

Development of the Active Ageing Awareness Questionnaire in Malaysia

Nor Hana Ahmad Bahuri

University of Malaya Department of Social and Preventive Medicine

Hussein Rizal

University of Malaya <https://orcid.org/0000-0001-9229-1586>

Hazreen Abdul Majid

University of Malaya Department of Social and Preventive Medicine

Mas Ayu Said (✉ mas@ummc.edu.my)

University of Malaya <https://orcid.org/0000-0002-1341-4582>

Tin Tin Su

Universiti Monash Malaysia Jeffrey Cheah Sekolah Perubatan: Monash University Malaysia Jeffrey Cheah School of Medicine and Health Science

Research

Keywords: active ageing, confirmatory factor analysis, exploratory factor analysis, adults, quality of life

Posted Date: November 19th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-110168/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background

The World Health Organization endorsed the Active Ageing Framework (AAF) in 2002, aiming to improve quality of life of future older people. Active ageing is defined as the process of optimising the opportunity of health, participation and security in order to enhance the quality of life as people age. However, little is known about the status of awareness of active ageing at the population level with no appropriate tool for assessment. The aim of this study is to develop the Awareness of Active Ageing Questionnaire (AAAQ) based on the AAF.

Methods

The content, linguistic and face validations, as well as test-retest reliability were conducted. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed to test the structural validity of the AAAQ.

Results

A total of 110 participants (mean \pm SD = 50.19 \pm 5.52) were selected for the pilot, 81 participants (mean \pm SD = 49.40 \pm 5.70) for the test-retest and 404 participants (mean \pm SD = 49.90 \pm 5.80) for the CFA and EFA tests. The 16 items AAAQ Malay version showed satisfactory reliability and validity. The Cronbach's alpha was more than 0.7, and the model showed good fit: Cmin/df = 2.771, GFI = 0.903, TLI = 0.951, RMSEA = 0.08.

Conclusions

The AAAQ is suitable for measuring the awareness of active ageing among middle-aged Malaysians and may be instrumental for the development of evidence-informed active ageing promotion programme.

Background

In the year 2050, the global ageing population will outnumber the population aged less than 15 years old for the first time [1]. It has been estimated that Malaysia will become an aged nation in 2030 [2], and the proportion of older persons will be at least 15 percent of the total population [3]. In general, increasing ageing population reflects the tremendous achievement of public health policies, social and economic development. However, this phenomenon has resulted in profound health, social and economic implications, and led to significant challenges [4]. The older population suffers the highest rate of disability in areas such as hearing [5], visual [6], memory loss [7], urinary incontinence [8] and joint pain [9].

This phenomenon has resulted in the endorsement of the Active Ageing Framework in 2002 by the World Health Organization (WHO) [10] which serves as a guide for policymakers for designing policies and programs that aim to ensure the quality of life (QoL) of older persons. Active ageing is defined as "the process of optimising the opportunity of health, participation and security in order to enhance the QoL as people age" [10]. Whereas, QoL is defined as "an individual's perception of their position in their life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" [11].

Studies found that the perceived QoL of current older Malaysians (age 60 and above) is poor [12–13] and that older women have significantly lower psychological well-being as compared to their counterpart [14]. In addition, it was reported that the prevalence of successful ageing which is described as "low probability of disease and disease-related disability; high cognitive and physical functioning and active engagement in life" among older Malaysia is only 13.8 percent [15]. Aside from sociodemographic, factors such as differences in socioeconomic and medical illness status have been shown to be associated with health related QOL [16]. Therefore, there is a need to promote active ageing among the adult population through intervention programs in order to assist them to age actively.

There is currently no specific and standardised tool available to measure awareness of active ageing. Several studies have been conducted on awareness of ageing in many settings internationally, however the aspect of 'participation' and 'security' dimensions were left out in the questionnaires [17–18]. In other studies, the Healthy Ageing Quiz [19] and Elderly Awareness on Healthy Lifestyle during Ageing [17] were valid and reliable, however, the focus was again specifically on healthy ageing, and not reflect the active ageing as a whole. Therefore, there is a need to develop a valid and reliable measurement tool, which fully represents the active ageing concept.

The initial step in designing an Active Ageing Awareness Questionnaire (AAAQ) involved developing the three pillars to represent the WHO's Active Ageing Framework which are health, participation and security. These three pillars served as a guide in the form of constructs for the development and analysis of the items. The AAAQ is expected to measure the baseline population's awareness of active ageing which will be instrumental for the development of evidence-informed active ageing promotion programme in Malaysia.

