Shiraz E-Med J. ; In Press(In Press): e167072 https://doi.org/10.5812/semj-167072

Published Online: 2025 December 17 **Research Article**

Health Care Behaviors and Associated Factors Among Older Adults in Thailand: A PRECEDE-PROCEED Approach

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Received: 11 October, 2025; **Revised:** 25 November, 2025; **Accepted:** 9 December, 2025

Abstract

Background: As Thailand transitions into a super-aged society, promoting health care behaviors among older adults is essential to reduce the chronic disease burden and healthcare costs. Understanding the determinants of these behaviors is crucial for developing targeted interventions.

Objectives: This study aimed to examine health care behaviors among older adults in Samut Songkhram Province, Thailand, and identify associated factors using the PRECEDE-PROCEED model.

Methods: A cross-sectional study was conducted between February and April 2025 among 420 community-dwelling adults aged ≥ 60 years, selected through multi-stage random sampling. Potential sources of bias were minimized through randomization, standardized questionnaires, and researcher training. Descriptive statistics summarized the data, while chi-square tests, Pearson's, and Spearman's correlations examined associations at $P < 0.05$.

Results: Overall, 71.7% of participants reported high health care behavior (Mean = 2.61 ± 0.27). High predisposing (75.5%), enabling (71.0%), and reinforcing (63.1%) factors were observed. Significant associations were found with education ($P = 0.024$), marital status ($P = 0.039$), and income sufficiency ($P = 0.026$). Access to health information, literacy, and community participation were the key associated factors.

Conclusions: Older adults' health care behaviors are shaped by personal, social, and environmental factors. Enhancing health literacy, improving resource access, and strengthening community engagement—particularly via senior clubs—are essential for promoting healthy aging in Thailand's aging population.

Keywords: Health Behavior, Health Promotion, Aged, Health Literacy, Aging Society

1. Background

Thailand is undergoing a rapid demographic transition toward becoming a super-aged society, defined as a population in which individuals aged 60 years and older comprise more than 20% of the total population (1). According to the National Statistical Office (2), over 13 million people—representing 20.1% of the national population—are aged 60 years or above, and this proportion is projected to increase to 31.4% by 2030. This demographic shift has profound implications for the nation's economic stability, social structures, and public health system, particularly due to increasing healthcare expenditures and greater dependency among older adults (3).

Health care behavior encompasses actions and practices undertaken to promote, maintain, or restore health and to prevent illness. Such behaviors include consuming a balanced diet, engaging in regular physical activity, receiving vaccinations, undergoing routine health screenings, and avoiding health-risk activities such as smoking and alcohol consumption (4). For older adults, these behaviors are crucial in preventing or delaying the onset of chronic diseases—

How to Cite: Tipwong A, Ounprasertsuk J, Sonsnam W, Sillabutra J. Health Care Behaviors and Associated Factors Among Older Adults in Thailand: A PRECEDE-PROCEED Approach. Shiraz E-Med J. 2025; In Press (In Press): e167072. https://doi.org/10.5812/semj-167072.

such as diabetes mellitus, hypertension, osteoarthritis, and cardiovascular disorders—and in reducing risks associated with dementia and falls, which are major contributors to disability in later life (5).

Multiple determinants influence health care behaviors among older adults, including health literacy, personal attitudes and motivation, social and family support, and access to community-based health services (6, 7). Health literacy, in particular, enables individuals to obtain, interpret, and apply health information to make informed decisions regarding their well-being (8). Nonetheless, previous studies indicated that many older adults lack sufficient knowledge of appropriate self-care practices, remain physically inactive, follow suboptimal dietary patterns, and face limited access to healthcare services and social support (9, 10). As a result, overall health care behavior in this population often falls within moderate to low levels.

To investigate these complex interactions, the present study applied the PRECEDE-PROCEED model, a comprehensive framework for health promotion planning and evaluation (11). This model facilitates the identification of predisposing factors (e.g., knowledge, attitudes, and beliefs), enabling factors (e.g., access to resources and supportive environments), and reinforcing factors (e.g., social support and feedback) that collectively influence health behaviors. Its systematic approach allows for a multidimensional understanding of self-care behaviors in aging populations, thereby guiding the development of effective and sustainable community-based interventions.

