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Factors associated with healthy ageing among older persons in Senior Citizens Activity Centres (*Pusat Aktiviti Warga Emas*, PAWE), Klang Valley, Malaysia: a cross-sectional study

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Abstract

Background Malaysia is undergoing a demographic transition towards an ageing population, posing significant implications for public health planning. Understanding factors that promote healthy ageing is crucial to maintaining functional independence and quality of life. This study aimed to determine the level of healthy ageing and identify associated factors among older persons registered at Senior Citizens Activity Centres (*Pusat Aktiviti Warga Emas*, PAWE) in the Klang Valley.

Methods A cross-sectional study was conducted between October 2024 and August 2025 among 230 older persons aged 60 years and above registered at 20 Senior Citizens Activity Centres (PAWE) in Klang Valley, Malaysia (Selangor, Kuala Lumpur, Putrajaya), selected using probability proportionate to size sampling. Data were collected using a validated self-administered questionnaire and analysed using IBM SPSS Version 30.0. The healthy ageing level was the dependent variable, measured using the 15-item Healthy Ageing Questionnaire (HAQ) and classified as high (> 70%) vs. low (≤ 70%), while independent variables included sociodemographic characteristics, physical and mental health, multimorbidity, physical activity, and social support. Bivariate analyses were performed using simple logistic regression. Multivariable logistic regression was subsequently conducted to identify factors associated with high level of healthy ageing.

Results The response rate was 98.3%, and the prevalence of a high level of healthy ageing was 51.8%. Multivariable analysis showed that being female (AOR = 4.121, 95% CI: 1.699–9.994), reporting good self-rated health (AOR = 4.553, 95% CI: 2.150–9.644), not at risk of depression (AOR = 6.107, 95% CI: 2.125–17.552), and having no risk of social isolation (AOR = 4.848, 95% CI: 2.420–9.711) were significant factors associated with high level of healthy ageing.

Conclusion Female gender, good self-rated health, not at risk of depression, and no risk of social isolation were the significant factors associated with high level of healthy ageing. Public health strategies should prioritise strengthening the physical, mental, and social domains, with PAWE centres serving as key platforms to implement interventions that support healthy ageing in Malaysia.

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Keywords Healthy ageing, Older persons, Intrinsic capacity, Senior Citizens Activity Centre (PAWE), Klang Valley, Ageing population

Introduction

The rapid growth of ageing populations and the increasing burden of age-related health conditions have emerged as pressing global challenges. By 2030, one in six people worldwide will be aged 60 years or older, with the population projected to increase from one billion in 2020 to 1.4 billion in 2030 and to double to 2.1 billion by 2050 [1]. This demographic shift places considerable strain on healthcare systems and social structures worldwide.

In Malaysia, the proportion of older persons has risen from 6.2% in 2000 to 11.3% in 2023, with nearly one million residing in the Klang Valley, the country's most urbanised and densely populated region [2]. Health risks among older Malaysians remain a major concern. Findings from the National Health Morbidity Survey (NHMS) 2023 revealed high prevalence rates of non-communicable diseases (NCD), including hypertension (53.2%), diabetes (29.3%), and hypercholesterolemia (45.7%). In addition, nearly one in ten older persons experienced depressive symptoms, highlighting the need for targeted mental health interventions [3].

The World Health Organization (WHO) emphasises that healthy ageing is not only about extending life expectancy but also about ensuring that added years are lived in good health, independence, and with a sense of purpose [1, 4]. Concepts of ageing have evolved over time. Early perspectives often framed ageing primarily in terms of decline and disease management. Rowe and Kahn's "successful ageing" model (1997) later emphasised three domains: low risk of disease and disability, high physical and cognitive function, and active engagement with life [4, 5]. Building on these multidimensional views, the WHO introduced the "active ageing" policy framework (2002), which emphasised optimising opportunities for health, participation, and security to enhance quality of life as people age [4]. More recently, the WHO advanced the concept of "healthy ageing," defined as developing and maintaining the functional ability that enables well-being in older age, shaped by the interaction between intrinsic capacity (physical and mental capacities) and enabling environments [4, 6].