Methods

A pilot test-retest and Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted to test the structural validity of the AAAQ. The assessment was conducted in two districts of Johor, Malaysia, Kulajaya and Kota Tinggi. The participants were from non-professional group of employees from the private and public sectors [20]. Purposive quota sampling was employed to recruit the participants with the help of the selected organisations. The participants were Malaysians and aged between 40 and 60 years old. Ethical approval was obtained from the Ministry of Health, Malaysia and is approved by the Research Ethics Committee.

Content validation

Content validation of the AAAQ was to ensure that the items were relevant for measuring the awareness of active ageing among the target population, specifically in the Malaysian context. Therefore, three experts in Public Health and one in Gerontology and Geriatrics were asked to review and evaluate the items and rate the relevance of each item on a four-point Likert scale. Overall, the AAAQ was calculated to have a content validity index for individual items (I-CVI) of 1.00 and a content validity index for scale (S-CVI) of 1.00. In line with the experts' suggestions, a I-CVI ≥ 0.78 and a S-CVI ≥ 0.9 from at least three experts were considered to have good content validity [21]. Thus, the initial AAAQ contained two stand-alone questions and 22 items prior psychometric assessment.

Linguistic validation

The initial questionnaire was developed in English. The English version was sent for forward and backward translation to two native Malay speakers who have a medical background and who are proficient in English. The first person translated the questionnaire into Malay, the local and official language of Malaysia. After that, the second person translated the Malay version back into English and finally compared with the initial questionnaire by the researchers.

Face validation

The face validity check was done by recruiting five participants aged between 40 and 60 years old who were working in a public organisation and were classified as belonging to the non-professional group of employees. They were asked to answer the questionnaire and give feedback on the items in the questionnaire; the wording and understanding of the questions, the length of the questionnaire, the scoring system used, and the time needed to complete the questionnaire. The feedback from the participants were reviewed and taken into account but were not included in the data analysis.

Psychometric assessment

The psychometric assessment of the AAAQ involved a pilot test and a test-retest as well as validity and internal reliability testing using EFA and CFA. Data collection for the psychometric assessment of the AAAQ was conducted from October 2016 to January 2017.

A total of 110 participants completed the pilot test and 81 participants followed up for the retest two weeks later. A total of 404 participants were then recruited and completed the EFA and CFA. The eligible participants completed it and returned it to the researchers. The data was entered into REDCap software by two people, and then the researcher compared both sets of input data and cross-checked them with the questionnaire for any discrepancies. The researcher then verified the final dataset once again before exporting it to selected statistical software for further analysis.

Data analysis

The Statistical Package for the Social Science (SPSS) Version 23 and the Analysis of a Moment Structures (AMOS) Version 22 software programs were used. For the pilot test, mean values of each item was calculated and ensured that the highest correlation between each item and other items in the same construct ranged between 0.3 and 0.9. For the questionnaire to have reliability the lowest correlated-item-total-correlation (CITC) in each construct must be more than 0.3 [22] and the Cronbach's alpha value should be more than 0.7 [22]. For the test-retest, the ICC was calculated by comparing the item scores of the data from the two questionnaires. The ICC was classified as: poor (< 0.4), fair to good (0.4 to < 0.75) and excellent (≥ 0.75) [23].

The purpose of using EFA was to try to identify whether the items in the questionnaire were suitable for structure detection. Bartlett's test of sphericity was used to test the items' correlation matrix while the Kaiser-Meyer-Olkin (KMO) was used to measure sampling adequacy. Bartlett's test of sphericity with a significance level of less than 0.5 and a KMO of more than 0.7 that the items are suitable for structure detection and factor analysis [24]. After conducting EFA by using principal axis factoring, the eigenvalue of the factors extracted was compared with that of a parallel EFA analysis to confirm the number of factors that remain in the EFA [25] and that the eigenvalue should be more than 1 [22].

In a CFA, a tool undergoes assessments for dimensionality, validity and reliability [26] in which dimensionality was achieved when all the items have a factor loading of more than 0.5 [22, 26–27]. In addition, the questionnaire was tested for three types of validity: convergent, construct and discriminant. Convergent validity exists when the average variance extracted (AVE) for each construct is ≥ 0.5 ; construct validity is achieved when the fitness indexes of the model fulfil their criteria; and discriminant validity examines the redundancy of the constructs in the model [26]. Discriminant validity is achieved when the maximum shared variance (MSV) or the average shared variance (ASV) is less than the AVE [26]. The fitness of the model was also tested by using several indexes that are commonly used in the literature, namely, chi-square/degrees of freedom (CMIN/df < 3) [28]; goodness of fit index (GFI > 0.9) [29]; comparative fit index (CFI > 0.9) [30]; and root mean square of error approximation (RMSEA < 0.08) [31].