2. Objectives

This study aimed to assess health care behaviors among older adults in Samut Songkhram Province, Thailand, and examine the influence of predisposing, enabling, and reinforcing factors on these behaviors. The findings are expected to inform culturally sensitive and context-specific health promotion strategies that enhance the well-being of older adults and support healthy aging in Thailand's rapidly aging society.

3. Methods

3.1. Study Design

A descriptive cross-sectional study was conducted to investigate health care behaviors and associated factors among older adults, guided by the PRECEDE-PROCEED model. This framework informed the examination of three primary constructs: (A) predisposing factors—including knowledge, perceptions, and attitudes toward self-care; (B) enabling factors—such as access to healthcare services, environmental supports, membership in senior clubs, participation in health-related activities, and use of health promotion manuals; and (C) reinforcing factors—including social support from family and healthcare providers, as well as access to health-related information.

3.2. Study Setting and Participants

The study was conducted among community-dwelling adults aged 60 years and older who were capable of performing daily activities independently. According to the Provincial Public Health Office, 32,056 individuals met these eligibility criteria as of March 2025. The required sample size was determined using the Krejcie and Morgan (12) formula based on the provincial population of older adults (N = 32,056). The calculated minimum sample was 380 participants, and an additional 10% was added to account for potential non-response, resulting in a total of 420 participants. This ensured representativeness and adequate statistical power. A multi-stage random sampling technique was employed. Three districts were randomly selected, followed by the random selection of subdistricts and villages. If more than one person aged ≥ 60 years lived in the same household, only one individual was randomly selected to participate to avoid clustering effects and ensure the independence of observations. A proportional allocation based on each district's older-adult population was applied, resulting in approximately 140 participants per district to represent both urban and rural areas.

3.3. Research Instruments

Data were collected using a structured, self-administered questionnaire developed and adapted in accordance with the PRECEDE-PROCEED model. The instrument comprised three sections:

Demographic and personal characteristics (10 items): gender, age, education level, marital status, monthly income, sources of income, income sufficiency, presence and type of chronic disease, and family structure.

Predisposing, enabling, and reinforcing factors (4) (33 items): These items were rated on a 3-point rating scale (1 = Disagree, 2 = Neutral, 3 = Agree). Mean scores were categorized as low (1.00 - 1.66), moderate (1.67 - 2.33), or high (2.34 - 3.00) (13) to indicate the extent to which each factor was present. Content validity was established by a panel of five experts (content validity

Index [CVI] = 0.90), and internal consistency was acceptable (reliability = Cronbach's α = 0.84).

Health care behaviors (3) (30 items): This section assessed behaviors related to diet, physical activity, stress management, environmental hygiene, and self-care during illness. Items were rated on the same 3-point rating scale (1 = Never, 2 = Sometimes, 3 = Always) and categorized using the same cut-off points (low = 1.00 - 1.66, moderate = 1.67 - 2.33, high = 2.34 - 3.00) (13) to ensure comparability across domains. Content validity was established by the same expert panel (CVI = 0.94), and reliability was acceptable (Cronbach's α = 0.80).

3.4. Data Collection

Data were collected between February and April 2025. Prior to participation, all individuals were informed about the study objectives and procedures, and written informed consent was obtained. Questionnaires were completed in a quiet, comfortable environment, with 20 - 30 minutes allocated per participant. Assistance was provided when necessary to ensure clarity.

3.5. Data Analysis

Data analysis utilized IBM SPSS Statistics version 29 (IBM Corp., Armonk, NY, USA). Descriptive statistics—frequencies, percentages, means, and standard deviations—summarized participants' demographics and health care behavior factors. Inferential methods included chi-square tests for categorical variable associations (e.g., sex, marital status, education) and correlation analyses using the Pearson or Spearman coefficients for interval and ordinal data, respectively. The focus was on the association between personal characteristics (age, education, income) and the predisposing, enabling, and reinforcing factors with older adults' health care behaviors. A significance level of $P < 0.05$ was used for all tests.

