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MORALITY BEFORE KNOWLEDGE

METAPREV: Holistic empowerment program for nursing homes integrated with a website to reduce metabolic syndrome in the elderly

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ABSTRACT

Background: Panti Werdha Hargo Dedali Surabaya is a social welfare institution for the elderly established in 1987, located at Jalan Manyar Kartika IX, Sukolilo, Surabaya, East Java. The institution faces serious challenges, where the initial screening of 29 elderly residents revealed a high incidence of Metabolic Syndrome (MS) indicators, aggravated by the absence of a structured program supporting a healthy lifestyle. **Methods:** Its implementation methodology utilizes the CBPR approach, comprising: coordination with partners, validation of partner need, creation of intervention media, activity implementation, and evaluation and cadres. **Findings:** The results of the Metaprev program are highly significant: the elderly experienced an improvement in health categories, with an increase in MS knowledge (93%) and TOGA processing skills (98%), alongside the establishment of new routine exercises and yoga. The Metaprev Website now functions optimally as a user-friendly monitoring tool. Sustainability is ensured through the formation of 7 Meta SEHAT Cadres. **Conclusion:** The Metaprev program successfully reduced the risk of metabolic syndrome and empowered older adults through integrated health education, digital monitoring, and sustainability led by healthcare professionals. This comprehensive approach provides a replicable and effective model for improving geriatric preventive care and promoting healthy aging in social welfare institutions. **Novelty/Originality of this article:** Metaprev is proven effective in significantly improving the healthy lifestyle and reducing the rate of Metabolic Syndrome.

KEYWORDS: metabolic syndrome, elderly, Metaprev program

1. Introduction

The increasing life expectancy of the population in Indonesia is directly proportional to the rising risk of degenerative diseases. A significant multimorbid condition is Metabolic Syndrome (MS), defined as a cluster of cardiovascular and diabetes risk factors. MS has become a major focus of promotive and preventive interventions, especially among vulnerable groups such as the elderly (Fitria et al., 2023). Metabolic Syndrome is a set of conditions (risk factors) that occur simultaneously in the body and significantly increase the risk of cardiovascular disease and type 2 diabetes, with the main conditions being:

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hypertension, diabetes (high blood sugar), low HDL (good) cholesterol, high triglycerides, and central obesity (excess fat in the abdomen or waist), where the vulnerable group at risk of this disease is the elderly.

Panti Werdha Hargo Dedali, located at Jalan Manyar Kartika IX Number 22-24, Surabaya, is one of the elderly social welfare institutions established since 1987. Based on preliminary observation data from the shelter in June-July 2025, there were 29 elderly residents in the shelter, consisting of 10 men and 19 women. Their ages ranged from 58 to 90 years, with 23 of them being retirees and 6 unemployed. Among them, 24 elderly individuals (82.76%) suffered from hypertension, 15 (51.72%) had diabetes, 10 had low cholesterol (HDL) (34.48%), and 5 elderly individuals (17.24%) experienced central obesity. These conditions are considered indicators of metabolic syndrome, so the majority of the elderly in the shelter are at risk of metabolic syndrome (Fauzi et al., 2023).

Mrs. Ifah, the shelter nurse, revealed that health data management for the elderly is still done manually, which makes it difficult for them to monitor data flexibly and in a timely manner. According to Mrs. Ifah, the main problems in the shelter include as follows. Lifestyle and inactivity of elderly individuals who tend to consume unhealthy food and have high inactive time (± 10 hours of free time/day) due to the absence of structured activity programs. This low motivation is exacerbated by dietary issues (Suhaema &Masthalina et al., 2023). Manual health data management of health data collection is done manually, which hinders the flexibility of data monitoring by the care facility. Lack of comprehensive programs, there are no structured and integrated programs for the prevention of metabolic syndrome in the daily routines of the elderly, even though potential assets are available, such as vacant land (3 plots of 5m x 2m) and elderly individuals who are still fairly active.

Based on the observations of these partners, several problems were identified, namely, the partners require a design for a comprehensive, structured, and integrated program supported by the development of a digital platform (website) to address manual data management, capable of solving lifestyle issues, inactivity, and manual health data management, in order to reduce the risk of metabolic syndrome and promote Independence in elderly health at Panti Werdha Hargo Dedali Surabaya. The aim of the Metaprev program is to reduce the prevalence of metabolic syndrome (MS), implement media in the form of the Metaprev website, and empower the elderly through the TOGA Garden as a complementary therapy and physical activation.

Therefore, Metaprev is presented as a problem-solving solution, realized through the Metaprev (Metabolic Prevention) program which is innovative, interactive, and participatory, integrating aspects of empowerment and technology. The Metaprev program is developed with the main components, namely physical and skills aspects by implementing meta-fit (scheduled exercise and yoga), Meta-Herbeverage training (making herbal drinks from TOGA), and meta-flow garden (TOGA cultivation), nutritional and cognitive aspects, applying meta-meal plan (healthy eating and drinking guide for the elderly and caretakers), and meta-neuroliteracy (literacy corner and relaxation education using virtual reality), digital aspect (E-Health), with the development of the Metaprev website for partners (as a Meta-Health Screening Digital medium for initial NCD screening and program continuity monitoring), sustainability aspect, establishment and capacity building of meta-healthy cadres. Through the empowerment provided by this program, it aligns with the second and seventh goals of creating healthier and more empowered elderly individuals with support from sustainable programs and technology that facilitates partners in health monitoring.

2. Methods

The method used in this community service program is a Community-Based Participatory Research (CBPR) approach, as shown in Figure 1. This approach ensures active involvement of partners (elderly, nurses, and the nursing home head) throughout the entire program cycle (Fauzi et al., 2023). The program was conducted at Panti Werdha

Hargo Dedali Surabaya from July 7 to October 31, 2025, with the intervention focused on 10 elderly participants engaged intensively.

Fig. 1. Program implementation method

The stages of implementing the program are carried out as follows. Coordination with Partners (Panti Werdha Hargo Dedali) stage, the first step in implementing this program is coordinating with partners. This is done through observation and initial data collection regarding existing problems at the partner, such as establishing a baseline covering data on the health conditions and history of the elderly, lifestyle, and daily activities. Validation of Partner (Panti Werdha Hargo Dedali) needs. This stage is carried out offline through field observation, interviews with the nursing home staff, and analysis of the elderly's health data with Panti Werdha Hargo Dedali Surabaya, with the data and information we obtained as follows. The high number of elderly with metabolic syndrome indicators and unhealthy lifestyles. The absence of a structured and scheduled program involving physical activities for the elderly at the nursing home. The need to increase knowledge related to lifestyle changes toward a healthier direction. Health data collection for the elderly is still being carried out manual, which makes it difficult for them to monitor health data flexibly and in a timely manner.