Finally, the reliability of the questionnaire was assessed to determine how strongly the measurement items held together in each construct. This was achieved when the Cronbach's alpha for each construct exceeds 0.7 [22]. Composite reliability (CR), which indicates the reliability and internal consistency of the latent construct, was achieved when CR ≥ 0.6 for every construct. The AVE, which indicate the average percentage of variance explained by the latent construct, should be more than 0.5 [22, 26].

Results

Characteristics of the participants

Out of the 110 participants that were approached during the pilot test, only 81 (74%) responded during the test-retest (Table 1), while, 404 participants responded for EFA and CFA tests.

Table 1
Characteristics of the participants for the AAAQ validation.

Characteristic	Pilot test (n = 110)		Test-retest (n = 81)		EFA/CFA (n = 404)	
	n	%	n	%	n	%
Age (Years ± SD)	50.19 ± 5.52		49.4 ± 5.7		49.9 ± 5.8	
<i>Gender:</i>						
Male	72	65.5	47	58.0	208	51.5
Female	38	34.5	34	42.0	196	48.5
<i>Ethnicity:</i>						
Malay	93	84.5	73	90.1	372	92.5
Chinese	9	8.2	5	6.2	18	4.5
Indian	8	7.3	3	3.7	12	3.0

Reliability analysis

In the pilot test analysis, the items in the questionnaire were assessed according to their respective constructs, namely, health, participation and security. The constructs had 11, seven and four items, respectively. Table 2 show the inter-item correlation for the three constructs. An inter-item correlation value of more than 0.9 indicates that an item addresses the same issue as one other item. It can be seen that none of the inter-item correlations have a value more of than 0.9 except for items 23 and 24 indicating that one of these items should be deleted due to the presence of redundancy.

Table 2
The Inter-item Correlation for the constructs in the pilot test (n = 110)

Health construct											Participation construct						
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
3	-	0.552	0.432	0.452	0.396	0.493	0.381	0.315	0.323	0.326	0.288						
4	0.552	-	0.317	0.203	0.226	0.236	0.070	0.095	0.258	0.181	0.033						
5	0.432	0.317	-	0.316	0.570	0.377	0.341	0.382	0.337	0.379	0.372						
6	0.452	0.203	0.316	-	0.501	0.811	0.580	0.418	0.512	0.442	0.389						
7	0.396	0.226	0.570	0.501	-	0.578	0.575	0.397	0.326	0.280	0.346						
8	0.493	0.236	0.377	0.811	0.578	-	0.588	0.491	0.660	0.619	0.435						
9	0.381	0.070	0.341	0.580	0.575	0.588	-	0.612	0.516	0.407	0.553						
10	0.315	0.095	0.382	0.418	0.397	0.491	0.612	-	0.550	0.557	0.594						
11	0.323	0.258	0.337	0.512	0.326	0.660	0.516	0.550	-	0.867	0.610						
12	0.326	0.181	0.379	0.442	0.280	0.619	0.407	0.557	0.867	-	0.708						
13	0.288	0.033	0.372	0.389	0.346	0.435	0.553	0.594	0.610	0.708	-						
14												-	0.286	0.162	0.387	0.220	0.215
15												0.286	-	0.566	0.569	0.149	0.570
16												0.162	0.566	-	0.520	0.214	0.625
17												0.387	0.569	0.520	-	0.410	0.588
18												0.220	0.149	0.214	0.410	-	0.179
19												0.215	0.570	0.625	0.588	0.179	-
20												0.208	0.515	0.558	0.453	0.045	0.804
21																	
22																	
23																	
24																	

An additional file shows this in more detail [see Additional file 1].

The Cronbach's alpha values for health ($\alpha = 0.892$), participation ($\alpha = 0.800$) and security ($\alpha = 0.931$) were at a value of more than 0.7. Both health (CITC = 0.296) and participation (CITC = 0.271) construct had a corrected-item-total-correlation (CITC) of less than 0.3, while security was at 0.711. The CITC measures

the reliability of a multi-item scale.

The result of the test-retest analysis is shown in Table 3. It can be seen that the ICCs for all items range from 0.489 for item A6 to 0.788 for item A7. The preferred ICC value is > 0.75, which is achieved by items A7, A14, A18 and A22. The ICC values of the other items range from 0.489 to 0.739, which are considered as “fair to good” [23]. Thus, the findings of the test-retest confirmed the stability of the AAAQ.