In 2020, the United Nations (UN) declared 2021–2030 as the Decade of Healthy Ageing, with the WHO coordinating its implementation in collaboration with member states and partners. The initiative calls for action to foster age-friendly environments, combat ageism, strengthen integrated care, and expand access to long-term support [7].

The prevalence of healthy ageing differs across countries, with higher levels in developed settings such as Austria (58.3%) and Switzerland (51.2%) [8], and lower levels in developing and underdeveloped contexts such as Nigeria (7.5%) and Palestine (22.2%) [9, 10]. In Malaysia, earlier studies reported a 13.8% prevalence of successful ageing in 2012 (national-level study) and 14.1% prevalence of healthy ageing in Terengganu, Malaysia, in 2023 (state-level study), much lower than in many other countries [11, 12]. To date, no published study has reported the prevalence of healthy ageing in the Klang Valley, Malaysia. These variations may be explained by differences in tools and definitions, including the Healthy Ageing Instrument and multidimensional indices, which limit comparability across studies [11–15]. Policies such as the WHO's Global Strategy and the UN's Madrid International Plan of Action on Ageing provide international guidance, yet national adaptations, implementation capacity, and resource allocation play a role in local outcomes.

Poor healthy ageing imposes significant burdens at individual, social, and system levels. It contributes to functional decline, reduced cognitive capacity, and lower quality of life, often increasing dependency due to chronic diseases and disabilities [11, 16]. The resulting emotional and financial strain on families can lead to catastrophic health expenditure [9], while health systems face growing demand for long-term care and rising treatment costs, especially in resource-limited settings [17]. In Malaysia, healthcare utilisation among older persons was estimated at RM3.8 billion in 2014 (0.34% of GDP) and is projected to reach RM21 billion by 2040 (1.08% of GDP) [18]. These figures underscore the urgency of strengthening healthy ageing initiatives to mitigate the escalating social and economic strain of population ageing.

Although many factors associated with healthy ageing have been identified - such as sociodemographic characteristics, physical and mental health, multimorbidity, physical activity, and social support [19–23] - important evidence gaps persist. Observed inconsistencies may reflect variations in factors such as health literacy, access to care, and health-seeking behaviour across different levels of economic development [24, 25]. Differences in social systems, economic resources, and access to health services contribute to wide disparities in healthy ageing outcomes both between and within countries [17]. From a public health perspective, this highlights the need to address the social determinants of health, including income, housing, education, and social support. These structural factors shape the environments in which older people live and directly influence their ability to achieve healthy ageing [4]. In Malaysia, for example, a study in

Terengganu found that socioeconomic status, social support, and both physical and mental health were key determinants of healthy ageing, revealing disparities between urban and rural populations including differences in access to services and socioeconomic resources [11, 26–28]. These findings suggest that contextual, socioeconomic, and behavioural conditions continue to shape healthy ageing outcomes and emphasise the need to assess healthy ageing factors within urban populations like the Klang Valley.

In response to these needs, Malaysia introduced the National Policy for Older Persons (NPOP) in 2011 to enhance the well-being of older persons through institutional care (e.g., *Rumah Seri Kenangan* and *Rumah Ehsan*) and community-based activity centres such as the Senior Citizens Activity Centre (*Pusat Aktiviti Warga Emas*, PAWE). PAWE centres are designed to foster social participation, reduce isolation, and strengthen community engagement as pathways to healthy ageing [29, 30]. However, challenges such as limited financial support, inadequate training, and shortages of qualified personnel have been reported, alongside concerns about less engaging activities and insufficient facilities [31–33]. Understanding how healthy ageing manifests among PAWE participants is therefore essential to assess the effectiveness of this policy-driven community model and to inform future improvements.

To the best of our knowledge, no study has yet evaluated the prevalence of healthy ageing among older persons participating in PAWE. Given Malaysia's demographic transition, the limited national evidence, and the critical role of community-based platforms, this study aimed to determine the prevalence and factors associated with high level of healthy ageing among older persons registered at PAWE in the Klang Valley, Malaysia.