2.1 Intervention media creation stage

This stage is carried out to design the program and create media that are appropriate to the problems and needs that have been identified. The detailed explanation of each stage is as follows. Approach and coordination are conducted through discussions with health staff and the head of the nursing home regarding the technical implementation of the program and media concepts, as well as determining the program participants, which are 10 elderly individuals who meet the specified criteria, such as those capable of participating in the entire counseling activities. These 10 people will later become pioneers for other elderly individuals.

Program preparation includes Metaprev program and partner guideline books as references and guides in the precise implementation of each subprogram, starting from cultivating TOGA as an alternative therapy for SM. Preparation of the healthy menu book (Meta-Meal Plan Booklet) (Fitria et al., 2023). Establishment of the elderly physical activity schedule (exercise and yoga). Creation of Poster on Meta-Neuroliteracy, and the provision of Virtual Reality (VR) tools, as well as the use of website media.

Provision of screening tools: sphygmomanometer, digital scale, mid-line tape (for waist circumference), GCU and Triglyceride devices and strips (Samsiana et al., 2025). Provision of materials, TOGA seeds (ginger, turmeric, lemongrass, and galangal), planting media, polybags, as well as raw materials for herbal drink practice (Wirasisya et al., 2018). Creation of a digital platform (website mockup design using HTML, CSS, JavaScript, and PHP) with the main feature being an input form with responsiveness testing, with the creation process for elderly health monitoring and data storage through an integrated system performing Metabolic Syndrome screening and user-friendly for partners and elderly families.

2.2 Program implementation

The implementation stage of activities with details of baseline determination and coordination twice, program socialization once with partners, once with the elderly, 10 meetings including pre-test and post-test. 1 batch of cadre training and cadre inauguration and 2 sessions of program evaluation and testimonials for the elderly and partners, with a

total of 17 meetings held, monitoring of the TOGA Garden care and Literacy Corner 5 times. Activities took place from 09:00 to 10:30, with speakers from the Metaprev PKM-PM Team and participants consisting of 10 elderly, 3 nurses, and 4 orphanage cadres, held at the Orphanage Hall. The detailed activities are as follows: The Metaprev Program was carried out through a series of seven structured meetings focusing on screening, education, and lifestyle changes. Activities began with Meta-Health Screening, which included an Initial Examination of Metabolic Syndrome; weight, body mass index, body measurements, blood sugar, blood pressure, triglycerides, and light consultations related to lifestyle and habits. Subsequently, educational interventions were carried out as follows.

Metaprev, implementation of the metabolic syndrome educational counseling program for all elderly residents of the orphanage. Cognitive SM pre-test and post-test. Then, meta-herbeverage, counseling and training on Family Medicinal Plants, making herbal drinks from TOGA, pretest and post-test of TOGA (Safii et al., 2025). Furthermore, meta-meal plan, counseling on healthy food and beverage menus by providing booklets and examples of healthy menus (Suardi et al., 2025).

Aspects of physical activity and literacy are integrated through: meta-fit, counseling on light activities and exercise routines (Handayani et al., 2025). Meta-flow garden, counseling and training on how to grow TOGA (ginger, turmeric, lemongrass, galangal) (Pranowo et al., 2025). Meta-neuroliteracy, creating a literacy corner with small posters (pictures, descriptions, and benefits) of TOGA. decorating by painting polybags and making pinwheels. Education on Exercise and Physical Activity Using Virtual Reality (VR) (Hartanti, et al., 2016). Meta-commitree**,** a healthy living commitment written by the elderly and preserved in a tree icon .

2.3 Evaluation stage and cadre

The evaluation of the Metaprev program not only focuses on physical condition and diagnosis, but also includes indicators of knowledge, experience, and the program's impact on elderly individuals and partners. Therefore, the Pretest and Post-Test were created with 3 main components, namely, the implementation of the Metaprev program evaluation includes three main stages. Clinical evaluation, initial screening and rescreening to measure indicators of metabolic syndrome. Cognitive evaluation, pre-test and post-test on knowledge of Metabolic Syndrome and TOGA (Imam et al., 2025). Program testimonials to hear the experiences of the elderly regarding lifestyle changes and the program's impact on partners. Development in the Metaprev program involves various parties contributing to ensure the sustainability of the Metaprev program. The cadre consists of 7 people (3 nurses and 4 nursing home cadres) named SEHAT Cadres (Great Spirit and Responsive). Continuous program monitoring will continue to be conducted through the website agreed upon by the Team and the head of the nursing home.

3. Results Discussion

3.1 Meta-health screening results

Based on the results of the Metabolic Syndrome screening, it is shown that those who were previously categorized as having metabolic syndrome have moved to the pre-metabolic syndrome category (healthier), meaning that 60% of the elderly successfully shifted to a lower risk category after the implementation of a program promoting a healthy lifestyle (Ahmadi et al., 2025). The results of the Meta-Health Screening indicate a significant shift in the metabolic syndrome risk categories following the implementation of the comprehensive community-based Metaprev Program, affirming its efficacy. In the *Initial Screening*, out of the total 10 elderly participants intensively involved, it was found that 5 residents (50%) were categorized with Metabolic Syndrome (MS), 3 residents (30%) were in the Pre-Metabolic Syndrome (Pre-MS) category, and only 2 residents (20%) were classified as MS-free. A high MS prevalence of 50% in this population underscores the

urgent need for promotively and preventative interventions, considering the elevated risks of cardiovascular complications and type 2 diabetes among the elderly. Post-intervention (Re-Screening), a dramatic change occurred in the risk distribution, summarized in Table 1.

Table 1. Category metabolic syndrome

Category	Free MS	Pre MS	MS
Intial Screening	2 Elderly	3 Elderly	5 Elderly
Re-Screening	2 Elderly	6 Elderly	2 Elderly

These results demonstrate that 60% of the elderly initially diagnosed with MS successfully transitioned to a lower risk category (Pre-MS), reducing the MS prevalence from 5 to 2 individuals. The significant increase in the Pre-MS category (from 3 to 6 residents) is a strong indicator that individual risk factors have been substantially mitigated. Clinically, moving from the MS to the Pre-MS category implies that these elderly individuals no longer meet the minimum three out of the five diagnostic criteria for MS (hypertension, hyperglycemia, low HDL, high triglycerides, and central obesity). This remarkable reversal is attributable to the synergy of the three main pillars of Metaprev: physical activation (Meta-Fit), improved dietary patterns (Meta-Meal Plan), and complementary herbal therapy (Meta-Herbeverage). The combined effect of these pillars triggered improvements in insulin sensitivity, a reduction in visceral fat, and better lipid profiles, which are key mechanisms in reversing or preventing the progression of metabolic syndrome.

