84 at the post-test stage (Figure 2). This improvement shows that the debriefing material provided is effective in growing cadres' understanding related to stroke prevention and management of non-communicable disease risk factors. These results confirm the importance of cadre debriefing as the spearhead in promotive and preventive efforts at the community level.

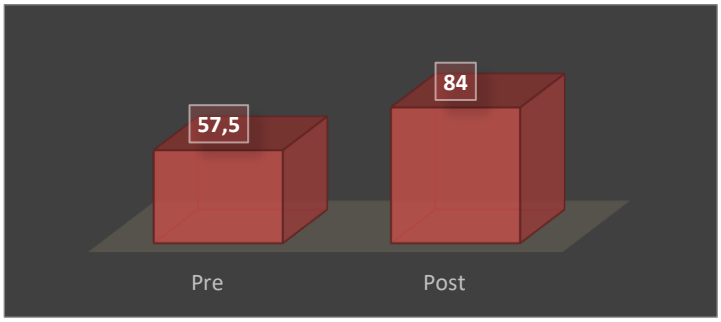

Figure 2. Pre and Post Debriefing Cadre Knowledge

The results of blood pressure measurements of older people before and after the implementation of interval walking training (IWT) showed an improvement in blood pressure values. At the initial (pre) measurement, the mean systolic blood pressure was recorded at 144 mmHg, and the diastolic pressure was recorded at 80 mmHg, indicating hypertension in most participants. After participating in the IWT (Kraemer et al.) program, there was a decrease in blood pressure, with the average systolic pressure decreasing to 133 mmHg and the diastolic pressure to 79 mmHg. This decrease shows that IWT has a positive impact on blood pressure control in older people. Although the reduction in diastolic pressure is relatively small, a significant decrease in systolic pressure reflects good cardiovascular adaptation due to regular physical activity. These results reinforce the role of community-based physical exercise as an effective nonpharmacological intervention in the prevention and control of hypertension in the elderly group.

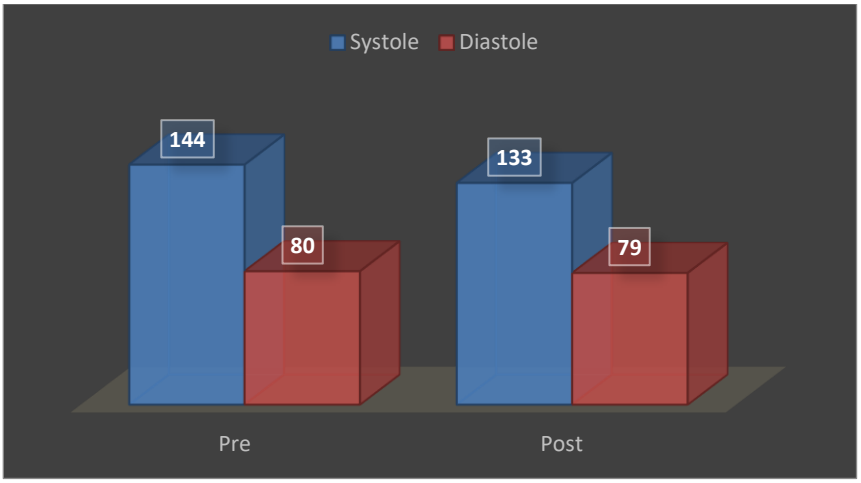

Figure 3. Systole and Diastole in pre- and post IWT

b. Discussion

Stroke is still a global health problem with a high burden of morbidity and mortality. Global Burden of Disease (GBD) data 2021 shows that stroke is the second leading cause of death in the world after ischemic heart disease, with a death rate of around 6.5 million people per year(Feigin et al., 2022). In Indonesia, the prevalence of stroke continues to increase, especially in the elderly age group with risk factors for hypertension, diabetes mellitus, obesity, dyslipidemia, and a sedentary lifestyle (BKPK, 2023). Therefore, a community-based promotive and preventive approach is needed to reduce the burden of stroke

Community empowerment in the health sector has been proven to be effective in increasing individual knowledge, skills, and independence in controlling risk factors for non-communicable diseases, as reported by the World Health Organization (WHO, 2021). This approach places the community as the main actor in maintaining their own health through increased literacy and active participation. In the context of stroke prevention, the empowerment of elderly groups through the Integrated Development Post for Non-Communicable Diseases (Posbindu PTM) and the Elderly Post has a very strategic role. These two community forums provide a great opportunity to carry out early detection of risk factors such as hypertension, diabetes, and dyslipidemia. In addition, Posbindu and Pos Lansia function as a means of continuous education regarding healthy living behaviors, physical activity, and dietary arrangements. The active involvement of the elderly community in these activities also encourages the formation of a sense of responsibility and independence, so that stroke prevention efforts can run more effectively and sustainably at the community level s. (Sacco et al., 2024) The program applies a community-based participatory research (CBPR) model, which places the community not only as the target of the activity but also as an active partner in the program planning, implementation, and evaluation process. Through this approach, the community is involved in decision-making so that the interventions carried out are more in line with local needs and contexts. The CBPR approach is in line with various research

results showing that community participation-based health interventions are more effective in improving program compliance, belonging, and sustainability compared to the top-down approach (The Lancet, 2022). Thus, this model supports the creation of more lasting health behavior changes at the community level.