Table 3
The Intra-class Correlation Coefficient of the items in the test-retest
(n = 81)

Dimension	Item	ICC	95% CI	p-value	
Health	A3	0.634	0.337–0.787	< 0.001	
	A4	0.628	0.424–0.760	< 0.001	
	A5	0.696	0.523–0.806	< 0.001	
	A6	0.486	0.209–0.667	< 0.001	
	A7	0.788	0.671–0.864	< 0.001	
	A8	0.624	0.414–0.758	< 0.001	
	A9	0.722	0.567–0.821	< 0.001	
	A10	0.712	0.554–0.814	< 0.001	
	A11	0.690	0.517–0.801	< 0.001	
	A12	0.584	0.351–0.733	< 0.001	
	A13	0.677	0.501–0.792	< 0.001	
	Participation	A14	0.751	0.606–0.842	< 0.001
		A15	0.629	0.421–0.761	< 0.001
A16		0.737	0.590–0.831	< 0.001	
A17		0.739	0.593–0.832	< 0.001	
A18		0.754	0.619–0.842	< 0.001	
A19		0.728	0.575–0.825	< 0.001	
A20		0.608	0.397–0.747	< 0.001	
Security	A21	0.540	0.291–0.702	< 0.001	
	A22	0.787	0.670–0.863	< 0.001	
	A23	0.691	0.520–0.801	< 0.001	
	A24	0.699	0.531–0.807	< 0.001	

ICC = Intra-class Correlation Coefficient, CI = Confidence Interval

Exploratory Factor Analysis (EFA)

The initial analysis showed that the four factors that were extracted explained 67 percent of the variance in the 22 items of the AAAQ. However, it was noticed that one of the eigenvalues was less than 1 (factor 1 = 10.971, factor 2 = 1.860, factor 3 = 1.077, factor 4 = 0.633), which indicates that the factor is not significant [22]. Therefore, in order to determine the ideal number of factors that should be extracted for the AAAQ, a parallel analysis was conducted [25] and the eigenvalues of both analyses were compared. The parallel analysis (factor 1 = 1.7422, factor 2 = 1.6289, factor 3 = 1.5289, factor 4 = 1.4312) showed all eigenvalues had a value of more than 1. However, factors 3 and 4 were removed as the eigenvalues were either too close or less than a value of 1.

Subsequently, the EFA was repeated, but the number of factors was fixed at two. The findings showed that the two factors explained 58 percent of the variance in the 22 items of the AAAQ. Also, the KMO measure of sampling adequacy for the two factors was 0.916 at a significance level of less than 0.001, which is considered good [22]. However, it was observed that item A23 and A24 were highly correlated with each other, i.e., the correlation coefficient value was more than 0.9, which suggested that redundancy should be removed. Table 4 shows the distribution of the items among the two factors. It can be seen that the first factor consists of all the items that belong to the health construct while the items in the second factor were previously assigned to the participation and security constructs. Therefore, prior to conducting CFA, the two factors were renamed as the health and non-health constructs.

Table 4
Pattern matrix of the AAAQ with two factors

Item	Factor 1	Item	Factor 2
A3	0.586	A14	0.340
A4	0.239	A15	0.498
A5	0.601	A16	0.687
A6	0.779	A17	0.417
A7	0.654	A18	0.064
A8	0.882	A19	0.742
A9	0.821	A20	0.742
A10	0.738	A21	0.825
A11	0.886	A22	0.923
A12	0.867	A23	0.974
A13	0.754	A24	0.956

Confirmatory Factor Analysis (CFA)

In the CFA, the 22 items were analysed according to the two constructs mentioned above. The model was analysed step by step until the fitness of the model was confirmed. All 22 items in Model 1 were included in the first modelling analysis (Fig. 1). The fitness of the model was not achieved by Model 1 because two of the 22 items in Model 1 were highly correlated with each other, as identified in the EFA. The items in question were items A23 and A24. Of these two items, item A24 had a lower factor loading (0.956) as compared to item A23 (0.974).

In light of the above, before running the second model, item A24 was deleted. Moreover, four items with a factor loading less than 0.5, namely, A4, A14, A17 and A18, were also deleted because items with a factor loading below this value can also affect the fitness of the model [26]. In Model 2, the unidimensionality of the model was achieved after removing these five items, but not the fitness of the model (Table 5).