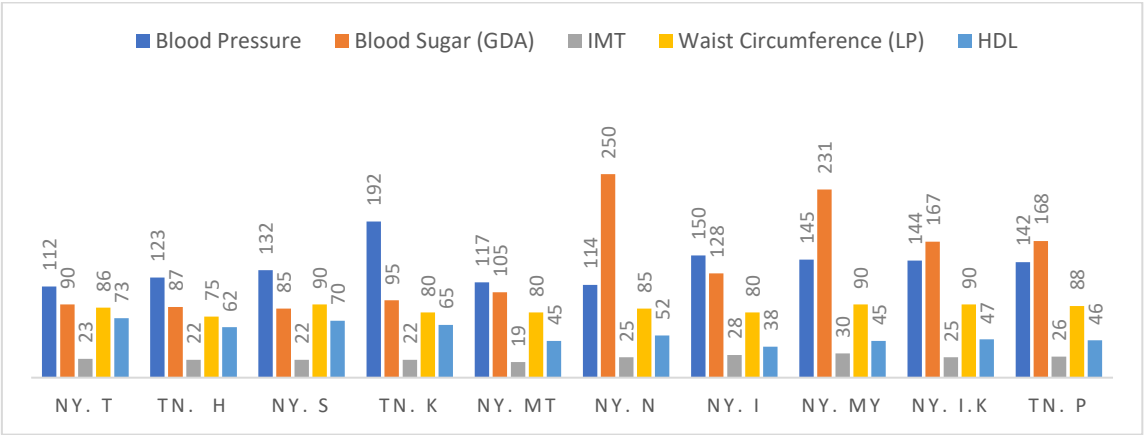
The changes from the initial screening and rescreening results are shown in Table 1. Furthermore, there are related to metabolic syndrome indicators. While Figure 2a and 2b present the detailed data from the initial and re-screening examinations, an extended narrative analysis is essential to articulate the significance of the changes in each clinical component, reduction in central obesity (waist circumference) Central obesity, defined by the accumulation of visceral fat (fat surrounding the abdominal organs), is the primary driver of insulin resistance and is considered a core MS criterion. The documented decrease in waist circumference following the Metaprev program indicates success in targeting visceral fat. Mechanism, the Meta-Fit activities (structured exercise and yoga) increased energy expenditure and stimulated the utilization of body fat reserves, especially visceral fat, which is highly responsive to exercise intervention. Furthermore, the Meta-Meal Plan, with its guidance on controlled calorie and carbohydrate intake, curtailed the deposition of new fat. The reduction of visceral fat directly improves adipocyte function and reduces the release of pro-inflammatory cytokines, which is crucial in breaking the pathogenic cycle of MS.

Blood pressure control (hypertension) data from Figure 2a and 2b would illustrate a decrease in average systolic and diastolic blood pressure within the intervention group. Hypertension was the most prevalent MS criterion found in the initial elderly population at the nursing home (82.76%). Mechanism, regular aerobic exercise through Meta-Fit is known to increase the production of Nitric Oxide (NO) by the vascular endothelium, promoting vasodilation and enhancing arterial elasticity. Yoga, as a component of Meta-Fit, specifically contributes to stress reduction and activation of the parasympathetic nervous system, thereby directly lowering blood pressure (Hastanti et al., 2021). Moreover, certain components of Meta-Herbeverage (such as specific rhizomes) have been reported in the literature to possess mild diuretic and antioxidant effects that support vascular health. Nugraha et al. (2023) support the notion that non-pharmacological lifestyle interventions are highly effective in reducing blood pressure in the elderly.

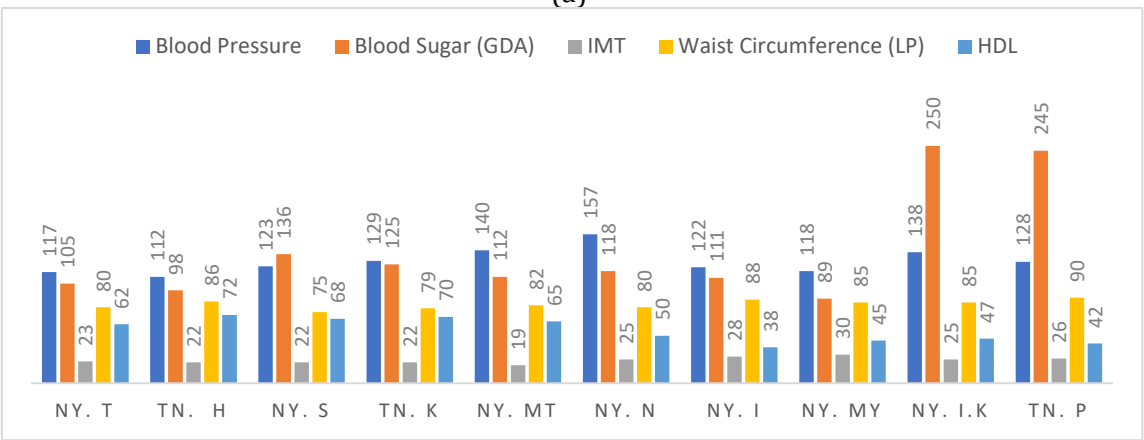
Improvement in Lipid Profile (Triglycerides and HDL) High Triglyceride (TG) levels and low HDL (good cholesterol) are components of dyslipidemia in MS. Positive changes in both parameters are a critical outcome. Mechanism: Increased regular physical activity from Meta-Fit is a strong stimulant for the enzyme Lipoprotein Lipase (LPL), which is responsible for breaking down circulating Triglycerides. The boost in LPL efficiently clears TGs, while exercise can also facilitate the transfer of cholesterol from tissues back to the

liver, elevating HDL levels. On the dietary front, the Meta-Meal Plan restricts the intake of simple sugars, which are the main precursors for hepatic Triglyceride synthesis. Literature indicates that diet and exercise interventions often yield the quickest impact on lipid profiles compared to other metabolic parameters.

Reduction in blood sugar (hyperglycemia) while the specific blood glucose data for the elderly are the applied results, a reduction in average blood sugar signals an improvement in insulin sensitivity. Mechanism**,** exercise increases the uptake of glucose by the muscles, lowering blood glucose levels even without a significant increase in insulin secretion. The Meta-Meal Plan diet program was designed to have a lower glycemic load. Herbal components like Turmeric and Ginger utilized in Meta-Herbeverage have been extensively studied for their potential antidiabetic effects through the potential stimulation of insulin secretion and improvement of insulin signaling. Collectively, the Meta-Health Screening confirmed that the integrated Metaprev approach is capable of reversing MS risk trends in the elderly, demonstrating an effective and relevant model for long-term care institutions. These results indicate that the Metaprev program fully supports and facilitates the reduction of metabolic syndrome risk in most elderly individuals. The instruments used refer to relevant journals concerning diabetes, hypertension, and obesity (Nugraha et al., 2023).