Methods

Research design and setting

An analytical cross-sectional study was conducted between October 2024 and August 2025 in the Klang Valley region of Malaysia, which encompasses the Federal Territories of Kuala Lumpur and Putrajaya, as well as the state of Selangor. Malaysia's total population was estimated at 34 million in early 2024, of which 11.3% (3.8 million) were aged 60 years and above [34]. The Klang Valley, with a population of approximately nine million, included about one million older persons, representing 26.3% of the national elderly population [34]. Accordingly, PAWE centres in this urbanised region were selected as the study setting due to the high concentration of older persons and the presence of established community-based activity centres.

Research population

The study population comprised older persons registered at PAWE, community-based senior citizens activity centres established under Malaysia's NPOP 2011. In 2024, there were 20 PAWE centres in Klang Valley (11 in Selangor, eight in Kuala Lumpur, and one in Putrajaya), each with an average membership of 200 individuals [30]. Eligible participants were Malaysian citizens aged 60 years and above who were able to understand Malay or English. Exclusion criteria included observable cognitive impairments, communication difficulties (verbal and non-verbal [visual and hearing] difficulties), bedridden status, severe frailty, or advanced chronic illnesses that could hinder participation.

The required sample size was 230 participants, calculated using a two-proportion formula by Lwanga & Lemeshow (1991) based on differences in healthy ageing across marital status groups reported by Pitisuttithum et al. (2018) [19], where the proportion of healthy ageing was 75% among married older persons (P1) and 57.1% among single older persons (P2). Marital status was selected as it is a commonly reported factor associated with healthy ageing and produced the largest sample size estimate, ensuring adequate power to detect between-group differences, consistent with the study aim to examine associated factors. The calculation was performed with 80% power, a 95% confidence level, and a 5% allowance for non-response [35]. The formula is as below:

$$n = \frac{\left[Z_{1-\alpha/2}\sqrt{2\,\overline{P}\,(1-\overline{P})} + Z_{1-\beta}\sqrt{P_1\,(1-P_1) + P_2\,(1-P_2)}\right]^2}{(P_1 - P_2)^2}$$

where, n = sample size

$z1-\alpha2$ = standard error associated with 95% confidence interval = 1.96

$z1-\beta$ = standard error associated with 80% power = 0.842

P1 = population proportion 1

P2 = population proportion 2

$$\overline{P} = \frac{P_1 + P_2}{2}$$

A stratified random sampling approach with probability proportionate to size was employed to ensure representation from all 20 PAWE centres. The number of participants selected from each centre was proportional to its membership size, and within each centre, individuals were selected using simple random sampling from the membership lists with a randomiser tool. This multistage strategy minimised selection bias and ensured representativeness across the Klang Valley.

Study instrument

Data were collected using a validated self-administered questionnaire, that was translated from English to Malay (*Bahasa Melayu*) using WHO translation guidelines [36]. Forward translation and independent back-translation were conducted by bilingual experts, and discrepancies were reconciled to ensure conceptual and semantic equivalence. The questionnaire comprised seven sections:

A) Sociodemographic characteristics consisted of six items including age, gender, ethnicity, marital status, education level, and household income. For descriptive analysis, ethnicity, marital status and education were presented in multiple categories. For regression analysis, the variables were recoded as follows:

- ethnicity (Malay vs. non-Malay [Chinese and Indian]) [37].
- marital status (married vs. not married [never married, widowed, divorced or separated]) [37].
- education level (low [no formal education and primary education] vs. high [secondary education and tertiary education]) [16].
- household income (low < RM3000 vs. high ≥RM3000) based on the national median household income in Malaysia reported in UNICEF Malaysia in 2024 [38].

B) Physical health was divided into two subcomponents. Part B(i) measured functional status using the Katz Index of Independence in Activities of Daily Living (ADL), which evaluates six domains - continence, bathing, dressing, toileting, transferring, and feeding. Scores range from 0, indicating complete dependence, to 6, indicating complete independence [39], with a Cronbach's alpha of 0.82 [40]. Part B(ii) measured self-rated health (SRH) using a single-item, five-point scale ranging from 1 (excellent) to 5 (poor). Four-week test-retest reliabilities for this tool range from 0.51 to 0.86 [41]. For analysis, scores of 1 and 2 were classified as "good," while scores of 3 to 5 were classified as "fair or poor" [42].

