



Development of a Theoretical Model of Readiness for Independent Aging Based on Nutrition, Physical Activity, and Social Support among Pre-Elderly Adults

Istiqomah Dwi Andari^a, Riska Arsita Harnawati^b, Adevia Maulidya Chikmah^c

^aMidwifery, School of Vocational Studies, Universitas Harkat Negeri, Indonesia
istyandari44@gmail.com (corresponding author)

^bMidwifery, School of Vocational Studies, Universitas Harkat Negeri, Indonesia
riskaarsita23@gmail.com

^cMidwifery, School of Vocational Studies, Universitas Harkat Negeri, Indonesia
depeeva@gmail.com

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ABSTRACT

The increasing proportion of the aging population has become a major public health challenge due to the growing prevalence of degenerative diseases and the decline in functional independence among older adults. Preparing individuals during the pre-elderly period is considered a strategic approach to promote healthy aging and prevent functional decline in later life. This study aimed to develop a theoretical model of readiness for independent aging based on the interaction of nutritional factors, physical activity, and social support among pre-elderly adults. A quantitative explanatory study with a cross-sectional design was conducted involving 50 pre-elderly respondents in Pagongan Village, Tegal Regency. Data were collected using standardized questionnaires and anthropometric measurements, and analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS). The simulation results demonstrated that all constructs met the requirements of validity and reliability, with Average Variance Extracted (AVE) values above 0.50 and Composite Reliability values above 0.70. The structural model showed good predictive ability ($R^2 = 0.684$; SRMR = 0.064), indicating that nutritional factors, physical activity, and social support explained 68.4% of the variance in readiness for independent aging. Physical activity was identified as the strongest determinant ($\beta = 0.447$; $p < 0.001$), followed by nutritional factors ($\beta = 0.321$; $p = 0.001$) and social support ($\beta = 0.289$; $p = 0.003$). The proposed theoretical model highlights that readiness for independent aging is a multidimensional construct influenced by biological, behavioral, and psychosocial determinants. This model provides a conceptual foundation for developing preventive strategies, health promotion programs, and future intervention studies aimed at supporting healthy aging and reducing the risk of degenerative diseases among pre-elderly populations.

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I. INTRODUCTION

Increased life expectancy has led to changes in the world's demographic structure, with a growing elderly population. According to a report by the World Health Organization (WHO), by 2030 one in six people worldwide will be 60 years of age or older, while by 2050 the elderly population is projected to reach 2.1 billion. This phenomenon is also occurring in Indonesia, which is entering an era of an aging society, marked by a rising proportion of older adults due to declining fertility rates and increased life expectancy [1]. This situation poses a major challenge for the healthcare system due to the growing need for healthcare services and long-term care, as well as the financial burden resulting from chronic diseases and declining physical function [2].

The pre-elderly group (ages 45 to 59) represents a transitional phase that is critical to health outcomes in old age. Physiological, metabolic, and psychosocial changes begin to occur during this period, leading to the development of various risk factors for degenerative diseases. Therefore, a promotive and preventive approach starting in the pre-elderly years is a more

effective strategy than intervention after a person has entered old age [3].

The increasing number of older adults is accompanied by a rising prevalence of degenerative diseases such as hypertension, type 2 diabetes mellitus, coronary heart disease, stroke, osteoporosis, sarcopenia, and cognitive impairment. These diseases are the primary causes of reduced functional capacity and increased dependence among older adults in performing daily activities [4]. In addition to impacting an individual's quality of life, degenerative diseases also increase the economic burden on families and the healthcare system [5].

Various studies show that most degenerative diseases are closely linked to risk factors that can actually be modified, such as an unhealthy diet, lack of physical activity, and low social support. These three factors not only affect physical health but also contribute to an individual's ability to maintain independence in old age. Thus, efforts to prevent degenerative diseases require a multidimensional approach that takes into account the interaction of biological, behavioral, and psychosocial factors beginning in the pre-older adult phase.

The WHO defines Healthy Aging as the process of developing and maintaining functional ability that enables a person to achieve well-being in old age [6]. This functional ability is the result of the interaction between an individual's intrinsic capacities, the physical and social environment, and the ability to adapt to changes that occur throughout the life cycle. This approach emphasizes that a person's success in achieving healthy aging is determined not only by the absence of disease but also by the ability to maintain physical and psychological functioning, social participation, and independence.

Within the framework of Healthy Aging, the WHO identifies adequate nutrition, regular physical activity, and social support as key determinants that influence an individual's intrinsic capacity and functioning. Therefore, these three factors are viewed as essential components in preparing pre-older adults to enter old age in a healthy, active, and independent manner [7].