Table 5
Fitness of the model for AAAQ

Model	CMIN/DF	GFI	AGFI	TLI	CFI	RMSEA
	< 3	> 0.9	> 0.9	> 0.9	> 0.9	< 0.08
1	4.448	0.772	0.717	0.853	0.870	0.107
2	5.362	0.750	0.676	0.840	0.861	0.131
3	3.150	0.884	0.833	0.922	0.938	0.092
4	2.771	0.903	0.859	0.951	0.938	0.082
CMIN/DF = Chi-Square/Degree of Freedom, GFI = Goodness of Fit, AGFI = Average Goodness of Fit Index, TLI = Tucker Lewis Index, CFI = Comparative Fit Index, RMSEA = Root Mean Square of Error Approximation						

After the second model failed to achieve model fitness, the modification indices (MI) were examined. A MI value of more than 15 suggests that items are redundant [26]. Therefore, at this point in the CFA, items with a high MI were deleted and some of the paired items were set as 'free parameters'. Therefore, the MI was re-evaluated after Model 3 and another pair of items was set as 'free parameters'. Finally, the fitness of the fourth model was achieved. The items that were deleted in Model 2 and Model 3 were items A7, A12 and A23, while the paired items of A3-A5, A6-A8, A19-A20 and A21-A22 were set as free parameters. In Model 4, the construct validity was acceptable (Fig. 2). The findings in Table 6 was obtained after the fitness of the model was achieved in Model 4. The final model consists of 14 items; eight items from the health construct and six items from the non-health construct.

Table 6
The CFA validity and reliability results for the final model

Construct	Item	Factor loading	Cronbach's alpha (≥ 0.7)	CR (≥ 0.6)	AVE (≥ 0.5)	Health construct	Non-health construct
Health	3	0.55	0.92	0.91	0.56	0.75	-
	5	0.59					
	6	0.77					
	8	0.87					
	9	0.84					
	10	0.75					
	11	0.86					
	13	0.74					
Non-health	15	0.63	0.91	0.89	0.58	0.86	0.76
	16	0.76					
	19	0.82					
	20	0.81					
	21	0.73					
	22	0.82					
CR = Composite Reliability, AVE = Average Variance Extracted							

Finally, the composite reliability (CR) for the health and non-health constructs was 0.91 and 0.89, respectively, while the average variance extracted (AVE) was 0.56 and 0.58, respectively. Besides, the Cronbach's alpha for both constructs was 0.92 and 0.91, respectively. These findings indicate that the 14 items remaining in the final model of the AAAQ achieved satisfactory reliability [22]. The AAAQ also achieved convergent validity for the AVE for both constructs which was more than 0.5 [22].

Discussion

The development of the AAAQ was conducted systematically, and its psychometric properties were evaluated by testing it on a sample of 404 middle-aged persons (EFA and CFA only). The development of the AAAQ was guided by published literature and the Active Ageing Framework endorsed by the WHO [10], as well as input and feedback from experts in public health, geriatrics and gerontology. The AAAQ tool was intended to assess whether participants are aware of the three pillars of active ageing.

Most of the available tools have been developed for a specific population and set of objectives, which restricts usability for the general population, and which means that they are not appropriate for comparison. For example, the active ageing measurement tool developed by Perales et al. [32], targeted at European countries while [33] developed the tool to assess active ageing attributes based on Thai culture. Also, the evaluations of the related available tools to measure awareness of ageing have limitations in terms of their validity and reliability, and the issue being measured [18, 34].

Moreover, some of them have not completely incorporated all three pillars of active ageing, namely, health, participation, and security, into the questionnaire [17, 19]. Furthermore, the validation of these tools is not fully explained, and none of them have been translated and validated for local users. Therefore, the researcher became interested in developing an awareness of active ageing questionnaire for Malaysia based on the ageing framework selected for this study.

EFA is a statistical technique that is appropriate for scale development and is used to test or measure the underlying theory for hypothesized patterns of loading [35]. During the development of the items, initially, three factors were developed to represent the three pillars of the Active Ageing Framework. However, it became apparent from the EFA result that the three pillars were inextricable. The EFA yielded two factors for the 22 items that explained 58 percent of the variance in the items at a significance level of less than 0.001, which indicated as good explanatory power. It was apparent from the EFA result that all the items appropriately belonged to these two respective factors, and these two factors were renamed health and non-health factors. The EFA also revealed that two items were highly correlated with each other, and it was noted that this issue might affect the model fits later.

CFA is a statistical technique that is used to verify the factor structure in a set of items. It allows the researcher to test the hypothesis that there is a relationship between the items and the factors to which they belong [36]. Apart from a factor loading, convergent validity in this study was examined by observing the CR and AVE for each factor in the AAAQ. The value of CR and AVE should be more than 0.5 and 0.6, respectively. A lower CR indicates that the items do not measure what they are intended to measure. A low AVE indicates that more error remains in the items than the variance explained by the intended factor [22].