C) Mental health also consisted of two subcomponents. Part C(i) measured depression using the 15-item Geriatric Depression Scale (GDS-15), with scores of five or more indicating risk of depression and scores of four or less indicating no risk [43, 44]. Cronbach's alpha for GDS-15 was 0.83 [45]. Part C(ii) evaluated cognitive function using the Clock Drawing Test (CDT). A normal drawing, with all numbers placed in the correct order and both clock hands present, was classified as intact cognitive function, while an abnormal drawing indicated poor cognitive function. The test-retest reliability is $r = 0.78$ after 3 months and $r = 0.76$ after 6 months [46, 47].

D) Multimorbidity was a self-developed questionnaire to assess self-reported diagnosis of four chronic conditions within the past three months: hypertension, diabetes mellitus, hypercholesterolemia, and cancer [48]. The presence of two or more conditions was classified as multimorbidity [49].

E) Physical activity consisted of a single item asking whether participants engaged in at least 30 minutes of exercise three or more times per week, with responses recorded as "Yes" or "No" [50].

F) Social support was evaluated using the Lubben Social Network Scale (LSNS-6), a six-item instrument assessing family and friend networks [51] with a Cronbach's alpha of 0.74 [52]. Scores range from 0 to 30, with scores of 12 or lower indicating risk of social isolation and scores of 13 or higher indicating adequate social support [37].

G) Healthy ageing was measured using the 15-item Healthy Ageing Questionnaire (HAQ) that was originally developed and validated in Singapore to measure healthy ageing level among community-dwelling older persons, with a Cronbach's alpha of 0.735. The HAQ consisted of five components: physiological and metabolic health, physical and mental capacity, social well-being, and psychological well-being. According to Ng et al. (2023), these domains align conceptually with the WHO healthy ageing framework, capturing aspects related to intrinsic capacity and functional ability within enabling environments. In this study, these HAQ components were mapped conceptually to the WHO framework, where physiological and metabolic health as well as physical, mental capacity and psychological well-being reflect intrinsic capacity–related domains, while social well-being outcomes are shaped by participation and supportive environments. Therefore, the HAQ was used as a proxy indicator of WHO healthy ageing rather than a direct measure of intrinsic capacity. Scores were transformed into percentages, with values greater than 70% classified as a high level of healthy ageing and 70% or lower as a low level [20]. As this cut-off has not been specifically validated in Malaysian populations, it was used as an operational threshold for classification in the present study.

Content validity was assessed by experts. Face validity was assessed among older persons to evaluate clarity and comprehension. The questionnaire was then pre-tested among 30 older persons residing in the Klang Valley to

assess clarity and consistency, pilot data were excluded from the main analysis. Internal consistency was in the range of acceptable to good, with Cronbach's alpha values ranging from 0.70 to 0.85 across domains.

Data collection

Data collection was conducted face-to-face at selected PAWE centres from April to May 2025 by the study investigator (SASM) using a validated questionnaire. Prior to data collection, study objectives and procedures were explained to PAWE centre managers. Individuals were screened for eligibility before being briefed on the study's purpose and procedures. All participants were informed that participation was voluntary and anonymous, and they were assured that confidentiality would be maintained. After obtaining written consent, participants completed a self-administered questionnaire. Respondents completed the questionnaire on-site, with an average completion time of 20–30 min.

Data analysis

Data were analysed using IBM SPSS version 30.0. Data cleaning and verification were performed prior to analysis to check for missing or out-of-range values. No missing data were observed for variables included in the analysis. The distribution of continuous variables was assessed using skewness, kurtosis, the Shapiro–Wilk test, and graphically with histograms. Continuous variables such as age and household income were subsequently categorised for analysis. Descriptive statistics were used to summarise respondent characteristics, with categorical variables presented as frequencies and percentages.