Health Education and Behavior Change

Health education is one of the key components of community-based stroke prevention interventions. Knowledge of stroke risk factors, such as hypertension, smoking habits, excessive salt consumption, and lack of physical activity, is an important capital in driving health behavior change. A good understanding allows individuals to recognize risks early on and take appropriate preventive measures. Previous studies have shown that science-based health education can improve risk factor control in individuals with hypertension and diabetes. The increase in control contributes significantly to reducing the risk and incidence of stroke in the community. (Volterrani & Caminiti, 2023)

The results showed an increase in participants' knowledge scores by ≥20% after the implementation of the intervention. These findings are in line with various studies that report that health counseling is effective in increasing public understanding of clean and healthy living behaviors (PHBS). Increasing knowledge is an important first step in the process of changing health behavior. However, knowledge alone is not enough to guarantee sustainable behavior change. It is necessary to strengthen through regular assistance and monitoring so that the healthy behaviors that have been introduced can be applied consistently in people's daily lives. (Bam et al., 2022)

Physical Activity as a Key Intervention

Physical activity is one of the main pillars in stroke prevention efforts. The World Health Organization (WHO, 2020) recommends that older people do at least 150 minutes of moderate-intensity aerobic physical activity per week, accompanied by strength training at least twice a week. Regular physical activity has been shown to provide a variety of physiological benefits. A number of studies show that physical exercise is able to lower blood pressure, increase insulin sensitivity, and improve lipid profiles in the blood. In addition, physical activity also plays an important role in supporting brain neuroplasticity, so it can help maintain cognitive function and nervous system health in older people. (Avery et al., 2022)

In this program, the interventions provided are in the form of hypertension gymnastics and interval walking training (IWT). The choice of this type of exercise is considered appropriate because IWT has been proven to be able to increase cardiorespiratory capacity effectively with a relatively low risk of injury, making it safe and suitable for the elderly group. (Dwi Agustina, 2023). In addition to the physical benefits, group-based exercise also has a positive social impact on older people. Interaction and support between fellow seniors can increase motivation, sense of togetherness, and confidence in exercising. This condition contributes to improved compliance with regular and continuous physical activity in daily life. (Nemoto et al., 2007)

Evaluation of community service programs shows an increase in the frequency of physical exercise in most older people, with the achievement of doing physical activity at least three times per week. These findings indicate that the interventions implemented are able to encourage positive behavioral changes related to physical activity in the elderly group. The increase in the frequency of these exercises not only reflects an increase in awareness of the importance of physical activity but also shows a good acceptance of the program being carried out. These results are in line with the findings of a meta-analysis that reported that community-based interventions were more effective in increasing elderly participation in physical activity compared to individual interventions. The community approach was reported to be able to increase participation rates by up to 40%, due to the social support, sense of community, and mutually reinforcing motivation between participants. Thus, community-based interventions have the potential to be an effective and sustainable strategy in increasing the physical activity of older people. (Creighton et al., 2022)

Healthy Diet and Nutrition Education

Nutritional factors have an important role in determining the risk of stroke. Consumption patterns high in salt, saturated fat, and sugar have been shown to contribute to increased blood pressure, cholesterol levels, and insulin resistance. This condition is the main risk factor for cardiovascular disease, including stroke (Mazur et al., 2024). Therefore, the regulation of a healthy diet is an important component in stroke prevention efforts, especially in the pre-elderly and elderly groups. Thus, in this program, a healthy menu cooking demonstration was carried out that emphasized the consumption of vegetables, fruits, fish, and salt reduction.

The practical method of using cooking demonstrations has proven more effective than just providing theoretical information. A study in Japan showed that a cooking practice-based intervention increased adherence to a healthy diet by up to 55% (Hasan et al., 2019). In this activity, some older adults started to reduce their consumption of fried foods and replaced them with boiled or steamed foods, indicating a behavior change.