In the CFA, the initial 22 items were loaded into two factors (health and non-health). Then, a repeated process of modification was performed based on the factor loading of each item, the correlation between the items and factors, as well as the model fit. Initially, all the items with a factor loading of less than 0.4 were deleted. Also, when two items were highly correlated, the one with the lower factor loading was deleted. The MI were also examined, and when there were pairs of items that had high values, one of them was deleted or they were set as free parameters. Finally, the model that exhibited the most acceptable fitness

based on RMSEA, GFI, CFI, TLI, and χ^2/df were kept. The findings suggested that the model with 14 items had the best fit, and achieved construct validity, which indicated that the AAAQ was able to distinguish between those who were aware of active ageing and those who did not. Thus, in the final model, eight out of the 22 items were deleted (36 percent). It has been suggested that the proportion of items deleted should not be more than 20 percent [26].

The deleted items were essential factors for active ageing as agreed by the experts, but the psychometric assessment among study population did not support this view. Most probably, the item statements were not well understood by the participants. Besides, the development of the items was based on the findings and opinions of older persons, which the participants, who were in a younger age group, may not agree with until they became elderly. The CR, AVE and standardised factor loading of the final model with 14 items indicated that convergent validity was achieved. The two structures in this scale were considered good because all the factor loadings of the items were more than 0.5, the AVEs were more than 0.5 and the CRs were more than 0.6. This result indicated that there was sufficient convergent validity in this tool. Thus, the items were well correlated with their respective factors. Cronbach's alpha, AVE, and CR values confirmed that the AAAQ had internal consistency.

On the other hand, the AAAQ did not achieve discriminant validity. The maximum shared variance (MSV) and average shared variance (ASV) for both the health and non-health constructs were found to be 0.86. Thus, the values of both the MSV and ASV were higher than that of the AVE of the constructs, which suggested that discriminant validity was not achieved. However, even though discriminant validity is not achieved by the AAAQ, the overall validity of the AAAQ is not affected. In the AAAQ, all 14 items covering both constructs are summed up to get a score for the awareness of active ageing as there is no intention to discriminate the awareness of active ageing between the two constructs. This is because the review of the literature confirmed that the pillars of the Active Ageing Framework are inextricable. The fact that the three pillars of the Active Ageing Framework are inextricable may be the reason for the lack of discriminant validity [37–38].

This study has a number of limitations. Firstly, the result is based self-reported measure, which is a type of measurement that is prone to response and information bias. Secondly, the psychometric assessment of the AAAQ involved only the Malay version. It may be quite challenging to validate the English version in this study population as English is not their main language. Finally, as this is one of the first instruments to incorporate the Active Ageing Framework, there is no gold standards against which to evaluate its criterion validity. Thus, criterion validation of the AAAQ cannot be established.

In short, although the outcome of the EFA and CFA yielded only two factors, namely health and non-health factors; the essence of the active ageing framework is still captured in this questionnaire as it considers all three pillars, namely health, participation and security. Therefore, the 16 items (two stand-alone questions and 14 statements) of the Malay version of the AAAQ are satisfactory reliable and valid so the AAAQ can be used as a measurement tool to assess awareness of active ageing.

Conclusions

In summary, the relevancy of the AAAQ was tested by conducting content validation and face validity, reliability and consistency evaluations, as well as construct, convergent and discriminant validity tests. From the results, it was confirmed that the Malay version of the AAAQ was satisfactorily valid and reliable questionnaire with acceptable internal consistency that could be used in a local setting in Malaysia. Thus, it was suitable for use in measuring the awareness of active ageing among middle-aged population in Malaysia. This validated tool will enhance future public health research in this domain.

Abbreviations

AAF

Active Ageing Framework; AAAQ:Active Ageing Questionnaire; AGFI:Average Goodness of Fit Index; AMOS:Analysis of a Moment Structures; ASB:Average Shared Variance; AVE:Average Variance Extracted; CFA:Confirmatory Factor Analysis; CFI:Comparative Fit Index; CI:Confidence Interval; CITC:Correlated-Item-Total-Correlation; CMIN/DF:Chi-Square/Degree of Freedom; CR:Composite Reliability; EFA:Exploratory Factor Analysis; GFI:Goodness of Fit; ICC:Intra-class Correlation Coefficient; I-CVI:Content Validity Index for Individual Items; KMO:Kaiser-Meyer-Olkin; MI:Modification Indices; MSV:Maximum Shared Variance; QoL:Quality of Life; RMSEA:Root Mean Square of Error Approximation; SPSS:Statistical Package for the Social Science; S-CVI:Content Validity Index for Scale; TLI:Tucker Lewis Index; WHO:World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Ministry of Health, Malaysia (NMRR-16-40-28747), Medical Research & Ethics Committee and Medical Ethics Committee University Malaya Medical Center (MREC ID no: 20161-2037).