(a)



(b)

Fig. 2. Initial examination and re-screening results: (a) intial screening results Panti Werdha Hargo Dedali Surabaya 2025; (b) re-screening results lansia in Panti Werdha Hargo Dedali Surabaya 2025

3.2 Results of pre-test and post-test on metabolic syndrome and TOGA material

The results show a significant increase in elderly people's knowledge about metabolic syndrome and TOGA. In the pre-test, the average knowledge score about metabolic syndrome was 26%, while in the post-test it increased to 93%. For elderly knowledge about

TOGA, the pre-test score was 37%, which drastically increased to 98% in the post-test. There was an increase of 67% in metabolic syndrome material and 55% in TOGA material. Effective Educational Methods: The key to success lay in the combination of diverse delivery methods, tailored to the learning characteristics of the elderly as follows.

Interactive approach, educational sessions were not merely lectures but included discussions and Q&A sessions. Visual and Practical: The use of small posters and a literacy corner (Meta-Neuroliteracy) presented information visually attractively, alongside practical demonstrations (making Meta-Rhizome Tea). VR innovation, the use of Virtual Reality (VR) for relaxation and physical activity education (Hartanti et al., 2016). VR provided an immersive experience that helped the elderly process information and reduce anxiety, indirectly boosting memory and knowledge retention. This is a novel approach rarely utilized in nursing homes, highlighting Metaprev's innovation.

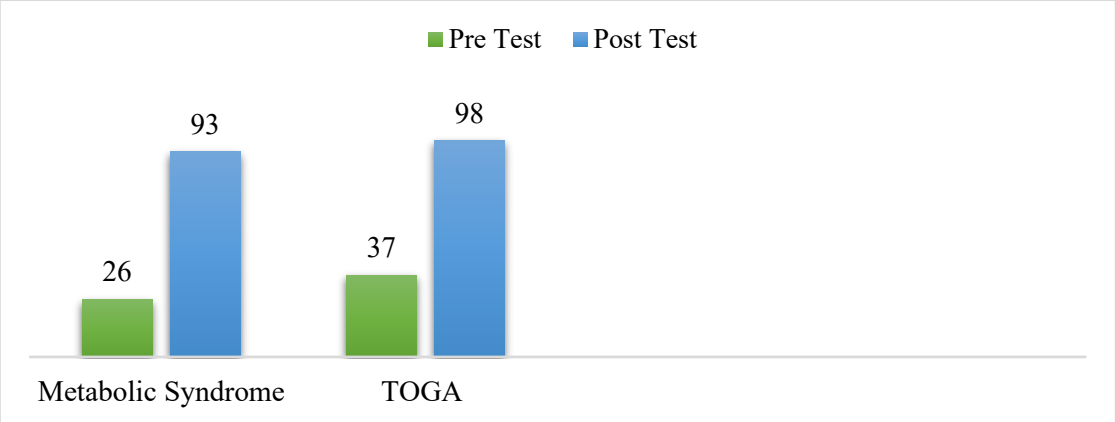


Fig. 3. Results pre and post test knowledge of metabolic syndrome and TOGA

3.3 Improving elderly skills

After receiving education, training, and mentoring related to the Metaprev program, efforts were made to enhance the skills and potential of the elderly, with the results: The elderly are able to create healthy menus (Meta-Meal Plan) with the assistance of nursing home cadres and the provision of guidebooks so that the elderly and the cadres can implement healthier eating habits. As a result, 70% of the elderly and nursing home cadres understand healthy food and drink menus (Istianah et al., 2020).

Fig. 4. Activity of creating healthy meal menus and providing meal plan guidebook

Success of the Meta-Meal Plan Implementation Figure 2. 70% of the elderly and nursing home cadres now understand and can create healthy menus based on the guidance provided in the Meta-Meal Plan Booklet. This guide facilitated the transition from unhealthy eating behaviors to a balanced diet suitable for SM prevention (low in sugar, salt, and saturated fat). Implication, this success was supported by the active involvement of the

cadres, who are the food gatekeepers in the facility. With the guidebook, staff now have a standard reference for managing daily diets, ensuring the sustainability of the changed eating patterns.

The creation of the TOGA Garden (Meta-Flow Garden) as a means of physical activation with 90% of the elderly actively participating in TOGA cultivation (Gerungan et al., 2019). Physical activation and occupational therapy figure 5. With 90% of the elderly actively participating in TOGA cultivation, the *Meta-Flow Garden* transcended being just a source of herbal raw materials; it transformed into a structured physical activation and occupational therapy facility. Dual benefit, the gardening activity fulfilled the elderly's need for regular, low-impact physical activity, which is crucial for maintaining joint mobility and muscle strength without strain.

Fig. 5. TOGA garden as a literacy corner and physical activity facility

This activity is also therapeutic, providing a sense of ownership and purpose, significantly enhancing the quality of life and reducing the risk of depression in the elderly. Elderly people are aware (98%) of the types and benefits of TOGA and actively participate in making herbal drinks. The creation of Meta Teh-Rimpang Herbal Drink serves as an alternative therapy for metabolic syndrome (Bağrici Bozan & Cangöl, 2023). Traditional Medicine Preparation Skills (Figure 5) The 98% awareness level of TOGA types and benefits among the elderly, followed by the skill to make Meta-Rhizome Herbal Tea, is a significant achievement.

Fig. 6. Processing TOGA results into rhizome Meta-Tea

Product innovation, Meta-Rhizome Tea is a product resulting from the intervention that provides a low-cost and easily accessible complementary therapy alternative. The product utilizes local plants (ginger, turmeric, lemongrass, galangal), which have been scientifically and empirically recognized for their anti-inflammatory, antioxidant, and mild hypoglycemic effects, supporting SM management Scheduled physical activities (Meta-Fit) for the elderly every morning and Yoga every Tuesday. All elderly participants (100%) attend the exercise session from 07:00 to 08:00.

Fig.7. Regular gymnastics and yoga activities

Meta-Fit, physical activity adherence (Figure 7) The 100% attendance rate at the scheduled morning exercise and yoga sessions (07:00-08:00) indicates that the elderly responded positively to a structured and socially supported program. Social aspect, the success of Meta-Fit was underpinned by the social aspect and group support generated within the nursing home. Group activities increase motivation and adherence. Regular physical activity (Handayani et al., 2025) is the main antidote to a sedentary lifestyle and a primary intervention for insulin resistance.

3.4 Structured literacy improvement for the elderly

We enhance the literacy and skills of the elderly through. The Meta-Neuroliteracy program has successfully created an easily accessible literacy corner (using small posters) integrated with crafting activities. innovative therapy, relaxation therapy education is carried out using virtual reality (VR) videos, introducing new relaxation and neuroliteracy methods for the elderly.