3.6. Ethical Considerations

The study received approval from the Institutional Review Board (IRB) at Suan Sunandha Rajabhat University (Approval No. COA.1-006/2025). This study was also conducted in accordance with the Declaration of Helsinki. All study participants gave their informed consent prior to data collection. Anonymity had been assured.

4. Results

4.1. Participant Characteristics

A total of 420 older adults participated in the study, with a mean age of 67.85 years (SD = 5.48; range: 60 - 91 years). Females accounted for 60.0% of participants, and about half (50.9%) were aged 60 - 69 years. Nearly half (49.5%) had completed primary education, while 10.7% had no formal education. Most participants (63.7%) reported having sufficient income without savings, and 47.9% had at least one chronic condition, primarily diabetes, hypertension, or hyperlipidemia. Slightly more than half (51.2%) lived in extended families. Participant characteristics are presented in Table 1.

Table 1. Characteristics of the Study Population [a]

Variables	Values
Sex	
Female	252 (60.0)
Male	168 (40.00)
Age (y)	67.85 ± 5.48
60 - 69	214 (50.95)
> 70	206 (49.05)
Education	
No formal education	45 (10.71)
Primary education	208 (49.52)
Secondary education or higher	167 (33.77)
Marital status	58 (13.81)
Single	152 (36.19)
Married	173 (41.19)
Widowed	37 (8.81)
Monthly income (Baht)	3000 ± 828.9
< 1000	58 (13.81)
> 1000	362 (86.19)
Sources of income	
Spouse	98 (23.33)
Children/grandchildren/pension	36 (8.57)
Interest/pension	30 (7.14)
Employment	100 (23.81)
Elderly allowance	152 (36.19)
Other (relatives)	4 (0.96)
Income sufficiency	
Insufficient	89 (21.19)
Sufficient but no savings	266 (63.66)
Sufficient with savings	65 (15.48)
Type of chronic disease	
No	124 (29.53)
Diabetes/hypertension/hyperlipidemia	201 (47.86)
Heart disease	60 (14.29)
Osteoarthritis/osteoporosis	30 (7.14)
Other (prefer not to answer)	5 (1.18)

Variables	Values
Family structure	
Nuclear family	205 (48.81)
Extended family	215 (51.19)

[a] Values are expressed as No.% or Mean ± SD.

4.2. Levels of Predisposing, Enabling, and Reinforcing Factors

Most participants scored in the high range across all three PRECEDE-PROCEED domains. Specifically, 75.5% had high predisposing factors (Mean = 2.67, SD = 0.35), 71.0% had high enabling factors (Mean = 2.49, SD = 0.28), and 63.1% had high reinforcing factors (Mean = 2.59, SD = 0.25). Regarding overall health care behavior, 71.7% of older adults demonstrated high levels (Mean = 2.61, SD = 0.27), particularly in healthy eating, regular exercise, and consistent use of health services. Details are summarized in Table 2.

Table 2. Levels of Predisposing, Enabling, and Reinforcing Factors, and Health Care Behaviors

Domains	No. (%)	Mean ± SD
Predisposing factors		2.67 ± 0.35
High (2.34 - 3.00)	317 (75.48)	
Moderate (1.67 - 2.33)	91 (21.67)	
Low (1.00 - 1.66)	12 (2.85)	
Enabling factors		2.49 ± 0.28
High (2.34 - 3.00)	298 (70.95)	
Moderate (1.67 - 2.33)	112 (26.67)	
Low (1.00 - 1.66)	10 (3.38)	
Reinforcing factors		2.59 ± 0.25
High (2.34 - 3.00)	265 (63.10)	
Moderate (1.67 - 2.33)	125 (29.76)	
Low (1.00 - 1.66)	30 (7.14)	
Health care behaviors		2.61 ± 0.27
High (2.34 - 3.00)	301	
Moderate (1.67 - 2.33)	98 (23.33)	
Low (1.00 - 1.66)	21 (5.00)	

4.3. Factors Associated with Health Care Behaviors

Significant associations were found between health care behavior level and education (P = 0.024), marital status (P = 0.039), and income sufficiency (P = 0.026). In descriptive terms, participants with only primary education and those who were divorced or separated showed high levels of reported health care behavior. Older adults who reported having sufficient income with savings also tended to report healthier behaviors. No significant relationships were observed for age, sex, monthly income, income source, chronic disease, or family structure. Results are summarized in Table 3.