Clean and Healthy Living Behavior (PHBS)

Stroke prevention is not only related to medical and clinical factors, but is also strongly influenced by daily behavior and environmental conditions. Behaviors such as washing hands regularly, not smoking, maintaining ecological cleanliness, and avoiding exposure to pollutants make an important contribution to reducing the risk of non-communicable diseases, including stroke. Various studies emphasize the importance of a combination approach that not only targets biological factors but also pays attention to behavioral and environmental aspects as determinants of health (El Husseini et al., 2025). In this community service program, education at PHBS is provided interactively through group discussion methods and simulations. This approach allows older people to actively participate, share experiences, and understand the application of PHBS in their daily lives. The results of the activity show

that the elderly are beginning to realize that PHBS not only plays a role in the prevention of infectious diseases, but also supports the prevention of non-communicable diseases by forming a consistent healthy lifestyle. This increased understanding is expected to drive sustainable behavioural change and contribute to a reduction in stroke risk at the community level.

Technology and Innovation in Empowerment

The use of simple technology is one of the important innovations in the implementation of this program. The use of WhatsApp groups is used as a means of monitoring activities, disseminating health information, and sending reminders of physical exercise through gymnastics videos. In addition, the Posbindu Information System (SIP) from the Ministry of Health is used for recording and monitoring participants' health data digitally. Although some older adults still face limitations in access and digital literacy, the active involvement of health cadres plays an important role in bridging this gap, so that the use of technology continues to run effectively and supports the sustainability of the program.

The use of community-based health technology is in line with previous research findings that show that the use of digital health applications can increase community involvement in health promotion activities. The integration of technology in health programs also allows for continuous monitoring of participants' health conditions and behaviors. This consistent monitoring is an important factor in ensuring the success of long-term health interventions and the sustainability of behavior change at the community level. (Kang et al., 2023; Page-Reeves, 2019)

Impact on Health and Productivity

The interventions carried out in this program not only have a positive impact on health aspects but also contribute to increasing the social and economic productivity of the community. Older adults who have better health conditions tend to remain active in social activities, have higher independence, and reduce dependence on family. This condition can indirectly reduce the burden of household health costs. The World Health Organization (WHO, 2021) states that non-communicable disease prevention efforts have the potential to save up to 70% of long-term health costs that are generally allocated to the treatment of chronic diseases.

In addition, this program provides a social impact in the form of increased solidarity and community cohesion. The involvement of older people in stroke care groups encourages the formation of a culture of mutual support and sharing of experiences, which strengthens the sustainability of the program. On the other hand, health cadres gain new skills in the use of digital technology and medical devices, which have the potential to open up opportunities for the development of community-based health services.

Obstacles and Challenges

Although this community service program has shown various positive results, there are still some obstacles that need to be addressed. The first obstacle is limited access to the internet and digital devices, so that the use of health technology has not been able to run optimally for all participants. The second obstacle is related to the low motivation of some older adults to do physical activity independently at home, especially when there is no direct assistance. In addition, the sustainability of the program is still highly dependent on the active role of health cadres and the support of local partners, which can be a challenge in the event of limited resources.

To overcome these various obstacles, a comprehensive strategy is needed, including strengthening the capacity of health cadres, increasing digital literacy for older people and cadres, and developing cross-sector collaboration. Cooperation between the government, universities, and the community is key to ensuring the sustainability and expansion of the program's impact in the long term.

Policy Implications and Recommendations

This program is in line with the Transformation of Primary Services of the Ministry of Health of the Republic of Indonesia, especially in strengthening the PTM Posbindu. In the future, the results of this program can be replicated in other regions with several recommendations. Simple integration of digital technology with Posbindu services. 2) Increasing cadre training in evidence-based health education. 3) Regulatory support to expand community-based physical activity and nutrition interventions. 4) Long-term monitoring to assess the impact on reducing stroke incidence.

6. CONCLUSIONS

This community empowerment program has succeeded in improving the knowledge, skills, and preventive behavior of older people at risk of stroke. Health education, physical exercise, a healthy diet, and PHBS, integrated with Posbindu and Pos Elderly, have proven effective. Simple technological innovations support the sustainability of interventions. This model has the potential to become a national strategy for community-based stroke prevention in Indonesia. It is recommended that this community-based empowerment model be integrated into public health programs on an ongoing basis to expand its impact on stroke prevention and productivity.

THANKS

Thank you to Direktorat Penelitian dan Pengabdian kepada Masyarakat, Direktorat Jenderal Riset dan Pengembangan, Kementerian Pendidikan Tinggi, Sain, dan Teknologi, UPN Veteran Jakarta, and RW. 007 Kelurahan Pekayon, Kecamatan Pasar Rebo, Jakarta Timur.

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