(a)

(b)

Fig. 8. (a) Crafting and relaxation therapy with VR; (b) The tree icon as a commitment to an independent healthy life

The commitment to a healthy lifestyle for the elderly is reinforced through the Meta-Commitree program, which uses a tree icon so that it can be remembered and revisited by the elderly and their families during visits. In addition to serving as a visual reminder, this commitment tree also functions as a tool for periodic self-assessment of the mental and physical health of older adults. As a result, it is hoped that the healthy lifestyle habits they have developed will continue to be maintained even after the support program has ended

3.5 The creation of the Metaprev website

Development of a digital platform (website) for monitoring elderly health and storing data with an integrated system that conducts screening for Metabolic Syndrome categories (Ariska et al., 2018). The full display of the Metaprev Website can be accessed at: http://metaprev.biz.id. This website is user-friendly and available for nurses, nursing home staff, and the families of the elderly to monitor elderly health, accessing medical records and elderly health history. The following is the full display of the Metaprev website as follows.

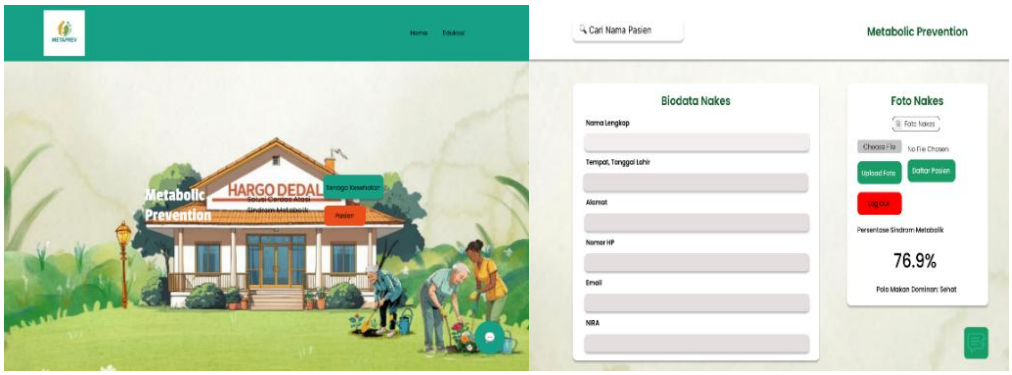


Fig. 9. Initial website display and healthcare worker biodata

The Metaprev website is designed with two main access flows, for healthcare professionals (HC) and families or Patients. Healthcare professionals flow, in this view, healthcare professionals can input patient data and health test results to determine metabolic syndrome category parameters by clicking the “Patient Register” button. HC Flow Figure 11, gives nurses and cadres the ability to input patient health data in an integrated manner via the Patient Register feature. The data input includes all core MS parameters. Primary function, the system automatically performs screening and classifies MS risk based on diagnostic criteria (e.g., NCEP ATP III or IDF), providing instant feedback on the elderly resident’s risk category. This eliminates reliance on manual calculation, enhancing accuracy and monitoring flexibility.

Fig. 10. Family or patient flow

Integrated additional features, this website is equipped with innovative features for the sustainability of holistic interventions. Metaprev-AI, contains information related to the health check-up schedule for the elderly in the care home, questions about metabolic

syndrome, and healthy lifestyle. This chatbot feature serves as a virtual assistant providing quick information on check-up schedules, common questions about MS, and healthy lifestyle tips. This mitigates the time constraints of nursing home nurses and ensures the elderly/cadres have a 24/7 information resource.

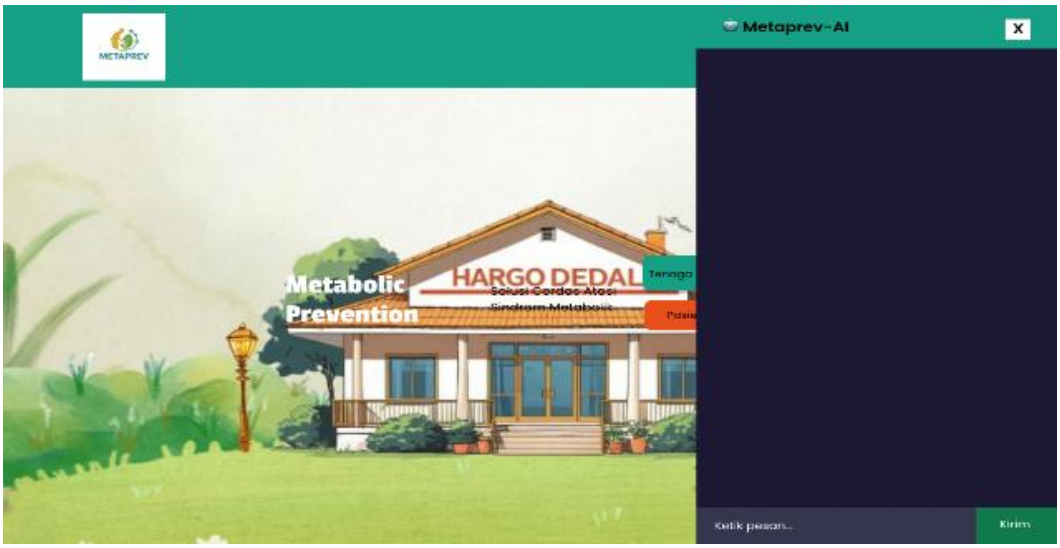


Fig. 11. Metaprev-AI feature display

Integrated educational features, education in the form of articles and videos on healthy eating patterns, how to make TOGA drinks, physical activities such as foot exercises for diabetes and yoga are included in this feature with the hope that they can be accessed by nurses and cadres as a holistic and sustainable intervention. Contains a repository of educational materials (articles, Yoga videos, diabetes foot exercises) that were tested in the program. This feature ensures that the education can be accessed repeatedly by cadres, nurses, or new recruits, guaranteeing that the standard of educational intervention is maintained (Andini et al., 2022).