Associations between independent variables and healthy ageing were initially examined using simple logistic regression. Variables with $p < 0.25$ were considered for inclusion in the multivariable logistic regression after assessing multicollinearity and interaction terms. Multicollinearity was evaluated using the variance inflation factor (VIF); all variables had VIF values < 5, indicating no multicollinearity [53]. Model selection involved the "Enter," "Forward LR," and "Backward LR" approaches, and variables that were non-significant after adjustment were excluded and the most parsimonious model was retained. Results were reported as crude and adjusted odds ratios (OR) with 95% confidence intervals (CI) and statistical significance was set at $p < 0.05$.

Ethical considerations

Ethical approval was obtained from the Ethics Committee for Research Involving Human Subjects, Universiti Putra Malaysia (JKEUPM-2025-232). Permission to conduct the study was granted by the Department of Social Welfare Malaysia (JKM). Written informed consent was obtained from all participants before data collection. To ensure participant safety, those who scored ≥ 5 on the GDS-15 were referred to local health facilities for further evaluation and appropriate management [54]. Data confidentiality was strictly maintained, where all responses were anonymised, stored in a password-protected database accessible only to the research team, and will be retained for seven years before secure deletion.

Results

Prevalence of healthy ageing

Of the 230 eligible older persons, 226 consented and participated, yielding a response rate of 98.3%. The mean (± SD) healthy ageing score was 70.64 ± 12.17. Overall, 51.8% of respondents had a high level of healthy ageing.

Participants' demographic characteristics

The median age was 66 years (IQR = 8), with most participants aged 60 to 69 years (68.6%). The majority were female (85.0%) and Malay ethnicity (92.0%). More than half were currently married (52.7%) and the majority had completed secondary education (58.4%). The median household income was RM1,450 (IQR = 3,000), with most respondents (69.0%) classified as having low income (< RM3,000) (Table 1).

Table 1 Distribution of sociodemographic characteristics of respondents ($n = 226$)

Characteristic	Median (IQR)	Frequency (*n*)	Percentage (%)
Age	66 (8)		
70 years old and above		71	31.4
60–69 years old		155	68.6
Gender			
Male		34	15.0
Female		192	85.0
Ethnicity			
Malay		208	92.0
Chinese		12	5.3
Indian		6	2.7
Marital status			
Never married		12	5.3
Currently married		119	52.7
Divorced or separated		14	6.2
Widowed		81	35.8
Education level			
No formal education		3	1.3
Primary education		45	19.9
Secondary education		132	58.4
Tertiary education		46	20.4
Household income	1450 (3000)		
Low income (< RM3000)		156	69.0
High income (≥ RM3000)		70	31.0

Table 2 Factors associated with high level of healthy ageing among respondents ($n = 226$)

Independent variable	Simple Logistic Regression		Multiple Logistic Regression				
	Crude OR	*p*-value	Adjusted coefficient	Adjusted OR	95% CI		*p*-value
					Lower	Upper	
Intercept			-4.217				
Age							
70 years old and above	Ref						
60–69 years old	1.480	0.173					
Gender							
Male	Ref		Ref				
Female	2.213	**0.040***	1.416	4.121	1.699	9.994	**0.002***
Education level							
Low education	Ref						
High education	1.677	0.116					
Household income							
Low income	Ref						
High income	1.924	**0.026***					
Physical function	1.773	0.079					
Self-rated health							
Fair and poor			Ref				
Good	4.208	**< 0.001***	1.516	4.553	2.150	9.644	**< 0.001***
Depression							
Depression	Ref		Ref				
Not at risk of depression	7.376	**< 0.001***	1.809	6.107	2.125	17.552	**< 0.001***
Cognitive function							
Poor	Ref						
Good	1.841	0.153					
Multimorbidity							
No	Ref						
Yes	0.614	0.071					
Physical activity							
No	Ref						
Yes	2.338	**0.012***					
Social support							
Risk of social isolation	Ref		Ref				
No risk of social isolation	4.212	**< 0.001***	1.579	4.848	2.420	9.711	**< 0.001***