Older adults with stronger perceptions of self-care exhibited significantly higher health care behavior scores (P = 0.025). Access to health services was also positively associated with health care behavior (P = 0.045). Although supportive environments and participation in senior club activities showed positive trends, these associations were not statistically significant.

Among reinforcing factors, family and professional support and access to health information were strongly associated with higher levels of health care behavior (P = 0.034). These findings suggest that older adults who receive continuous social support and reliable health information are more likely to maintain healthy lifestyles. Results are summarized in Table 4.

5. Discussion

This study examined the health care behaviors of older adults in Samut Songkhram Province, Thailand, and the factors associated with these behaviors within the PRECEDE-PROCEED model framework. The findings indicate that the majority of participants demonstrated high levels of health care behavior, particularly in dietary practices, physical activity, and utilization of health services. These results suggest that many older adults in this community maintain an active orientation toward self-care, a pattern consistent with findings from similar Thai and international studies (3, 4, 7, 10).

Interestingly, older adults with lower formal education and those who were divorced or separated also reported high engagement in health care behaviors. This finding may reflect a stronger reliance on community health services, senior clubs, and formal care programs among these groups, possibly due to their greater perceived vulnerability or increased participation in government-supported initiatives for older adults (14, 15). Although this pattern contrasts with international evidence linking higher education and stable marital status to healthier behaviors (16, 17), it suggests that in Thailand, community-based health resources and social support networks may mitigate the disadvantages associated with lower socioeconomic status (6, 7, 17). Overall, the results underscore that access to supportive environments and social participation can play a crucial role in promoting healthy behaviors among older adults, complementing the well-established influence of education, income sufficiency, and marital stability on health literacy and lifestyle practices (17, 18).

Table 3. Associations Between Personal Characteristics and Health Care Behaviors [a]

Personal Factor	Low	Moderate	High	P-Value
Sex				0.051
Male	9 (5.36)	31 (18.45)	128 (76.19)	
Female	5 (1.98)	47 (18.65)	200 (79.37)	
Age (y)				0.865
60 - 69	11 (5.14)	115 (53.74)	88 (41.12)	
≥ 70	4 (4.75)	77 (37.38)	125 (57.87)	
Education				0.024 [b]
No formal education	2 (4.45)	15 (33.33)	28 (62.22)	
Primary	7 (7.36)	47 (22.60)	154 (70.04)	
Secondary or higher	6 (3.60)	56 (33.53)	105 (62.87)	
Marital status				0.039 [b]
Single	6 (10.35)	17 (29.31)	35 (60.34)	
Married	10 (6.58)	18 (11.84)	124 (81.58)	
Widowed	3 (1.74)	35 (20.23)	135 (78.03)	
Divorced/separated	0 (0.00)	5 (13.51)	32 (86.49)	
Monthly income (Baht)				0.062
< 1000	5 (8.90)	11 (18.96)	42 (72.14)	
≥ 1001	4 (1.11)	103 (28.45)	255 (70.44)	
Main source of income				0.120
Spouse	5 (5.10)	18 (18.37)	75 (76.53)	
Children/grandchildren/pension	6 (11.67)	5 (18.89)	25 (69.44)	
Interest/pension	0 (0.00)	1 (3.37)	29 (96.67)	
Employment	5 (5.00)	10 (10.00)	85 (85.00)	
Elderly allowance	2 (1.31)	26 (17.11)	124 (81.58)	
Other (relatives)	0 (0.00)	1 (25.00)	3 (75.00)	
Income sufficiency				0.026 [b]
Insufficient	5 (5.62)	9 (10.11)	75 (84.27)	
Sufficient, no savings	6 (2.25)	75 (28.20)	185 (69.55)	
Sufficient with savings	3 (4.62)	5 (7.69)	57 (87.69)	
Type of chronic disease				0.412
None	5 (4.03)	9 (7.26)	110 (88.71)	
Diabetes/hypertension/hyperlipidemia	4 (1.99)	8 (3.98)	189 (94.03)	
Heart disease	2 (3.33)	4 (6.67)	54 (90.00)	
Osteoarthritis/osteoporosis	0 (0.00)	3 (10.00)	27 (90.00)	
Other (prefer not to answer)	0 (0.00)	1 (20.00)	4 (80.00)	
Family structure				0.076
Nuclear family	8 (3.60)	19 (9.27)	178 (86.83)	
Extended family	5 (2.32)	21 (9.77)	189 (87.91)	

[a] Values are expressed as No. (%).