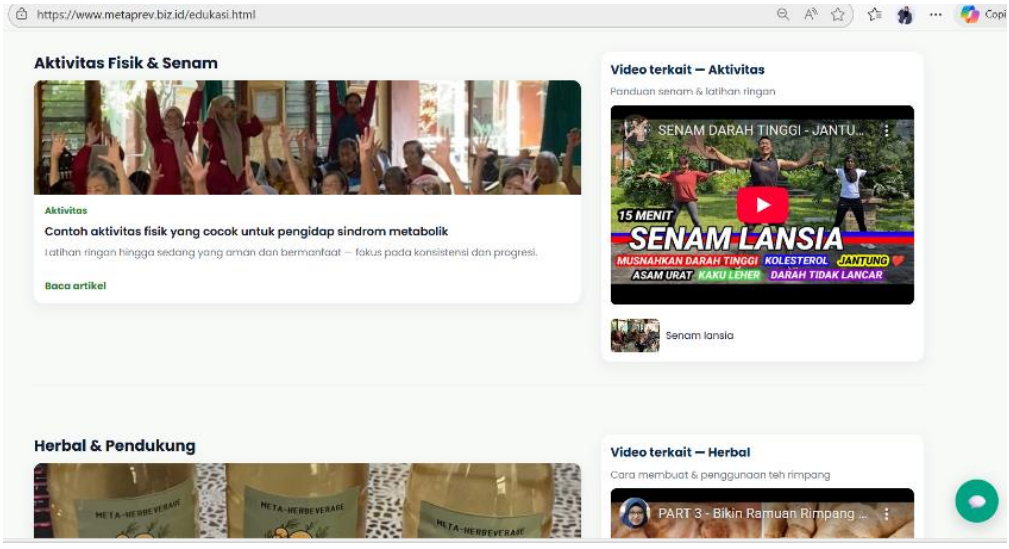


Fig. 12. integrated educational features for metabolic syndrome

Meal pattern diagram feature, this feature allows nurses/cadres to input the elderly's daily meal pattern data, which is then visualized in a diagram. This data visualization is essential for early identification of dietary deviations and facilitates the evaluation of adherence to the Meta-Meal Plan. This feature supports the practical application of the Meta-Meal Plan Booklet (Mukti et al., 2021).

Fig. 13. Eating pattern monitoring feature

Message care, a private chat feature that allows the elderly, families, or care home staff to communicate directly with the Metaprev server. Overall, the Metaprev website functions as a user-friendly monitoring tool that digitizes medical data and facilitates communication and ongoing education. This private chat feature opens a direct and private communication channel between users (elderly, family, staff) and the Metaprev server (management team/head cadres). This acts as a rapid and private feedback mechanism, allowing the elderly to communicate sensitive concerns or needs, reinforcing psychosocial support and compliance (Masi et al., 2023).

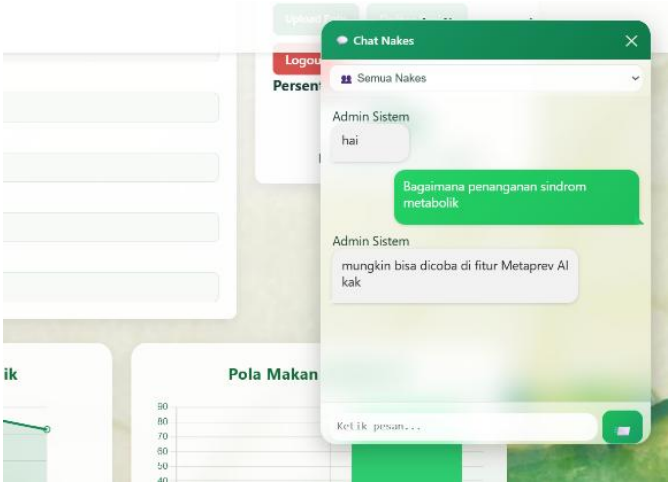


Fig. 14. What's up feature (private chat between server and user)

3.6 Program sustainability, independence, and institutionalization

In addition to involving the elderly in the Metaprev program related to healthy lifestyle patterns, Team formed 7 cadres consisting of 3 health staff and 4 orphanage cadres. The formation of the SEHAT cadres aims to ensure the sustainability of the program in the orphanage so that the Metaprev program can continue and be further developed by the partners. The sustainability of the Metaprev Program is ensured through the capacity building of partners and the institutionalization of products, which are significant outcomes of the Community-Based Participatory Research (CBPR) approach.

3.6.1 Formation of the SEHAT Metaprev cadres Figure 14.

The formation of the 7 SEHAT Cadres (comprising health staff and nursing home cadres) is a strategic step towards localizing expertise and transferring program ownership. These cadres received intensive training not only on the clinical aspects of MS and TOGA but also on the operation and maintenance of the Metaprev Website. Cadre Role: The cadres now act as Local Program Managers, responsible for daily monitoring, conducting Meta-Fit, maintaining the TOGA Garden, and crucially, data entry into the website. The establishment

of this cadre system creates an independent internal system, reducing reliance on external community service teams.

3.6.2 Institutionalization through practical Products

The institutionalization of the program is supported by physical products that have now become assets of the nursing home. Partner handbook (Figure 15), **t**his handbook serves as the official SOP for the program. Equipped with a QRCBN (Quick Response Code Book Number), the book provides step-by-step guidance on how to properly execute each Metaprev sub-program, from cultivation to screening. This ensures consistency and quality of intervention, even with staff turnover (Samsiana et al., 2025).

Meta-Meal plan guidebook (Figure 15), this guidebook serves as the standard reference for nursing home cooks and cadres in serving healthy meals. Its presence ensures that the successful dietary changes achieved during the intervention can be structurally maintained in the daily menu of the facility (Ahmadi et al., 2025). The Metaprev program is designed to be a self-sustaining model. With the cadre system and the digital platform as monitoring tools, the nursing home is now equipped to manage the MS prevention program independently, aligning with the goals of elderly empowerment and independence.

Fig. 15. Website training with meta-healthy cadres

3.7 Partner handbook

The handbook was compiled based on literature and discussions with supervising lecturers conducted over 7 days. This handbook contains guidelines on how to properly implement each subprogram, ranging from TOGA cultivation, healthy menu planning, to physical activities for the elderly. This handbook is expected to assist health staff and nursing home cadres in monitoring and evaluating the sustainability of the program. The book is equipped with QRCBN and accessible QR Codes. This book has been handed over to the partners (Samsiana et al*.,* 2025). The long-term viability and internal capacity of the Panti Werdha Hargo Dedali to sustain the Metaprev Program were fundamentally established through the institutionalization of two critical practical resources: the partner handbook and the healthy eating guidebook (Meta-Meal Plan). These documents serve as the internal Standard Operating Procedures (SOPs), ensuring that the integrity and consistency of the intervention are maintained regardless of staff turnover.