Multiple logistic regression (Forward LR), no interaction ($p > 0.05$), no multicollinearity, Hosmer and Lemeshow goodness of fit test ($p = 0.299$), Omnibus model of coefficient ($p < 0.001$), Nagelkerke R^2: 0.338

*Significant at *p*-value < 0.05

Factors associated with healthy ageing

Simple logistic regression analyses were conducted to examine associations between independent variables and healthy ageing level, with statistical significance set at $p < 0.05$. Female respondents had higher odds of achieving a high level of healthy ageing compared to males (OR = 2.213, 95% CI: 1.036–4.725, $p = 0.040$). Respondents with high household income were also more likely to experience a high level of healthy ageing than those with low income (OR = 1.924, 95% CI: 1.080–3.429, $p = 0.026$).

In terms of physical health, good self-rated health was significantly associated with healthy ageing (OR = 4.208, 95% CI: 2.179–8.128, $p < 0.001$). Respondents not at risk of depression had greater odds of achieving a high level of healthy ageing compared to those at risk (OR = 7.376, 95% CI: 2.725–19.966, $p < 0.001$). Engagement in regular physical activity was also positively associated with healthy ageing (OR = 2.338, 95% CI: 1.207–4.530, $p = 0.012$). Regarding social support, respondents with no risk of social isolation were significantly more likely to report a high level of healthy ageing than those at risk (OR = 4.212, 95% CI: 2.267–7.827, $p < 0.001$). Results from simple logistic regression showed that ten categorical independent variables and one continuous variable with *p*-values < 0.25 were included in the multivariable analysis (Table 2).

Multiple logistic regression analysis using the Forward LR method identified four statistically significant factors associated with high level of healthy ageing: female

gender, good self-rated health, not at risk of depression, and no risk of social isolation. The model demonstrated good fit based on the Hosmer–Lemeshow test ($\chi^2 = 7.242$, df = 6, $p = 0.299$) and explained 33.8% of the variance in healthy ageing level (Nagelkerke $R^2 = 0.338$). Overall, the model correctly classified 74.3% of respondents.

Female respondents were four times more likely to achieve a high level of healthy ageing compared to male respondents (AOR = 4.121, 95% CI: 1.699–9.994, $p = 0.002$). Respondents with good self-rated health had greater odds of a high level of healthy ageing compared to those with fair and poor self-rated health (AOR = 4.553, 95% CI: 2.150–9.644, $p < 0.001$). Similarly, those not at risk of depression were six times more likely to achieve high level of healthy ageing compared to those at risk (AOR = 6.107, 95% CI: 2.125–17.552, $p < 0.001$). Social support was also an important associated factor, with respondents not at risk of social isolation four times more likely to have a high level of healthy ageing compared to those at risk (AOR = 4.848, 95% CI: 2.420–9.711, $p < 0.001$) (Table 2).

Discussion

This study contributes to the growing body of evidence on healthy ageing within community-based settings in Malaysia, providing insights relevant to the implementation of the National Policy for Older Persons and the UN Decade of Healthy Ageing.

This study found that more than half (51.8%) of older persons registered at PAWE centres in Klang Valley achieved a high level of healthy ageing. This prevalence is considerably higher than previously reported in Malaysia, where healthy ageing was found in 14.1% of older persons in Terengganu [11] and successful ageing was reported at 13.8% nationwide in 2012 [12]. Internationally, the prevalence observed in this study was higher than in India (27.2%) [16] but lower than in Thailand (66%) [19] and China (65.5%) [15]. These variations may be attributed to differences in measurement tools, study populations, and cultural perceptions of ageing. For instance, Ghazali et al. [11] and Hamid et al. [12] applied multidimensional frameworks, while Chen et al. employed specific instruments such as the Healthy Ageing Instrument [15] and Ng et al. used Healthy Ageing Questionnaire [20]. The higher prevalence in this study may also reflect the PAWE setting, where members regularly participate in structured activities and are more socially engaged compared with community-dwelling populations in earlier local studies, who may face ageing-related challenges such as mobility barriers and reduced social interaction that can limit participation and well-being.