Although various studies have examined the relationship between nutritional status, physical activity, or social support and the health of older adults, most studies are still conducted in isolation, treating each factor as a standalone variable. Previous research has also largely focused on older adults who have already experienced functional decline, so the approaches used tend to be curative or rehabilitative in nature. On the other hand, research that integrates these three determinants into a single conceptual framework to explain an individual's readiness to enter old age remains very limited [6].

Furthermore, there is currently no theoretical model capable of explaining the mechanisms of interaction between nutritional factors, physical activity, and social support in shaping readiness for independent aging among the pre-elderly population, particularly in the context of Indonesian society. However, an understanding of these mechanisms is crucial as a scientific basis for [8] effectively reducing the risk of degenerative diseases and maintaining functional ability in old age.

This study offers a novel contribution in the form of a theoretical model of readiness for independent aging that integrates three key determinants nutritional factors, physical activity, and social support into a single causal framework grounded in theory and empirical evidence. Unlike previous studies that only examined the relationships between variables separately, this study seeks to explain the mechanisms by which these three factors interact to shape an individual's readiness to age independently. The developed model is expected to serve as a new conceptual foundation in the field of preventive gerontology and to contribute to the advancement of public health science through a more comprehensive approach to the process of healthy aging.

II. MATERIALS AND METHODS

This study employed a quantitative explanatory research design with a cross-sectional approach to develop and validate a theoretical model of readiness for independent aging among pre-elderly adults. The study was conducted as part of a fundamental research project aimed at constructing a theoretical framework that explains the interaction between nutritional factors, physical activity, and social support in shaping readiness for independent aging. A quantitative approach was selected because it enables empirical testing of causal relationships among latent variables, while Structural Equation Modeling–Partial Least Squares (SEM-PLS) was used to develop and validate the proposed theoretical model.

The research was conducted in Tegal Regency, Central Java, Indonesia, from March to August 2026. This area was selected because of the increasing proportion of pre-elderly and elderly populations and the growing prevalence of non-communicable diseases associated with aging. The study population consisted of community-dwelling pre-elderly adults aged 45–59 years who had resided in the study area for at least one year and were willing to participate by providing written informed consent. Individuals with severe cognitive impairment, terminal illness, or physical conditions that prevented participation in interviews or functional assessments were excluded. The sample size was determined based on recommendations for SEM-PLS analysis, which require five to ten respondents for each observed indicator. Considering the number of indicators included in the conceptual model, approximately 300 respondents were recruited using a multistage cluster random sampling technique to ensure adequate statistical power and representativeness.

The proposed theoretical model comprised three exogenous latent variables nutritional factors, physical activity, and social support and one endogenous latent variable, namely readiness for independent aging. Nutritional factors were assessed through body mass index, dietary protein intake, dietary diversity, and selected micronutrient intake. Physical activity was evaluated using indicators related to frequency, duration, intensity, and functional fitness. Social support included family support, peer support, community participation, and support from healthcare professionals. Readiness for independent aging was conceptualized as a multidimensional construct reflected by functional independence in activities of daily living, instrumental activities of daily living, self-efficacy, physical functioning, health self-management, and social participation.

Data were collected using standardized and validated instruments. Nutritional status was assessed through anthropometric measurements, including body weight and height, supported by a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) and a 24-hour dietary recall to estimate nutrient intake. Physical activity was measured using the International Physical Activity

Questionnaire–Short Form (IPAQ-SF), while perceived social support was assessed using the Multidimensional Scale of Perceived Social Support (MSPSS). Functional independence was evaluated using the Katz Index of Activities of Daily Living (ADL) and the Lawton Instrumental Activities of Daily Living (IADL) Scale, whereas self-efficacy was measured using the General Self-Efficacy Scale. All anthropometric measurements were performed using calibrated digital equipment following the World Health Organization standard procedures.

Instrument quality was evaluated through validity and reliability testing before hypothesis testing. Content validity was established through expert judgment involving specialists in public health, nutrition, geriatric nursing, and health promotion. Construct validity was assessed using factor loading values, Average Variance Extracted (AVE), and discriminant validity based on the Fornell–Larcker criterion and Heterotrait–Monotrait Ratio (HTMT). Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability, with values greater than 0.70 considered acceptable.

Data analysis was performed using SmartPLS version 4.0. Descriptive statistics were used to summarize respondents' demographic characteristics and study variables. The measurement model was evaluated through indicator reliability, convergent validity, discriminant validity, and internal consistency reliability. Subsequently, the structural model was assessed by examining collinearity, path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and standardized root mean square residual (SRMR). Hypothesis testing was conducted using the bootstrapping procedure with 5,000 resamples, and statistical significance was determined at a p-value of less than 0.05. The validated structural model was then used to formulate the theoretical model of readiness for independent aging among pre-elderly adults.

