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Does Active Aging Reduce Mortality Risk Among Older Adults? A Survival Analysis in Malaysia

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Abstract

Active aging is important for promoting the health, wellbeing, and participation of older adults. This study investigated the association between active aging and mortality risk among 2 230 respondents aged 60 and older. Principal component analysis extracted a five-factor structure from 15 indicators of active aging. The mean active aging score was 55.57 and the median was 53.33. The Kaplan-Meier curve showed that individuals with active aging scores of 53.33 and above had significantly longer survival than those below the median. Cox regression analysis indicated the significance of active aging in reducing mortality risk by 2.5% after adjusting for sex, marital status, age, ethnicity, chronic diseases, and risk factors. The active aging approach comprising health, economic, and social factors is crucial in improving survival among older adults. Hence, policies and programs that promote active aging should be encouraged to enhance the health and wellbeing of older adults and their engagement in society.

Keywords

active aging, mortality risk, survival, principal component analysis, Kaplan-Meier curve

What We Already Know

- Active aging is an emerging concept in European countries.
- Active aging has the potential to reduce mortality risk among older adults.
- At present, there are limited studies in Malaysia on active aging, particularly regarding mortality risk.

What This Article Adds

- In this study, a five-factor structure was found to explain active aging.
- The mean active aging score of the study sample is 55.57.
- Active aging remains a significant factor in predicting mortality risk after adjusting for socioeconomic and demographic characteristics, diagnosed diseases, and risk factors.

Introduction

The world's population is aging rapidly, with advances in public health contributing to increased longevity. The population of Eastern and South-Eastern Asia is expected to decline from 2 342 million in 2022 to 2 317 million in 2050. At the same time, the percentage of persons aged above 65 years will increase from 12.7 to 25.7 in this region.[1] Longevity is a triumph of public health, and advances in medicine are one of the contributors in this regard.[2,3] Longevity has led to a growing number of older adults, and a new perspective has emerged which views them as potential human resources and assets. They continue to make significant contributions to their families, communities, and the nation.[2] Active aging has emerged as a positive way to promote the contribution of older adults to society.

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While there is no universal definition of active aging, there is a consensus that it involves health, participation, and security as people age. The World Health Organization[2] and the International Longevity Center Brazil[4] emphasized the importance of health participation and security as people age. Zaidi et al[5] highlighted continuous participation in the formal labor market and engagement in unpaid productive activities as well as healthy, independent, and secure lives. These definitions have focused not only on the health aspect but also on economics and social determinants.

Prior to active aging, several "aging well" theories were operationalized to describe a positive aging process, but with limitations. The concept of successful aging has been criticized as it overprioritizes physical and mental health by assuming the absence of major diseases.[6] Productive aging amplifies engagement in productive activities.[7] Thus, unlike earlier theories of successful aging and productive aging, active aging is a more comprehensive approach that recognizes the multidimensional nature of aging.[8,9]

However, operationalizing this concept remains a matter of debate among practitioners, with different models and indicators used to measure the status of active aging.[9] One emerging indicator in European countries is the Active Aging Index (AAI).[5] The AAI is a useful tool as it can monitor the status of active aging over time.[5] It provides independent evidence that could help in identifying successful policy recommendations at the micro-level and allows mutual learning at the macro-level.[10]

The potential of active aging includes reducing premature death and increasing the chances of survival.[2,5] Mortality statistics have been used universally as important indicators of population health. A population-based study in Spain found that health pillars in active aging may play a vital role in survival.[11] This is further supported by two other studies that examined the relationship between successful or healthy aging that focused on health determinants and mortality risk.[12,13] Despite this potential, no studies have assessed the association between active aging and mortality risk.

Malaysia's population is rapidly aging, with 7% aged 65 and older in 2020, indicating the emergence of an aging nation.[14] This presents an opportunity to improve the quality of life of older adults through research. This study focused on active aging and mortality risk. To measure the status of active aging, we operationalized the definition proposed by Zaidi et al[5] and adopted the same indicators as an individual construct. This is similar to what was done in other countries.[15] We validated this individual construct by identifying the underlying variation among the indicators and used it to compute the active aging score. This study informs the public about the importance of active aging in determining the population health and discusses policy suggestions Thus, the aim of this study is to investigate the association between active aging and mortality risk in Malaysia.