[b] $P < 0.05$ indicates statistical significance.

Recent Thai studies further support our findings. A prior study reported that health awareness and dementia risk management among older adults with hypertension and diabetes were associated with greater engagement in self-care and preventive behaviors (19). Similarly, another study highlighted that self-management strategies among older adults with multiple chronic conditions emphasized the role of reinforcing factors—such as family and professional support—in sustaining positive health care behaviors (20). These findings collectively suggest that addressing both behavioral and contextual determinants is essential for successful aging in Thailand's rapidly aging population.

Table 4. Associations Between PRECEDE-PROCEED Model Factors and Health Care Behaviors

Factor Domains	Health Care Behavior Level; No. (%)			P-Value [a]
	Low	Moderate	High	
Predisposing				0.025
Perception of self-care for health	12 (2.85)	91 (21.67)	317 (75.48)	
Enabling				0.045
Access to health services	41 (9.76)	123 (29.29)	256 (60.95)	
Environment supporting health behavior	0 (0.00)	135 (32.14)	285 (67.86)	
Membership in senior clubs	15 (3.57)	125 (29.76)	280 (66.67)	
Participation in senior club activities	8 (1.91)	62 (14.76)	350 (83.33)	
Possession/use of health promotion manuals	10 (2.38)	165 (39.29)	245 (58.33)	
Reinforcing				0.034
Support from family members	6 (1.69)	149 (35.48)	245 (58.33)	
Support from health professionals	4 (0.97)	117 (27.86)	301 (71.67)	
Access to health information	5 (1.19)	90 (21.43)	325 (77.38)	

[a] $P < 0.05$ indicates statistical significance.

The application of the PRECEDE-PROCEED model offered a comprehensive and multidimensional understanding of the determinants of health care behaviors among older adults. All three domains—predisposing, enabling, and reinforcing factors—showed significant associations with health care behaviors, underscoring the interplay between individual, social, and environmental influences. Among these, access to health services emerged as a key enabling factor, while access to reliable health information represented the most influential reinforcing factor. These findings are consistent with previous studies emphasizing that community participation—such as involvement in senior clubs—and the availability of trustworthy health information are vital for sustaining positive health behaviors in older populations (14-16). Moreover, health literacy serves as a central mechanism that enables individuals to interpret, evaluate, and apply health information effectively in their daily lives, thereby supporting long-term and sustainable behavior change (16, 17).

Importantly, this study revealed nuanced differences across subgroups. Although significant associations were observed between education, income sufficiency, and health care behaviors, the direction of these relationships varied. Older adults with lower formal education and those with sufficient income and savings demonstrated higher engagement in health care behaviors. This pattern suggests that targeted community health programs, accessible primary care, and Thailand's strong social-welfare infrastructure may help offset the disadvantages typically associated with lower educational attainment. These findings emphasize the need for tailored interventions that continue to strengthen equitable resource accessibility and deliver health communication that reaches low-literacy and low-income older adults through culturally and contextually appropriate strategies (14, 18).

The findings highlight the importance of applying behavioral frameworks, such as the PRECEDE-PROCEED model, in designing community health-promotion programs for older adults. Practical efforts should emphasize strengthening community-based resources (e.g., senior clubs), improving access to health services, and providing culturally and linguistically appropriate health information to enhance enabling and reinforcing factors. Health-promotion strategies should avoid assuming that education level alone determines engagement in health care behaviors; rather, they should focus on fostering supportive environments, social participation, and family or professional support that encourage sustained behavior change. From a research perspective, future studies should adopt longitudinal or mixed-method designs to assess the long-term effects of these factors, evaluate intervention effectiveness across diverse older-adult populations, and

explore contextual influences that shape health behaviors within community settings.

