Individual-level Active Ageing Index in Iran and its Associations with Health-Related Quality of Life of Older People: A Cross-Sectional Survey

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Abstract

Background- Iran is one of the fastest ageing countries in the world and is expected that it will face with major challenges in future, as it is yet unprepared to respond to the necessities of its older population. The model of Active Ageing could be a strategy that greatly contribute in addressing the problem of population ageing in Iran. This study measured the status of Active Ageing in Iran at the individual-level and examined its associations with the health-related quality of life of older people. It was hypothesized that having an active life in old age is associated with better health-related quality of life of older people.

Methods- A quantitative cross-sectional survey of a random sample of 623 people aged 55+ years resident in Tehran was conducted using multistage stratified cluster sampling method. In total, 590 people responded. The Active Ageing was measured using AAI questionnaire and the health-related quality of life was measured using SF-36 questionnaire. Associations between the domains and the overall AAI scores with the quality of life of older people were examined by MANCOVA analysis in four models using the STATA software.

Results- The score of overall AAI was calculated at 26.8 (men 33.9 vs. women 20.6) out of 100. On average, the participants had slightly better scores in the mental component summary of SF-36 than the physical component (55.8 vs 52.7). The analyses indicated that there is a stronger association with the physical component than the mental component of the SF-36 and the score of the overall AAI was only associated with the physical component. Generally the 1st (employment) and the 2nd (participation in society) domains of the AAI showed little or no association with SF-36, but there was an association between the 3rd domain (enabling environment for active ageing) and the SF-36 and a particularly strong associations with the 4th domain (independent, healthy and secure living capacity).

Conclusion- Implications of these findings for older people currently living in Tehran are considered and recommendations for future studies and appropriate interventions, taking account of the results, are made.

Background

Iran is one of the fastest ageing countries in the world, as a result of experiencing an exceptionally fast fertility transition and considerable improvements in life expectancy [1]. The Total Fertility Rate (TFR) decreased from 7 children per women of reproductive age in 1980 to 2.5 in 1996, and further to 1.7 in 2016, just below the replacement level [2]. As a result of the demographic transition in Iran, a radical transformation in the age structure of the population is occurring, with an increase in the population's mean and median age due to a rapid decline in the proportion of children and a considerable rise in the proportion of older people. *Figure 1* illustrates the extent of these changes in Iran by comparing population's age pyramid in 2005 with that of projected for 2050. It is projected by the United Nations that the percentage of older people aged 60 or over in Iran which was 8.2 in 2015 will be reached to 31.2% by 2050 and at the same period the median age will increase from 29.5 to 44.7 years old [3]. Although

population ageing is a global phenomenon, it is taking place in a much shorter period of time in Iran than in most of other countries. According to the UN projections, worldwide the “old-age support ratio”, which is the number of persons aged 15 to 64 per person aged 65 and over, was 9 in 2009, projected to fall to 4 persons of working age per person aged 65 and over in 2050; this is while in Iran this indicator was 15 in 2009, which is projected to decline to 2.7 per elderly by 2050 [4].

[Figure 1, here] [5]

The rapid pace of population ageing in Iran means it will have less time to adjust to these challenges compared to many of other countries. This is particularly problematic as Iran has currently an under-developed social security system. The majority of working adults -the future older population- have low incomes and are unable to save for their old age. Providing a pension system for those who lack other resources and maintaining and extending the currently limited social security and pension systems represent a major challenge for a yet unprepared community. On the other hand, future older people of Iran will have smaller families and less available sources of support as a result of decline in fertility rates, which means that they will have fewer adult children to depend on for care and support in old age [6–7].