Methods

Study Population

The study sample comprised 2230 respondents aged 60 and older who participated in the Malaysia Aging and Retirement Survey (MARS). The rationale for choosing participants aged 60 years and older was that the mandatory retirement age in Malaysia was set at 60 years. The MARS is a nationwide longitudinal study of older adults covering both Peninsular and East Malaysia. This study aimed to understand the various aspects of aging and retirement experiences among middle-aged (aged 40 years and older) community-dwelling older adults in Malaysia. The baseline study was conducted between 2018 and 2019. A total of 5 613 respondents were interviewed via Computer-Assisted Personal Interview (CAPI) with a response rate of 84%. The sampling setting excluded institutionalized individuals. Ethical approval was obtained from the Institutional Ethics Review Board of the Universiti Malaya (reference no. UM.TNC2/UMREC-341). Written informed consent was obtained from the respondents prior to the interviews.

Mortality

The death status of the 2 230 respondents was observed approximately 48 months (four years) following the completion of the baseline study. This was done using mortality data provided by the Ministry of Health Malaysia (MOH) where the status of death was traced using the National Registration Identity Card Number, a unique number assigned to each Malaysian citizen. In Malaysia, reporting deaths prior to burial is a legal requirement, and this can be done either by health care providers from hospitals or by individuals to local authorities such as the police.

Active Aging Assessment Tool

The status of active aging in this study was assessed using the active aging assessment tool in MARS, which was derived from the 22 indicators introduced by Zaidi and Um[15] (Supplementary material 1). These indicators assessed the status of active aging in terms of employment; participation in society; independent, healthy, and secure living, as well as capacity and enabling environment. The initial idea of these indicators was to measure the status of active aging from the perspective of national performance. This information was obtained from multiple data sources. Several age groups were used to measure the aging experience at different stages. In this study, we adopted 22 indicators as closely as possible to assess the status of active aging from the perspective of individual performance using MARS data. Hence, the original indicators were modified to transform them into individual constructs. The reference age groups that were originally used in the indicators were abolished as they were

no longer applicable in this study. The family contribution originally captured using two separate indicators was combined into a single measurement in this study, where the contributory work made through either one was considered. The two financial security indicators originally drawn from household income data were replaced with a single measurement of perceived financial independence from the MARS; the Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) were combined into a single measurement to represent independent living. An individual was said to live independently if and only if with the absence of difficulty in both ADL and IADL. Self-rated health replaced the health capacity that was originally measured using the life expectancy and healthy life expectancy.[16] Physical safety was removed and not able to measure as there was no information in MARS data.

Active Aging Score

Altogether, there was a total of 15 indicators used in this study to measure individual performance. All indicators were expressed in a binary outcome of 0 and 1 where 0 indicates the absence and 1 indicates the presence of such ability. All indicators were summed up and then harmonized into an individual score ranging from 0 to 100.[17] This score follows the positive normative judgment that the higher the score, the better.

Other Variables

Several confounding variables were considered in this study. This included socioeconomic and demographic background such as sex, age, place of residence, marital status, and ethnicity. Diabetes, hypertension, and high cholesterol were the top three diseases among older adults aged 60 years and older in Malaysia,[18] and they were included in this study as potential variables associated with the outcome measure. Risk factors such as abdominal obesity and obesity were also included in this analysis.[19-22]

Statistical Analysis

Statistical analyses were performed in four phases. First, descriptive statistics were generated as percentages to understand the characteristics of the sample. Second, to explore the latent construct of the 15 indicators in measuring active aging, the principal component analysis (PCA) was performed with varimax rotation. The Kaiser-Meyer-Olkin (KMO) sampling adequacy with a cut-off value of 0.6 and above indicated the appropriateness of data in performing PCA. The number of factors retained was based on the eigenvalue equal to or greater than 1. The internal consistency of the 15 indicators was evaluated using Cronbach's alpha where a value of 0.6 and above indicated good internal consistency. Third, the active aging score was transformed into a binary outcome where the median score was used as the cut-off value. Kaplan-Meier survival curves were constructed to compare the survival time between those who scored below the median value and those who scored higher than the median value. The log-rank test was used to test for significant differences between the two survival curves, and the significance of the test was set at 5%. Fourth, hazard ratios (HRs) and 95% confidence interval (95% CI) were computed to examine the longitudinal impact of active aging on mortality risk using the Cox proportional-hazards regression model. The significance of HR (α) was set at 5%. All the analyses were carried out using SPSS version 28.