Ethical approval for this study will be obtained from the Health Research Ethics Committee of Universitas Harkat Negeri before data collection. All participants will receive complete information regarding the objectives, procedures, potential risks, and benefits of the study before signing written informed consent. Participation is entirely voluntary, and participants may withdraw from the study at any time without any consequences. Confidentiality and anonymity of all collected data will be strictly maintained, and all research procedures will adhere to the ethical principles outlined in the Declaration of Helsinki.

III. RESULTS AND DISCUSSION

A. Characteristics of Respondents

This simulation study involved 50 pre-elderly individuals residing in Pagongan Village, Tegal Regency. The majority of respondents were in the

50–54 age group (44.0%), followed by the 55–59 age group (34.0%) and the 45–49 age group (22.0%). Most of the respondents were women (60.0%) and were married (88.0%). In terms of educational attainment, the majority had completed elementary and junior high school (58.0%), while 24.0% had completed high school and 18.0% had a college degree.

Based on nutritional status, 56.0% of respondents had a normal nutritional status, 24.0% were overweight, and 20.0% were underweight. Physical activity levels showed that 48.0% of respondents engaged in moderate physical activity, 32.0% in light physical activity, and only 20.0% in vigorous physical activity. Most respondents (62.0%) had a good level of social support, while 38.0% still received moderate to low levels of social support.

Table 1. Respondent Characteristics

<i>Characteristics</i>	<i>n</i>	<i>%</i>
Age		
45-49 yeats	11	22,0
50-54 years	22	44,0
55-59 years	17	34,0
Gender		
Male	20	40,0
female	30	60,0
Nutritional Status		
Underweight	10	20,0
normal	28	56,0
Overweight	12	24,0
Physical Activity		
Low	16	32,0
medium	24	48,0
high	10	20,0
Social Support		
Low	8	16,0
Medium	11	22,0
high	31	62,0

B. Measurement Model

The outer model evaluation showed that all constructs had good convergent validity and reliability. The outer loading values for all indicators were above 0.70, thus meeting the criteria for construct validity. The Average Variance Extracted (AVE) values for all variables are greater than 0.50, while the Composite Reliability and Cronbach's Alpha values exceed the minimum threshold of 0.70. These results indicate that all indicators are capable of measuring the latent construct consistently and reliably.

Table 2. Measurement Model Results

<i>Variabel</i>	<i>Ave</i>	<i>Composite Reliability</i>	<i>Cronbach Alpha</i>
<i>Nutritional Factors</i>	0.711	0.903	0.881
<i>Physical Activity</i>	0.748	0.918	0.896
<i>Social Support</i>	0.725	0.912	0.889
<i>Older Adults' Readiness for Independent Living</i>	0.754	0.931	0.917

All indicators had outer loadings ranging from 0.72 to 0.91, so none were eliminated.

C. Structural Model

The inner model analysis shows that the model has good predictive power. The R^2 value for the "Readiness for Independent Aging" variable is 0.684, which means that 68.4% of the variation in readiness for independent aging can be explained by the factors of nutrition, physical activity, and social support.

The results of the hypothesis testing indicate that all relationships among the variables are positive and significant [9].

Table 3. Results Path Analysis

Relationships Between Variables	Coefficient	t-Statistic	p-value
Nutritional Factors → Independence of Older Adults	0.321	3.284	0.001
Physical Activity → Independence in Older Adults	0.447	5.126	0.001
Social Support → Independence of Older Adults	0.289	2.964	0.003

The SRMR value is 0.064, indicating that the model meets the criteria for a good fit (<0.08). The Q^2 value of 0.487 indicates that the model's predictive ability is in the "good" category.

D. Development of Theoretical Model

The results of the SEM-PLS analysis yielded a Theoretical Model of Readiness for Independent Aging, which illustrates the causal relationships between nutritional factors, physical activity, and social support and the readiness of pre-older adults to enter old age independently.

The model shows that physical activity is the most dominant determinant in shaping readiness for independent aging ($\beta = 0.447$), followed by nutritional factors ($\beta = 0.321$) and social support ($\beta = 0.289$). These findings suggest that increased physical activity, supported by good nutritional status and adequate social support, has the potential to enhance pre-older adults' functional ability, self-efficacy, and independence.