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

Funding

This study was supported by the Long Term Research Grant (LRGS) awarded to the Malaysia Research University Network (MRUN) approved by the Ministry of Education, Malaysia (Grant number: LGRS MRUN/F1/01/2019).

Authors contribution

Substantial contributions were made by the authors of this paper such as conception, acquisition and analysis of work and interpretation of data. The paper was drafted and revised critically by each author. Specifically, Nor Hana and Hussein outline the initial draft of the paper, whereas, Hazreen, Mas Ayu and Tin Tin Su made significant contribution to the introduction, methodology and discussion section of the paper. Final approval of the version was made by all authors and agreement to be accountable for all aspects of the work.

Acknowledgements

The authors thank the non-professional group of employees from both the private and public sectors that participated and the Ministry of Health, Malaysia for facilitating the study.

Author's information

¹Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia, ²Centre for Population Health (CePH), Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia, ³Jeffrey Cheah School of Medicine & Health Sciences, Monash University, Bandar Sunway, 47500 Subang Jaya, Selangor, Malaysia.

References

1. United Nation Population Fund and HelpAge International: **Ageing in the Twenty-First Century: A Celebration and A Challenge**. New York, NY: United Nations Population Fund; 2012.
2. Department of Statistics Malaysia: **Population Projection (Revised), Malaysia, 2010 - 2040**. Department of Statistics Malaysia; 2016.
3. United Nations: **World Population Ageing 2013**. New York, NY: United Nations Publication; 2013.
4. Christensen K, Doblhammer G, Rau R, Vaupel JW: **Ageing populations: The challenges ahead**. *Lancet* 2009, **374(9696)**:1196-1208.
5. Cacciatore F, Napoli C, Abete P, Marciano E, Triassi M, Rengo F: **Quality of life determinants and hearing function in an elderly population: Osservatorio Geriatrico Campano Study Group**. *Gerontology* 1999, **45(6)**:323-328.
6. Bravo VTF, Ventura RU, Brandt CT, Sarteschi C, Ventura MC: **Visual impairment impact on the quality of life of the elderly population that uses the public health care system from the western countryside of Pernambuco State, Brazil**. *Arq Bras Oftalmol* 2012, **75(3)**:161-165.
7. Barca ML, Engedal K, Laks J, Selbaek G: **Quality of life among elderly patients with dementia in institutions**. *Dement Geriatr Cogn Disord* 2011, **31(6)**:435-442.
8. Abreu NS, Baracfo ES, Drado MGA, Dias RC: **Quality of life from the perspective of elderly women with urinary incontinence**. *Braz J Phys Ther* 2007, **11(6)**:429-436.
9. Abou-Raya S, Abou-Raya A: **Depression in elderly patients with knee osteoarthritis: Effect on patient functioning and quality of life**. *Ann Rheum Dis* 2007, **66**:489-489.
10. World Health Organization: **Active ageing: A policy framework**. Switzerland: World Health Organization; 2002.
11. World Health Organization: **WHOQOL: Measuring quality of life**. World Health Organization; 2018 [<http://www.who.int/healthinfo/survey/whoqol-qualityoflife/en/>], link valid from 04-11-2020.
12. Yadollah AM, Hamid TA, Yahaya N, Ibrahim R: **Effects of chronic comorbidity on psychological well-being among older persons in northern peninsular Malaysia**. *Appl Res Qual Life* 2010, **5(2)**:133-146.
13. Yahaya N, Abdullah SS, Yadollah AM, Hamid TA: **Quality of life of older Malaysians living alone**. *Journal of Educational Gerontology* 2010, **36(10-11)**:893-906.
14. Yadollah AM, Ibrahim R, Hamid TA, Yahaya N: **Sociodemographic predictors of elderly's psychological well-being in Malaysia**. *Aging Ment Health* 2011, **15(4)**:437-445.
15. Hamid TA, Yadollah AM, Ibrahim R: **Predictors and prevalence of successful aging among older Malaysians**. *Gerontology* 2012, **58(4)**:366-370.
16. World Health Organization: **WHOQOL: Measuring quality of life**. World Health Organization; 2018 [<http://www.who.int/healthinfo/survey/whoqol-qualityoflife/en/>], link valid from 04-11-2020.
17. Magid T, Mehri M, Babak P, Mohammadbeigi A: **Elderly awareness on healthy lifestyle during aging**. *Trop Med Surg* 2013, **139(1)**:1-5.
18. Palmore E: Facts on aging: **A short quiz**. *Gerontologist* 1977, **17(4)**:315-320.
19. Cyarto EV, Dow B, Vratsidis F, Meyer C: **Promoting healthy ageing: Development of the Healthy Ageing Quiz**. *Australas J Ageing* 2013, **32(1)**:15-20.
20. Ministry of Human Resources Malaysia: **Malaysia Standard Classification of Occupations 2008 (3rd)**. Putrajaya, Malaysia: Ministry of Human Resources Malaysia; 2010.
21. Polit DF, Beck CT, Owen SV: **Is the CVI an acceptable indicator of content validity? Appraisal and recommendations**. *Res Nurs Health* 2007, **30(4)**:459-467.
22. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL: **Multivariate data analysis (6th)**. New Jersey, Upper Saddle River: Pearson Education Inc; 2006.