Table 1. Basic Characteristics of the Participants Based on Dependent Variable (n = 2230).

Variables	No. (%)
Sex	
Male	1026 (46.0)
Female	1204 (54.0)
Marital status	
Not married	734 (32.9)
Married	1496 (67.1)
Age (Years)	
60-69	1443 (64.7)
70-79	620 (27.8)
80+	167 (7.5)
Place of residence	
Rural	865 (38.8)
Urban	1365 (61.2)
Ethnicity	
Malay	1227 (55.0)
Chinese	324 (14.5)
Indian	206 (9.2)
Others	473 (21.2)
Diagnosed illnesses	
Diabetes	98 (4.4)
Hypertension	418 (18.8)
High cholesterol	83 (3.7)
Any of the two diseases	496 (22.3)
All three diseases	253 (11.4)
Not at all	878 (39.4)
Risk factors	
Obesity	674 (31.6)
Abdominal obesity	1561 (72.7)

Results

The response rate for this study was 84%. The respondents who participated in this study were predominantly women, married, and aged 60 to 69 years. Approximately 61% of the respondents lived in urban areas and more than half of the respondents were Malay (Table 1). About 39% of the respondents had no diagnosed diseases, 32% had obesity, and 73% had abdominal obesity. Tracking of the mortality status of

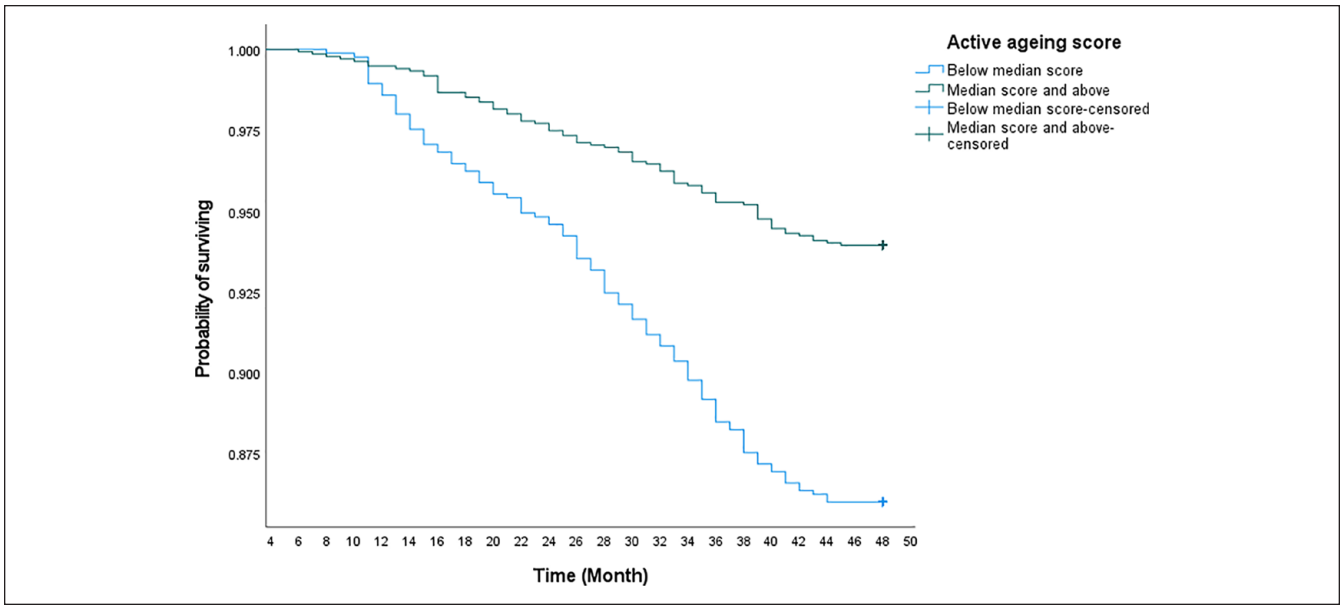

Figure 1. Kaplan-Meier curve of the active aging score below median value versus median value and above.

the 2 230 respondents showed that 204 deaths (9.1%) occurred over the course of four years. The death rate among those who had an active aging score below the median value was 14.0% compared with the death rate of 6.1% among those who scored higher than the median value.