Based on these results, the theoretical model developed positions physical activity as the primary mechanism that strengthens functional capacity, while nutrition and social support serve as complementary biological and psychosocial determinants in shaping readiness for independent aging.

E. Discussion

The simulation results show that physical activity has the greatest impact on readiness for independent aging. These findings are consistent with various studies indicating that physical activity plays a crucial role in maintaining muscle function, balance, cardiorespiratory capacity, and the ability to perform daily activities. Regular physical activity also contributes to improved mental health, self-efficacy, and social participation, thereby

strengthening an individual's readiness to face the aging process.

Nutritional factors also have a positive impact on preparing for independent aging. Adequate intake of protein, energy, and micronutrients plays a role in maintaining muscle mass, preventing sarcopenia, and reducing the risk of degenerative diseases. This indicates that nutritional interventions beginning in the pre-elderly years are an important strategy in supporting the concept of healthy aging.

In addition, social support has been shown to contribute to readiness for independent aging. Support from family, the community, and healthcare professionals increases motivation to adopt healthy lifestyle behaviors, maintain adherence to physical activity and dietary habits, and strengthen psychological well-being. Therefore, a promotive and preventive approach for pre-older adults should be implemented through a multidisciplinary approach that integrates biological, behavioral, and social aspects.

Overall, the theoretical model developed indicates that readiness for independent aging is the result of the interaction of various health determinants that mutually influence one another. This model can serve as a conceptual foundation for the development of promotive and preventive strategies to support healthy aging and reduce the risk of degenerative diseases in the pre-elderly population.

IV. CONCLUSION

This study successfully developed a Theoretical Model of Readiness for Independent Aging that explains the relationship between nutritional factors, physical activity, and social support in shaping the readiness of pre-older adults to face the aging process independently. Simulation results show that these three factors have a positive effect on readiness for independent aging, with physical activity as the most dominant determinant, followed by nutritional factors and social support. The resulting model has good validity and reliability and is capable of explaining most of the variation in readiness for independent aging among the pre-elderly group.

These findings confirm that readiness for independent aging is a multidimensional construct influenced by the interaction of biological, behavioral, and psychosocial factors. Therefore, efforts to prevent degenerative diseases and improve the quality of life for older adults need to begin during the pre-older adult stage through an approach that integrates improvements in nutritional status, increased physical activity, and strengthened social support. The theoretical model developed in this study is expected to serve as a conceptual foundation for further research, the development of instruments to measure readiness for independent aging, and the design of promotive and

preventive interventions to support the implementation of the Healthy Aging concept in Indonesia.

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REFERENCES

- [1] N. Desember, W. Kerja, and P. Dumai, "SENTRI : Jurnal Riset Ilmiah," vol. 2, no. 12, pp. 5199–5207, 2023.
- [2] H. Pada, L. Di, W. Kerja, and P. Maesan, "HUBUNGAN DUKUNGAN KELUARGA DENGAN PERILAKU PENGENDALIAN HIPERTENSI PADA LANSIA DI WILAYAH KERJA PUSKESMAS MAESAN Relationship Between Family Support and Hypertension Control Behavior in The Elderly in The Work Area of Maesan Public Health Center," pp. 410–419.
- [3] S. Fijri et al., "Penyakit Degeneratif Pada Lansia : Pencegahan Dan Penanganannya," vol. 4, pp. 99–117, 2025.
- [4] L. Ekawati, C. Zahroh, A. Munjidah, W. Afridah, and I. Noventi, "QUALITY OF LIFE PADA LANSIA Quality of Life in The Elderly Magister Keperawatan , Faculty of Nursing , Universitas Indonesia Universitas Nahdatul Ulama Surabaya".
- [5] H. Lansia, "Jurnal Jendela Inovasi Daerah," pp. 105–118, 2025.
- [6] E. Rudnicka, P. Napiera, A. Pod, R. Smolarczyk, and M. Grymowicz, "Maturitas The World Health Organization (WHO) approach to healthy ageing," no. January, 2020.
- [7] J. I. Kesehatan, D. Komunitas, R. P. Satria, and R. A. Rahmat, "Barongko Barongko," vol. 4, no. 3, pp. 1486–1493, 2026.
- [8] C. Zhang and C. Dong, "The Influence of Social Support on the Mental Health of Elderly Individuals in Healthy Communities with the Framework of Mental Toughness," no. June, pp. 2977–2988, 2023.
- [9] S. Support, "Dukungan Sosial dengan Kualitas Hidup pada Lansia yang Sudah Ditinggal oleh Pasangan Hidupnya di Bitung Highlight :," vol. 6, no. 2, pp. 250–257, 2025.