This study has several limitations. First, its cross-sectional design restricts causal inferences between associated factors and health care behaviors. Second, reliance on self-reported data may introduce recall and social desirability bias. Third, the study was limited to a single province and included only older adults, which may reduce generalizability to frailer populations or other geographic regions. Future research should address these limitations by including more diverse samples and employing longitudinal or experimental designs to verify causal relationships.

5.1. Conclusion

Community-dwelling older adults in Samut Songkhram Province reported generally high engagement in health care behaviors, particularly healthy diet, physical activity, and appropriate use of health services. Health care behavior was associated with education, marital status, and income sufficiency, and was further shaped by predisposing, enabling, and reinforcing factors defined in the PRECEDE-PROCEED model. These findings highlight the value of strengthening senior-club participation, access to reliable health information, and supportive social and service environments to promote healthy aging in Thailand.

Footnotes

AI Use Disclosure: The authors declare that no generative AI tools were used in the creation of this article.

Authors' Contribution: Conceptualization, A.T., J.O., W.S., and J.S.; methodology, A.T., J.O., and J.S.; software, A.T., and J.O.; validation, A.T., J.O., and W.S.; formal analysis, A.T., and J.O.; writing—original draft preparation, A.T., and J.O.; writing—review and editing, A.T., J.O., W.S., and J.S.; All authors have read and agreed to the published version of the manuscript.

Conflict of Interests Statement: The authors declare no conflict of interest.

Data Availability: The dataset presented in this study is available on reasonable request from the corresponding author during submission or after publication. The data are not publicly available due to privacy and ethical restrictions involving participant information.

Ethical Approval: The study received approval from the Institutional Review Board (IRB) at Suan Sunandha Rajabhat University (Approval No. COA.1-006/2025). This study was also conducted in accordance with the Declaration of Helsinki.

Funding/Support: The present study received no funding/support.

Informed Consent: Written informed consent was obtained from the participants.

References

1. National Statistical Office. *Report on the situation of Thai older persons*. Bangkok, Thailand: National Statistical Office; 2023. Available from: https://www.nso.go.th/nsoweb/nso/survey.
2. National Statistical Office. *The 2024 survey of the older persons in Thailand*. Bangkok, Thailand: National Statistical Office; 2024. Available from: https://www.nso.go.th/nsoweb/nso/survey_detail/iM?set_lang=en#gsc.tab=0.
3. Suksatan W, Teravecharoenchai S, Sarayuthpitak J. Determinants of the Health-Promoting Behaviors Among Community-Dwelling Older Adults with Non-communicable Diseases During the Post-Covid-19 Era. *J Nurs Midwife Sci*. 2024;**11**(1). e144587. https://doi.org/10.5812/jnms-144587.
4. Suksatan W, Teravecharoenchai S, Sarayuthpitak J. Health-Promoting Behaviors among Older Adults with Noncommunicable Diseases in Rural and Urban Areas during the New Normal Post-COVID-19 Era: A Structural Equation Modeling Analysis. *Nutrients*. 2022;**15**(1):101. [PubMed ID: 36615759]. [PubMed Central ID: PMC9824811]. https://doi.org/10.3390/nu15010101.
5. Jaul E, Barron J. Age-Related Diseases and Clinical and Public Health Implications for the 85 Years Old and Over Population. *Front Public Health*. 2017;**5**:335. [PubMed ID: 29312916]. [PubMed Central ID: PMC5732407]. https://doi.org/10.3389/fpubh.2017.00335.
6. Pechrapa K, Yodmai K, Kittipichai W, Charupoonpol P, Suksatan W. Health Literacy among Older Adults during COVID-19 Pandemic: A Cross-Sectional Study in an Urban Community in Thailand. *Ann Geriatr Med Res*. 2021;**25**(4):309-17. [PubMed ID: 34735760]. [PubMed Central ID: PMC8749042]. https://doi.org/10.4235/agmr.21.0090.
7. Yodmai K, Pechrapa K, Kittipichai W, Charupoonpol P, Suksatan W. Factors Associated with Good COVID-19 Preventive Behaviors Among Older Adults in Urban Communities in Thailand. *J Prim Care Community Health*. 2021;**12**:21501327211036200. [PubMed ID: 34334008]. [PubMed Central ID: PMC8326623]. https://doi.org/10.1177/21501327211036251.
8. Bindhu S, Nattam A, Xu C, Vithala T, Grant T, Dariotis JK, et al. Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review. *Online J Public Health Inform*. 2024;**16**. e50898. [PubMed ID: 38506914]. [PubMed Central ID: PMC10993137]. https://doi.org/10.2196/50898.
9. Delerue Matos A, Barbosa F, Cunha C, Voss G, Correia F. Social isolation, physical inactivity and inadequate diet among European middle-aged and older adults. *BMC Public Health*. 2021;**21**(1):924. [PubMed ID: 33992074]. [PubMed Central ID: PMC8122541]. https://doi.org/10.1186/s12889-021-10956-w.
10. Geboers B, de Winter AF, Spoorenberg SL, Wynia K, Reijneveld SA. The association between health literacy and self-management abilities in adults aged 75 and older, and its moderators. *Qual Life Res*.