The KMO value of 0.786 indicates that PCA was appropriate, and the results show a five-factor structure in measuring the status of active aging with a total variance explained at 49% (Supplementary material 2). The five factors measured active aging from different perspectives, namely, social participation, cultural environment, health capacity, subjective wellbeing, and personal capacity. The Cronbach's alpha of these 15 indicators was 0.6763. These 15 indicators were aggregated by taking the summation, yielding plausible scores ranging from 0 to 15. The score was then normalized to the active aging score of 0 to 100 with a mean of 55.57 (standard deviation = 18.80) and median of 53.33.

The active aging score was transformed into a binary outcome of below the median score and above the median score. The Kaplan-Meier curve showed a visible gap in terms of probability of survival where respondents who scored above the median value had greater survival than those who had scored below the median value (Figure 1). The log-rank test was significant at the 5% level ($\chi^2 = 40.332$, P value = .00). Over the course of 48 months, the mean survival time of respondents with a median score was 47 months and the mean survival time of respondents with a median score below was 45 months.

The Cox regression in Table 2 shows that after adjusting for confounding factors, active aging was significant at the 5% level. The mortality risk was reduced by 0.975 times (95% CI [0.966, 0.983]). Among the confounding factors, female respondents (HR: 0.433, 95% CI [0.307, 0.611]) and married respondents (HR: 0.658, 95% CI [0.467, 0.927]) had a lower mortality risk. Respondents aged 80+ (HR: 2.717, 95% CI [1.749, 4.223]) and diagnosed with diabetes (HR: 2.975, 95% CI [1.712, 5.171]) had a higher mortality risk.

Table 2. Cox Regression to Determine the Impact of Active Aging on Mortality (n = 2230).

Variables	HR [95%CI]	P
Female	**0.433*** [0.307, 0.611]	<.001
Married	**0.658*** [0.467, 0.927]	.017
70-79 years[a]	1.351 [0.958, 1.904]	.086
80+ years[b]	**2.717*** [1.749, 4.223]	<.001
Chinese[b]	0.863 [0.545, 1.367]	.530
Indian[b]	0.650 [0.361, 1.171]	.151
Others[b]	1.079 [0.740, 1.573]	.691
Urban	0.888 [0.641, 1.229]	.473
Diabetes[c]	**2.975*** [1.712, 5.171]	<.001
Hypertension[c]	0.686 [0.436, 1.080]	.103
High cholesterol[c]	0.519 [0.163, 1.654]	.267
Any of the two[c]	1.175 [0.799, 1.728]	.412
All three diseases[c]	0.990 [0.585, 1.678]	.971
Abdominal obesity (Yes)	0.960 [0.679, 1.356]	.815
Obesity (Yes)	0.880 [0.610, 1.269]	.494
Active aging score	**0.975*** [0.966, 0.983]	<.001

Abbreviations: 95% CI, 95% confidence interval; HR, hazard ratio.
[a]Reference group is 60-69 years.
[b]Reference group is Malay.
[c]Reference group is No diagnosed diseases.
*$P < .05$.

Discussion

Studies on active aging are still scarce in Malaysia. To the best of our knowledge, this is the first study that assesses

active aging and mortality risk. In this study, we highlight the implications of active aging on mortality risk. We formulated an indicator to assess the status of active aging at the micro-level by adopting the same definition and indicators proposed by Zaidi et al.[5]

Active aging is a multidimensional concept.[23] The PCA extracted a five-factor structure based on 15 indicators. The first factor consisted of family contribution, voluntary activities, social activities, civic and religious activities, and involvement in physical exercise. This shows that the factor was related to participation in society. The second factor comprised working status, house ownership, financial independence, and independent living. This reflects one's personal capacity. The third factor was education and the use of information and communications technology (ICT). This is attributed to cultural and environmental factors. The fourth factor was self-rated health and mental wellbeing. Life satisfaction and access to healthcare facilities formed the fifth subjective wellbeing factor. Our study revealed that the five-factor structure was centered around participation in paid and unpaid activities as well as living a healthy and independent life.[5] Our results also amplified the importance of personal characteristics, sociocultural, economic, and policymaking that could encourage older adults to actively age.[9]