23. Fleiss J, Cohen J: **The Design and Analysis of Clinical Experiments**. New York: John Wiley & Sons; 1986.
24. IBM Knowledge Centre: **KMO and Bartlett's Test**. IBM Knowledge Centre; 2017
[https://www.ibm.com/support/knowledgecenter/en/SSLVMB_sub/statistics_casestudies_project_ddita/spss/tutorials/fac_telco_kmo_01.html; 2017], link valid from 04-11-2020.
25. Hayton JC, Allen DG, Scarpello V: **Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis**. *Organizational Research Methods* 2004, **7**:191-205.
26. Awang Z: **A handbook of SEM: SEM made simple (2nd)**. MPWS Publisher; 2015.
27. Andrew LC, Howard BL: **A first course in factor analysis (2nd)**. New Jersey, Hillsdale: Lawrence Erlbaum Associates Inc; 1992.
28. Marsh HW, Hocevar D: **Application of confirmatory factor analysis to the study of self-concept: First and higher order factor models and their invariance across groups**. *Psychol Bull* 1985, **97**(3):562-582.
29. Jöreskog KG, Sörbom D: **LISREL VI: Analysis of linear structural relationships by maximum likelihood, instrumental variables, and least squares methods**. Mooresville, Indiana: Scientific Software; 1986.
30. Bentler PM: **Comparative fit indexes in structural models**. *Psychol Bull* 1990, **107**(2):238-246.
31. Browne MW, Cudeck R: **Alternative ways of assessing model fit**. *Social Methods Res* 1992, **21**(2):230-258.
32. Perales J, Martin S, Ayuso-Mateos JL, Chatterji S, Garin N, Koskinen S, ... Haro JM: **Factors associated with active aging in Finland, Poland, and Spain**. *Int Psychogeriatr* 2014, **26**(8):1363–1375.
33. Kattika T, Sang-arun I, Hatthakit U: **Thai cultural understandings of active ageing from the perspectives of older adults: A qualitative study**. *Pac Rim Int J Nurs Res Thail* 2014, **18**(2):152-165.
34. Palmore E: **The facts on aging quiz: Part two**. *Gerontologist* 1981, **21**(4):431-437.
35. Hurley AE, Scandura TA, Schriesheim CA, Brannick MT, Seers A, Vandenberg RJ, Williams LJ: **Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives**. *J Organ Behav* 1997, 667-683.
36. Suhr DD: **Exploratory or confirmatory factor analysis?** Proceedings of the 31st Annual SAS, Cary, North Carolina: SAS Institute Cary; 2006.
37. Farrell AM: **Insufficient discriminant validity: A comment on Bove, Pervan, Beatty, and Shiu (2009)**. *J Bus Res* 2010, **63**(3):324-327.
38. Henseler J, Ringle CM, Sarstedt M: **A new criterion for assessing discriminant validity in variance-based structural equation modeling**. *J Acad Mark Sci* 2014, **43**(1):115-135.

Figures

Image not available with this version

Figure 1

The fitness of the model was not achieved by Model 1 because two of the 22 items in Model 1 were highly correlated with each other, as identified in the EFA.

Image not available with this version

Figure 2

The findings in Table 6 was obtained after the fitness of the model was achieved in Model 4. The final model consists of 14 items; eight items from the health construct and six items from the non-health construct.