The analyses identified four statistically significant factors associated with high level of healthy ageing: female gender, good self-rated health, not at risk of depression, and no risk of social isolation. Female respondents were four times more likely than males to achieve high level of healthy ageing, consistent with findings from China and Finland [15, 55]. Biological differences such as slower immunosenescence, the protective effects of estrogen, and genetic polymorphisms linked to longevity in women may explain this advantage [56, 57]. In the context of PAWE, this gender difference may also reflect patterns of social participation and program engagement, whereby older women may be more likely to participate in organised group activities and social networks than men, which may further enhance their likelihood of achieving healthy ageing.

Self-rated health was another associated factor, with respondents reporting good self-rated health significantly more likely to a have high level of healthy ageing. This finding is consistent with previous studies by Chen et al., Rivadeneira et al., and Wang et al. [15, 58, 59] that reflects the multidimensional nature of health perceptions, which are shaped by physical functioning, psychological resilience, and adaptation [60, 61]. The "disability paradox" may explain why some older persons perceive themselves as healthy despite chronic conditions, as they adapt to limitations and maintain a positive outlook [58]. The supportive environment of PAWE may have further contributed to positive health perceptions.

Not at risk of depression was also a significant associated factor; those not at risk of depression were six times more likely to achieve healthy ageing. This finding aligns with studies from Singapore and China [15, 20] as well as longitudinal evidence linking depression to loss of healthy ageing status and mortality [21]. Age-related stressors such as functional decline, bereavement, and ageism may exacerbate depression, limiting engagement in health-promoting behaviours and impeding the ageing process [62]. The results highlight the importance of mental health screening and timely interventions in older populations.

Social support was another important associated factor, as respondents with no risk of social isolation were four times more likely to report a high level of healthy ageing. This is consistent with studies from China and Japan [15, 22] and with local findings [63]. Evidence also suggests that strong social networks protect against dementia, depression, and reduced well-being [64, 65]. In the context of PAWE, regular group activities likely promoted social connectedness and improved mental well-being, highlighting the value of community-based programs in enhancing healthy ageing.

Other factors such as household income and physical activity were significantly associated with healthy ageing in bivariate analysis, but they were not retained in the final multivariable model because they became non-significant after adjustment. Respondents with high

household income were more likely to experience healthy ageing, supporting findings from Thailand and Malaysia [12, 19]. Financial stability may provide access to healthcare, healthier environments, and social opportunities, while economic insecurity can undermine nutrition, mobility, and psychological well-being [66, 67]. Similarly, physical activity was also associated with healthy ageing, consistent with evidence from India and Mexico [16, 21]. Regular physical activity supports functional ability, reduces frailty, and improves cardiometabolic and cognitive health, reinforcing its importance as a cornerstone of healthy ageing [16, 68].

Recommendations for research and service

These findings emphasise the need for public health strategies that integrate gender-sensitive approaches, proactive mental health screening, economic empowerment, and physical activity promotion, alongside efforts to strengthen social networks. Tailored interventions should also be developed based on the key factors associated with healthy ageing identified in this study. To increase male participation, community-based activities inspired by the "Men's Sheds" model could provide supportive spaces that reduce isolation and foster engagement [69]. Structured low-impact activities such as tai chi or brisk walking, combined with health education, may enhance functional ability and improve self-rated health [70]. Peer-led support models such as the "Friendship Bench" offer a scalable community-based approach to address depressive symptoms [71]. Strengthening social networks through buddy systems, intergenerational exchanges, and volunteer engagement can further reduce isolation and promote well-being [72].

In Malaysia, PAWE provides an existing delivery platform, and its programs could be strengthened through intersectoral collaborations. For example, PAWE could incorporate structured physical activity through Fit Malaysia by Ministry of Youth and Sports Malaysia [73], targeted male-friendly groups focusing on men's health, and routine mental health screening with clear referral pathways to primary care and community mental health services such as Community Mental Health Centre (MENTARI) under Ministry of Health Malaysia (MOH) [74]. Moreover, PAWE activities could also be aligned with community NCD prevention and health education support via "Healthy Community, Building the Nation" (*Komuniti Sihat Pembina Negara*, KOSPEN) by MOH [75], alongside community partnerships to expand social participation through neighbourhood organisations (*Kawasan Rukun Tetangga*, KRT). Continuous monitoring and evaluation of such initiatives are essential to assess effectiveness, refine implementation, and ensure alignment with Malaysia's National Policy for Older Persons and the UN Decade of Healthy Ageing.