The strategy which could greatly contribute in addressing the problem of population ageing in Iran is the strategy of “Active Ageing” (AA), making older people more active and independent. “AA” is a multidimensional concept referring to a situation where people participate in the formal labor market, engage in unpaid productive activities, and live healthy, independent and secure lives as they age [8]. The World Health Organization [9] defined AA as “... the process of optimizing opportunities for health, participation, and security in order to enhance quality of life (QoL) as people age”. Active Ageing Index (AAI), is a tool, developed by Zaidi A in 2012, to enable policymakers to devise evidence-informed strategies in dealing with the challenges of population ageing and its impacts on societies [10]. It is also stated that one of the main goals of AAI is acting as a useful tool to improve the QoL of older adults [8, 11].

Health related quality of life (HRQoL) is a subdivision of QoL, and most commonly refers to people’s experience of their global health [12]. HRQoL is a multi-dimensional concept that encompasses physical, mental and emotional, and social functioning domains [13]. However, HRQoL for the elderly people might be described in terms of functional status, independence and ability to engage in life activities [14]. An important aim of research into HRQoL in this age group is to enable older people to maintain their mobility, independence, their active contribution to society, and to respond effectively to the challenges of older age and in general bring an active aging for them [15]. Investigating HRQoL of the elderly is especially important because health issues limit their independence and ability to engage in life activities. It is hoped that having an active life and improvements in AAI of the countries could play a key role in improvements of HRQoL of older populations [16].

Despite the importance of population ageing in Iran and its potential challenges particularly in near future, as discussed above, the extent of active and reproductive life among older people of Iran is not yet

determined. There are only a few studies in Iran in the topic of AA but none of them has measured it as the concept with the mentioned definition at the individual level or only measured some aspects of activity or were qualitative studies [17–20]. Thus, this is very timely now to first understand to what extent the older people of Iran are currently living actively and according to the AAI in which domains and indicators they are doing well and in which aspects they need special attention and improvement.

In this study, firstly, we aimed to measure the current status of AA at the individual-level among community resident older people of Tehran using the AAI instrument, for the first time. The results of the AAI in Tehran are compared with the other countries to identify and discuss on the variations with respect to its indicators, domains and their relative importance. Secondly, HRQoL and socio-demographic characteristics of older people of Tehran are measured and described in this paper. Finally, associations between participants' overall and domain-specific scores of AAI with their HRQoL scores were examined, controlling for the effects of covariates. Thus, the main hypothesis of this study was having an active life among older people and living actively is associated with higher HRQoL among them.

This study measured the AAI in Tehran at the individual level, not at the community level, because some of the aggregated community-level data required to calculate the indicators of AAI are not yet available. However, to be able to make national level policy making to improve the status of AA in Iran, for the next step, it is required to design a large country-level study to understand geographical disparities at the AAI to explore determinants of possible variations. We hope the results of this study would help to better understanding of facilitators and barriers for the Iranian older population to experience an active life. Understanding factors contributing to HRQoL including the possible effects of the AA would be critical for developing the most appropriate interventions for improving or preserving QoL in rapidly growing older population of Iran. It seems that future older people of Iran will have no choice but to empower themselves and live more actively to overcome to the issue of population ageing in Iran.

Methods

Study Design and Data Collection

A quantitative cross-sectional survey of a random sample of 623 people aged 55+ years resident in the capital city of Tehran was conducted. The required sample size was calculated at 623 based on an alpha level of 0.05 and power of 80% using an expected odds ratio (OR) of 2 and a design effect of 1.5 based on results from earlier studies [6, 16]. Multistage stratified cluster sampling strategy was adopted in order to ensure representation of older people from neighborhoods of different socio-economic status in Tehran. For the first stage of the sampling, three out of 22 municipal districts of Tehran were chosen from areas of different socioeconomic status based on the information of municipality of Tehran city. For the second stage, one neighborhood from each district was randomly selected. To avoid selection bias, study individuals were then selected through systematic random sampling method, selecting one of every 10 houses randomly based on the municipal blocks on the map. Then it was asked whether any people aged 55 or more are living at that house and if so he/she was interviewed if agreed. The number of samples in

each neighborhood was calculated using probability proportionate to size allocation method within study clusters. Data collection stage took about 7 months. The data were collected using a structured multi-sectional questionnaire administered to respondents through face-to-face interviews conducted in their own homes. Ethical approval for the study was received from the ethical committee of the Tehran University of Medical Sciences (Ethics number: IR.TUMS.SPH.REC.1397.4974.)