An active aging assessment tool was established based on the results of the PCA. This active aging assessment tool showed reliable internal consistency which explained 49% of the variance. Similarly, another study established a micro-level AAI based on the same indicators used in the European Active Aging Index (EU-AAI).[16] This micro-level index is consistent with the macro-level index in explaining the status of active aging. Hence, our active aging assessment tool can capture the status of active aging in older Malaysians. On average, the active aging score of Malaysians aged 60 years and older was 55.57. This indicates that room for improvement is needed to facilitate and encourage older Malaysians to become more active. Room for improvement can be identified based on the indicators incorporated into the active aging score. The active aging score serves as a baseline for scrutinizing existing policies and implementing policy interventions. For example, Poland introduced a new long-term seniors policy for 2014-2020 after introducing their AAI.[10]

Our study confirms the findings of a previous study in which active aging predicted greater survival rates among older adults.[11] However, their study only incorporated the health pillar of the active aging model introduced by the World Health Organization. In contrast, our study provides a more holistic view of the potential of active aging in predicting survival chances by incorporating not only health indicators but also economic and social indicators. The Kaplan-Meier curve showed a significant difference in terms of survival period using the median score as the cut-off value. In the model estimation, we controlled for sex, marital status, age, ethnicity, diagnosed diseases (diabetes, hypertension, and high cholesterol), and risk factors (obesity and abdominal obesity); active aging remained a significant predictor with a one-unit increment in the active aging component; and the mortality risk was reduced by 2.5%. In other words, older adults are more likely to live longer and healthier even in the presence of a disease. Notwithstanding that the sample in this study included individuals aged 60 and older, our results partially supported the idea of the World Health Organization[2] where active aging reduced premature death and fewer disabilities related to chronic diseases, and achieved a better quality of life.

Our study contributes to the debate of São José et al[24] where we confirmed that the active aging indicators introduced by Zaidi et al[5] do explain some variation in active aging; to the least extent, we validated this using a statistical approach. However, the percentage of explained variance supported the argument that more indicators should be considered in active aging, especially the parameters that measure the capacity of older adults as capacity is the foundation of active aging.[24] Zaidi et al[5] proposed a four-factor structure in active aging which our study did not confirm; instead, we found a five-factor structure. This further emphasizes the importance of how older adults value their involvement in each aspect of active aging and the cultural values embedded in the local society. In sum, this does not prevent us from acknowledging the merits of the active aging indicators, but debate can be the cornerstone for future collaborative studies that can be undertaken in countries that have similar longitudinal studies on older persons.

The results of this study are encouraging and suggest that active aging predicts a greater chance of survival. While longevity can lead to increased health care costs, promoting a change to an active and healthy lifestyle can help reduce this burden on both individual and society.[25-27] One way to promote this is to organize health promotion and educational programs that impart knowledge on proper nutrition such as adequate protein, energy, and other nutrient intake; changes in dietary habit; the importance of exercises, particularly strength and resistance exercises; sleep health; and smoking cessation and reduction in alcohol consumption, which would increase the health awareness of older adults as part of public health initiatives. A periodic community-based fitness class is highly recommended to strengthen the physical capacity of older adults. This approach is in line with the concept of active aging, which emphasizes the importance of older adults participating in productive activities and maintaining independence and security.[2] Active aging promotes the management of population aging in an active way that is much more cost-effective than in a passive manner, where older adults do not always depend on states and families.[10] A limitation of this study is that we were unable to examine the impact of active aging on mortality risk by sex due to the small number of events that occurred within the study period. This is because gender differences prevail in many studies on active aging.

Conclusion

Our study contributes to the existing knowledge about active aging and provides empirical evidence on how active aging predicts a greater chance of survival. We considered beyond the health determinants by including the economics and social determinants in measuring active aging where we further emphasized the multidimensionality of the concept through PCA. A five-factor structure and significant association between active aging and mortality risk were found. Although there is limited evidence in bridging active aging and existing policy in the country, the highlight of this study is that policy interventions can be done through multifaceted dimensions so that older adults are not only living longer but also living longer in an active and healthier manner. Programs that could encourage older adults to continuously participate in paid and unpaid productive activities, as well as live independent, healthy, and secure lives are highly recommended.

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Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

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