Strengths and limitations of the study

One of the strengths of this study is its high response rate (98.3%), which reduces the likelihood of non-response bias. Importantly, it is also the first study to determine factors associated with healthy ageing among older persons registered at PAWE centres in Klang Valley, a community-based program that is part of Malaysia's National Policy for Older Persons. The use of proportionate stratified sampling ensured that participants were drawn from all PAWE centres in the region, enhancing representativeness across settings. In addition, data were collected using validated instruments that covered multiple domains of healthy ageing, increasing the consistency and strength of the findings.

Nevertheless, several limitations should be acknowledged. As a cross-sectional study, causal relationships between the associated factors and healthy ageing cannot be established. The study population was limited to older persons registered at PAWE centres, who are likely to be more socially active and functionally independent than the general older population. This may have introduced selection bias and overestimated the prevalence of healthy ageing, particularly as older persons with severe frailty, cognitive impairment, or advanced illnesses were not represented. Therefore, the prevalence estimates reported in this study may not be generalisable to the broader older population. The sample was also predominantly female, which may reflect differential program engagement. Thus, the observed association between female gender and high level of healthy ageing should be interpreted with caution. Finally, the use of a self-administered questionnaire may have introduced reporting or recall bias, although efforts were made to minimise these through careful instrument design and pre-testing.

Conclusion

This study found that more than half of older persons at PAWE centres in Klang Valley achieved a high level of healthy ageing. Female gender, good self-rated health, not at risk of depression, and no risk of social isolation were the significant associated factors. These findings highlight the importance of integrating gender-sensitive strategies, mental health support, physical activity promotion, and social engagement into community-based programs. The observed healthy ageing level among PAWE participants indicates that PAWE has the potential to function as an important delivery platform for community-based healthy ageing initiatives. Strengthening these initiatives in alignment with national and global ageing policies, guided by the associated factors identified in this study, will be essential to support Malaysia's transition towards an ageing society and to ensure that older persons not only live longer but also age healthily, independently, and with dignity.

Abbreviations

ADL	Activities of daily living
AOR	Adjusted odds ratio
CDT	Clock Drawing Test
CI	Confidence interval
GDS-15	Geriatric Depression Scale (15-item)
HAQ	Healthy Ageing Questionnaire
IBM SPSS	IBM Statistical Package for the Social Sciences
JKM	Department of Social Welfare Malaysia (Jabatan Kebajikan Masyarakat)
KOSPEN	Komuniti Sihat Pembina Negara
KRT	Kawasan Rukun Tetangga
MENTARI	Community Mental Health Centre
MOH	Ministry of Health Malaysia
NCD	Non-communicable disease
NHMS	National Health and Morbidity Survey
NPOP	National Policy for Older Persons
OR	Odds ratio
PAWE	Pusat Aktiviti Warga Emas
VIF	Variance inflation factor
WHO	World Health Organization
UN	United Nations

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Authors' contributions
The study was conceived and designed by SASM, NAMZ, and SAM. SASM collected the data, performed the statistical analyses, and drafted the manuscript. NAMZ and SAM contributed to the interpretation of the data and critically revised the manuscript. All authors read and approved the final version of the manuscript.

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Data availability
The datasets generated and/or analysed during the current study are not publicly available due to confidentiality agreements with participating centres but are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the Ethics Committee for Research Involving Human Subjects, Universiti Putra Malaysia (JKEUPM-2025-232). Permission to conduct the study was granted by the Department of Social Welfare Malaysia (JKM). Written informed consent was obtained from all participants prior to data collection. Participants who scored ≥ 5 on the Geriatric Depression Scale (GDS-15) were referred to local health facilities for further assessment and management. This study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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