Study Variables and Measurement

The status of AA among older people of Tehran, which was the main exposure variable in this study, was measured by the original AAI questionnaire. This index constructed of 22 individual indicators that are disaggregated by sex and grouped into 4 domains including “Employment”, “Participation in society”, “Independent, healthy and secure living capacity” and “Enabling environment for active ageing”. To develop questions for measuring each of the indicators, we used exactly the same questions used in the original AAI, as developed by Zaidi [10], which is available in the appendix of the AAI website, in order to be comparable with other countries measuring the AAI. The questions were translated to Farsi language and then a back translation was performed to ensure that the concepts were translated appropriately. It was then checked with a number of experts in this area to ensure that the questions were developed well and in accordance with the original questions. After completion of the fieldwork, we followed the same method for weighting and scoring the AAI indicators and domains as it was done for the original AAI [21]. The indicator weights within domains and the domain weights within the overall AAI index is shown in Table 1.

HRQoL of older people, as the outcome variable in this study, was measured using the Iranian version of 36-item Short Form Health Survey (SF-36). The psychometric properties of the Iranian version of the SF-36 (interview administered) are well documented [22]. The SF-36 includes 8 subscales including Physical functioning (PF), Role physical (RP), Bodily pain (BP), General health (GH), Vitality (VT), Social functioning (SF), Role emotional (RE), and Mental health (MH) and two summary scales, namely Physical Component Summary (PCS) and Mental Component Summary (MCS). Scores range from 0 to 100 for each subscale with higher scores indicating a better condition.

Socio-demographic characteristics of older people including age, gender, education, income level, living arrangement, marital status and family size and some other variables, as potential confounder variables, were also measured by study questionnaire.

Statistical Modeling and Data Analysis

The data were analyzed using descriptive and analytical approaches. Descriptive statistics such as mean, standard deviation, frequency, percentage were used and the results were shown by tables and figures. Normality of the outcome variable was checked through *Kolmogorov–Smirnov test* and also histograms and Q-Q plots, which all indicated non-normal distribution. Thus, *Spearman Correlation Analysis* was

used to check the correlations among exposure and outcome variables. In order to examine the associations between the domains and the score of overall AAI with the HRQoL of older people, regression analysis was used. However, before decision on the type of regression analysis, first the normality of the SF-36 scores was examined. Although scores distributions slightly were negatively skewed, all were found to be satisfactory (all skewness values less than one). Also, before decision on the inclusion of covariates in the models, co-linearity between all the study variables was checked.

Of the types of regression analysis, *Multivariable Analyze of Covariance (MANCOVA analysis)* was used, as the outcome variables in this study were PCS and MCS scores, which were correlated with each other. In this situation, MANCOVA test could perform the analysis with the highest precision and lowest error. The analyses were performed using four models; in *Model 1*, crude analysis was conducted to check the association of each independent variable (domains and overall score of the AAI) with the PCS and the MCS scores separately. As the overall AAI score was calculated by its four domains, separate models were then used for associations of domains and the overall score of the AAI with the outcomes. In *Model 2*, first the crude associations of domains and then in *Model 3* associations with adjusting the effects of covariates were used. Finally, in *Model 4*, the associations of the overall AAI score with the PCS and MCS scores adjusted for the effects of covariates were examined. The rate of missing data was very low in this study (about 3%), thus observations with missing values were disregarded in the analyses. All the analyses were conducted using STATA software version 14.