The Comprehensive Metaprev Partner Handbook Figure 15. The Partner Handbook was meticulously compiled over a focused seven-day period, synthesizing validated literature with insights derived from intensive discussions with the supervising lecturers and the Panti Werdha staff. This document is far more than a simple guide; it acts as the authoritative implementation blueprint for the entire Metaprev framework. Structure and content detail, the handbook systematically details the procedural steps required for the seamless execution of every single subprogram. This includes, but is not limited to: Meta-Flow Garden Protocols: Precise guidelines on the optimal cultivation, harvesting, and maintenance of the TOGA species (Ginger, Turmeric, Lemongrass, Galangal), including soil

preparation and pest control, ensuring a continuous supply of high-quality raw materials. Meta-Fit Scheduling, detailed routines and safety precautions for the scheduled physical activities, differentiating between morning aerobics and the weekly specialized Yoga sessions, complete with instructions for low-impact modifications suitable for geriatric participants. Meta-Herbeverage Preparation, standardized recipes and production steps for the Meta-Rhizome Tea, ensuring consistent dosage and quality control for the complementary therapy. Digital Monitoring Protocol: Instructions on the correct and timely use of the Metaprev Website, guiding cadres through data input for health screening results, meal pattern monitoring, and report generation. Facilitating Sustainability, the handbook's primary function is to empower the health staff and the newly formed Meta-Healthy cadres in their monitoring and evaluation duties. By providing clear, prescriptive steps, it mitigates reliance on implicit knowledge and ensures fidelity to the original program design. Formal Credibility, crucially, the book is formally institutionalized, being equipped with a QRCBN (Quick Response Code Book Number). This signifies that the handbook has been officially registered and verified, lending academic and operational credibility to the Panti's internal SOPs. Furthermore, the inclusion of accessible QR Codes allows for potential digital updates or access to supplementary online resources, bridging the physical document with the program's digital platform (Meo & Ganika, 2022). The formal handover of this comprehensive manual cemented the transfer of program ownership to the partners.

Fig. 16. Partner handbook with QRCBN

3.8 Healthy eating guidebook (Meta-Meal Plan)

The Healthy Eating Guidebook (Meta-Meal Plan) is the cornerstone of the nutritional intervention component, directly addressing the pre-existing issue of unhealthy food consumption among the elderly residents. Its development was a direct response to the need for standardized, geriatric-appropriate healthy eating guidelines. Targeted Nutritional Change, the guide provides clear, easy-to-follow meal planning and preparation instructions specifically tailored to prevent and manage Metabolic Syndrome. This involves detailing appropriate portions, emphasizing low-glycemic index foods, promoting controlled intake of healthy fats, and strictly limiting sodium and simple sugar content, which are primary drivers of hypertension and hyperglycemia.

Impact on compliance, the provision of this guidebook to the staff responsible for guiding the elderly's meal menus resulted in a measurable behavioral change, 70% of the elderly were documented to be following the healthier eating patterns prepared by the staff based on the guide (Ahmadi et al., 2025). This high compliance rate underscores the guide's practicality and effectiveness in translating theoretical nutritional advice into daily meal implementation. Empowering the Staff, the guide empowers the nursing home staff (cooks and cadres) by simplifying complex nutritional science into actionable daily menu plans. It likely includes templates, substitution lists for healthier ingredients, and visual aids for portion control, ensuring that meal preparation is consistent, scientifically sound, and

sustainable within the Panti's budget and resource constraints. It acts as an invaluable reference tool for maintaining the dietary component of the anti-MS strategy over the long term. (Ahmadi et al., 2025).

Fig. 17. Healthy eating guidebook (Meta-Meal Plan)

3.9 Program sustainability and independence

The sustainability of Metaprev can be ensured with the inauguration of 7 cadres consisting of 3 health staff, 4 orphanage cadres, as well as supervision from the head of the orphanage. These cadres are responsible for ensuring the program runs independently. In addition, with the Metaprev website, which has been submitted as an intellectual property work, we can continuously monitor the activities and data of the elderly, such as updates on their diet and daily activities. If there are delays or irregularities in data submission, communication will be made directly with the head of the orphanage to ensure the program's continuity (Syukron et al., 2020).

3.9.1 Program limitations

While the Metaprev Program demonstrated significant and measurable success, several limitations need to be acknowledged. Small sample size (*n=10*), although the intervention was conducted intensively, the small sample size limits the generalizability of the findings. While the percentage change (60% MS reduction) is highly dramatic, robust statistical validity necessitates testing in a larger population.

Limited intervention duration, the core program ran from July to October 2025 (approximately 3.5 months). Although rapid clinical changes occurred, the long-term efficacy and sustainability of the MS risk reduction requires longer follow-up (e.g., 6 months to 1 year) to ensure that the lifestyle changes have been permanently internalized. Clinical data limitations**,** the *screening* program was limited to the core MS indicators (BP, Glucose, TG, HDL, Waist Circumference). Future studies could be strengthened with more in-depth laboratory data, such as HbA1c levels (for long-term blood sugar control) and hs-CRP (as a systemic inflammatory marker closely linked to MS).

3.9.2 Future recommendations for program development

Based on the results and limitations, several recommendations can be proposed to enhance Metaprev's effectiveness and reach. Scalability testing and replication, replicating the Metaprev Program in other nursing homes in the Surabaya or East Java region to test the model's scalability, the effectiveness of cadre training in different social settings, and to validate the clinical findings in a larger sample. Advanced technology integration (wearable devices), developing the Metaprev Website to integrate data from wearable devices (e.g., smartwatches or simple fitness trackers) that can automatically track the elderly's daily physical activity and sleep quality (Puryaningtyas & Sarbini, 2024). This integration would enhance the accuracy of monitoring data and reduce the cadre's workload for data entry.

Quality of life (QoL) and health economics evaluation, future studies should incorporate health-related quality of life (HRQoL) assessment instruments to measure the holistic impact of the intervention. Furthermore, a health economics analysis is needed to calculate the Cost-Effectiveness of the Metaprev Program compared to standard pharmacological therapy for SM.

Clinical TOGA research, conducting more rigorous research (e.g., a Randomized Controlled Trial/RCT) on the Meta-Rhizome Herbal Tea to scientifically measure its dosage and clinical effectiveness against MS parameters (TG, Glucose) in the elderly. In conclusion, Metaprev has proven itself as an innovative, effective, and sustainable community intervention, successfully integrating behavioral change, cadre empowerment, and digital technology solutions to significantly reduce the risk of metabolic syndrome in a vulnerable elderly population.

4. Conclusions

All activities in the Metaprev program have been carried out and have shown significant improvements in the health of the elderly. Initial screening results that showed 5 elderly individuals with metabolic syndrome were successfully reduced to 2 elderly individuals post-intervention, with 3 people moving to the pre-metabolic syndrome category, indicating health improvements. There was a significant increase in knowledge about metabolic syndrome by 67% (from 26% to 93%) and knowledge related to TOGA increased by 55% (from 37% to 98%) after education and mentoring were provided. Other products have also been produced for the empowerment of the elderly, such as Meta-Herbeverage and TOGA Gardens. Additionally, a website for medical records and digital monitoring has been implemented, making it easier for nursing home staff and patients' families. The program's sustainability and independence have been ensured through the formation of Meta-Sehat cadres.