2016;**25**(11):2869-77. [PubMed ID: 27101999]. [PubMed Central ID: PMC5065597]. https://doi.org/10.1007/s11136-016-1298-2.

11. Crosby R, Noar SM. What is a planning model? An introduction to PRECEDE-PROCEED. *J Public Health Dent*. 2011;**71 Suppl 1**:S7-15. [PubMed ID: 21656942]. https://doi.org/10.1111/j.1752-7325.2011.00235.x.
12. Krejcie RV, Morgan DW. Determining Sample Size for Research Activities. *Educ Psychol Measure*. 1970;**30**(3):607-10. https://doi.org/10.1177/001316447003000308.
13. Shook G. An assessment of disaster risk and its management in Thailand. *Disasters*. 1997;**21**(1):77-88. [PubMed ID: 9086635]. https://doi.org/10.1111/1467-7717.00045.
14. Chi Z, Lun H, Ma J, Zhou Y. Income inequality and healthcare utilization of the older adults-based on a study in three provinces and six cities in China. *Front Public Health*. 2024;**12**:1435162. [PubMed ID: 39114522]. [PubMed Central ID: PMC11303323]. https://doi.org/10.3389/fpubh.2024.1435162.
15. Luo M, Ding D, Bauman A, Negin J, Phongsavan P. Social engagement pattern, health behaviors and subjective well-being of older adults: an international perspective using WHO-SAGE survey data. *BMC Public Health*. 2020;**20**(1):99. [PubMed ID: 31973695]. [PubMed Central ID: PMC6979381]. https://doi.org/10.1186/s12889-019-7841-7.
16. Chen Y, Hicks A, While AE. Loneliness and social support of older people in China: a systematic literature review. *Health Soc Care Community*. 2014;**22**(2):113-23. [PubMed ID: 23714357]. https://doi.org/10.1111/hsc.12051.
17. Sorensen K, Van den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z, et al. Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health*. 2012;**12**:80. [PubMed ID: 22276600]. [PubMed Central ID: PMC3292515]. https://doi.org/10.1186/1471-2458-12-80.
18. McMaughan DJ, Oloruntoba O, Smith ML. Socioeconomic Status and Access to Healthcare: Interrelated Drivers for Healthy Aging. *Front Public Health*. 2020;**8**:231. [PubMed ID: 32626678]. [PubMed Central ID: PMC7314918]. https://doi.org/10.3389/fpubh.2020.00231.
19. Ounprasertsuk J, Damuso S, Tipwong A. Health Awareness and Dementia Risk Among Older Adults with Hypertension and Diabetes: A Cross-sectional Study in Thailand. *Iran J Psychiat Behav Sci*. 2025;**19**(3). e161734. https://doi.org/10.5812/ijpbs-161734.
20. Sadeghi H, Mohammadi Shahbolaghi F, Hosseini M, Fallahi-Khoshknab M, Ghaedamini Harouni G. Self-management in Older Adults with Multiple Chronic Conditions (MCCs): A Qualitative Content Analysis. *Iran J Psychiat Behav Sci*. 2024;**18**(3). e150346. https://doi.org/10.5812/ijpbs-150346.