The comprehensive implementation of the Metaprev program has yielded demonstrably significant and positive health outcomes for the participating elderly population, affirming its efficacy as a targeted community service intervention. Most notably, the initial screening identified five elderly individuals suffering from metabolic syndrome, a chronic condition that significantly elevates the risk of cardiovascular disease and type 2 diabetes. Post-intervention, this number was successfully reduced to just two, translating to a 60% relative improvement in the prevalence of this high-risk condition. The three individuals who no longer met the full diagnostic criteria for metabolic syndrome transitioned into the pre-metabolic syndrome category, which is a strong indicator of health improvement and the reversal of critical metabolic risk factors. These physiological shifts underscore the program's success in mitigating serious health risks through non-pharmacological means, providing a viable model for geriatric preventive healthcare in community settings.

Beyond the direct clinical improvements, the Metaprev program achieved remarkable success in empowering the elderly through health education and practical skill development. Pre-program knowledge assessment regarding metabolic syndrome was low, standing at only 26%. Following the educational sessions and dedicated mentoring, knowledge significantly surged to 93%, representing a 67% increase in understanding of the condition's causes, symptoms, and management. Similarly, knowledge related to Traditional Medicinal Plants (TOGA) saw a substantial rise of 55%, moving from a baseline of 37% to an impressive 98%. This enhanced knowledge base is critical for fostering long-term health self-management, enabling the elderly to make informed dietary and lifestyle choices autonomously, and sustaining the positive momentum generated by the initial intervention.

The sustainability and widespread impact of the Metaprev program were strategically addressed through the creation of several practical, tangible products designed for long-term use and empowerment. The development of Meta-Herbeverage, a health drink utilizing locally available TOGA ingredients, provides a functional, preventative dietary

supplement tailored to the elderly's needs. Furthermore, the establishment of TOGA Gardens not only supplies the raw materials for the beverage but also offers a therapeutic, stimulating, and light-duty physical activity for the residents, thereby integrating preventive care into their daily routine. Complementing these physical assets, a dedicated website for medical records and digital monitoring was successfully implemented. This digital tool has dramatically streamlined the process of tracking individual health metrics, facilitating seamless communication between nursing home staff, the Meta-Sehat cadres, and the patients' families, thereby modernizing care delivery and improving oversight.

Finally, the long-term viability and independence of the intervention have been structurally assured through the formation and training of the Meta-Sehat cadres. These local volunteers are now fully equipped to perpetuate the program's activities, including ongoing health monitoring, maintaining the TOGA Gardens, and continuing health education sessions, effectively localizing the expertise and ensuring the program transcends the scope of the initial community service period. The documented health improvements, coupled with the significant increase in knowledge, the successful development of empowering products, and the establishment of a sustainable cadre system, collectively affirm that the Metaprev program is a highly effective, scalable, and self-sufficient model for promoting healthy aging and preventing metabolic diseases in vulnerable populations.

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Author Contribution

Conceptualization: A.A., S.F., P.H., A.B.N.M., F. (Defined the core idea and framework of the Metaprev program). Methodology: A.A. (Developed the study design, intervention protocols, and data collection procedures). Software: M.A.P.R. (Designed, developed, and implemented the website for medical records and digital monitoring). Validation: A.A., & F. (Ensured the accuracy and reliability of the data collection instruments and intervention fidelity). Formal Analysis: A.A., & F. (Conducted the statistical analysis of the pre- and post-intervention data)

Investigation: S.F., P.H., A.B.N.M. (Executed the on-site interventions, education sessions, and data collection from the participants). Resources: A.A. (Secured and managed the materials, equipment, and facilities required for the program). Data Curation: A.A., & F. (Organized, cleaned, and maintained the integrity of the collected raw data). Writing – Original Draft Preparation: A.A., & S.F. (Composed the initial manuscript). Writing – Review & Editing: A.A. (Critically reviewed, revised, and finalized the manuscript for submission). Visualization: M.A.P.R., & P.H. (Created all graphical representations, diagrams, and visual aids for the program and the manuscript). Supervision: A.A. (Provided oversight and guidance to the entire project team). Project Administration: A.A., & F. (Managed the project logistics, scheduling, and overall coordination). Funding Acquisition: A.A. (Secured the necessary financial support for the project.)

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Ethical Review Board Statement

Ethical review and formal approval from an Institutional Ethics Committee were formally waived for this study. This determination was made because the nature of the activity is strictly a community service program (Pengabdian kepada Masyarakat) focused on non-invasive interventions designed to directly improve the quality of life, health literacy, and well-being of the elderly in a nursing home setting. The activities involved only educational sessions, light physical activity, and measurement of basic anthropometric and physiological parameters (e.g., blood pressure, weight, glucose) that are part of routine health monitoring. As the project did not constitute formal clinical research requiring invasive procedures or the collection of sensitive clinical trial data, a formal review was deemed unnecessary in accordance with local institutional guidelines for community-based outreach.

Informed Consent Statement

For Participants**;** Prior to their enrollment in the Metaprev program, comprehensive informed consent was obtained from all subjects. This process involved a detailed explanation of the program's objectives, the nature of the interventions (education, exercise, TOGA usage), the expected benefits, and the assurance of absolute anonymity and the right to withdraw at any time without penalty. Written, signed informed consent forms were obtained from all elderly participants or, where appropriate, their legally authorized representatives, and from the entire participating nursing home staff to ensure their full understanding and voluntary involvement in the program.

For Publication; Written consent for the publication of the results derived from this program has also been secured from all participants. This consent explicitly guarantees the preservation of anonymity of all clinical data and the strict protection of personal privacy. Any information presented in this manuscript is aggregated and de-identified to ensure no individual participant can be recognized, fully adhering to ethical standards for human subjects.

Data Availability Statement

The comprehensive data sets supporting the findings reported in this article, which include the detailed pre- and post-intervention measurements, health monitoring logs, and survey responses, are available upon formal request from the corresponding author, Aisyah Al Mahiroh. Access to this data is subject to the stringent privacy and ethical restrictions mandated by Panti Werdha Hargo Dedali Surabaya and relevant institutional guidelines. Due to the highly sensitive and confidential nature of health data pertaining to vulnerable elderly individuals, no primary or raw data sets are publicly archived or made available on open-access platforms. This measure is crucial to uphold the commitment to maintaining the utmost confidentiality and ethical handling of all participant information.

Conflicts of Interest

The authors declare that there are no conflicts of interest that could be perceived as inappropriately influencing the representation or interpretation of the reported research results. Furthermore, the role of the funders, the Directorate of Learning and Student Affairs (Belmawa), was strictly limited to providing the financial support necessary for the project's execution. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Declaration of Generative AI Use

During the preparation of this work, the author(s) used several generative artificial intelligence tools: ChatGPT and Claude AI to assist in drafting, improving grammar, clarity, and academic tone of the manuscript; Grammarly for grammar enhancement and spelling correction; DeepSeek to support the development of the kombucha recommendation application code; and n8n and Sumo for workflow automation in application development. After using these tools, the author(s) reviewed and edited the content as needed and took full responsibility for the content of the publication.

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