Findings

In total, 590 people out of 623 pre-defined sample size responded (response rate 94%). Most of the non-respondents did not give any special reason for their unwillingness to participation. Of the 590 participants, 297 were men and 293 women. The main (SD) age was 64.9 (9.4) years and 78% were married. The mean (SD) of family size of participants were 13.7 (7.9) people, but 13% were living alone, 27% with their spouse, 51% with both spouse and children and others had other living arrangements. Twenty eight percent were illiterate, 34% had just primary education and only 9% had higher education (university level). Most of the participants (59%) reported to have very low or low income and 37% described themselves as being poorer than average of residents of Tehran.

The result of the AAI of the participants, including the scores of domains and indicators (raw and weighted) is shown in *Table 1*. The score of overall AAI was calculated at 26.8 (men 33.9 vs. women 20.6), of which 9.5 (men 15.8 vs. women 3.6) belonged to the first domain (Employment), 7.5 (men 8.1 vs. women 7.3) to the second domain (Participation in society), 4.1 (men 4.2 vs. women 4.1) to the third domain (Independent, healthy and secure living) and 5.7 (men 5.8 vs. women 5.6) to the last domain (Capacity and enabling environment for active ageing) (Table 1).

[Table 1, here]

The results of HRQoL scores of participants including its domains are shown in *Table 2*. On average, the participants had slightly better scores in the MCS than the PCS (55.8 vs 52.7). Bodily pain gained the highest score (66.1) and role physical had the lowest score (40.3). Men had higher HRQoL status compared to women particularly in the PCS (PCS 55.1 vs. 50.3 and MCS 56.8 vs. 54.9) (*Table 2*).

[Table 2, here]

The results of the correlations between the AAI domains and the overall AAI with the PCS and MCS of the HRQoL is shown in *Table 3*. As shown in the Table, all domains of the AAI, except the second domains (participation in the society) and the overall AAI score were positively and significantly correlated with the PCS, indicating that being employed (rather than unemployed), having an independent and healthy life and living in an enabling environment are correlated with higher PCS score. On the other hand, the third and the fourth domains of the AAI and its overall score were positively and significantly correlated with the MCS, indicating that having an independent, healthy and secure life and living in an enabling environment are correlated with higher MCS score. The highest correlation with both the PCS and the MCS, however, were found with the enabling environment ($r = 0.46$ and 0.49 , $p < 0.0001$) (*Table 3*).

[Table 3, here]

To test the main hypothesis of this study, MANCOVA analyses were conducted once for the PCS and again for the MCS scores. As shown in *Table 4*, in crude analysis, all the domains (except participation in society) and the overall AAI score showed significant associations with the PCS score. In the second model, a significant negative association with the second domain but significant positive associations with other domains were found with the PCS. This indicates that with controlling the effects of each other, being employed but less participation in society and having independent life and living in an enabling environment are associated with higher scores of the PCS. When the analysis of the second model were also controlled for the effects of covariates (including age, gender, income, marital status, family size and education) in Model 3, the directions of associations remained the same as the second model, but the size of effects attenuated slightly in all the domains. The third model was repeated in Model 4, but with the overall AAI score rather than the domains. The result indicated a significant positive association of the AAI score and the PCS, controlling for the effects of covariates. The results also indicated that being older is strongly associated with poor PCS score, but no significant associations were found with other covariates (*Table 4*)..

[Table 4, here]

The same set of analyses, as presented in *Table 4*, were repeated for the associations between the overall AAI and domains scores with the MCS and results are shown in *Table 5*. In crude analyses, significant positive associations were found between domains 3 and 4 and the overall AAI score with the MCS score, with the highest effect of the fourth domain (coefficient = 0.80 , $p < 0.0001$). In Model 2, again only the

domains of 3 and 4 showed significant positive associations with the MCS, controlling for the effects of each other, but with slightly lower effect size than model 1. When the second model was repeated and effects of covariates were controlled for in Model 3, only the domain 4 (capacity and enabling environment) still remained significantly associated with the MCS score (coefficient = 0.50, $p < 0.0001$). In the last model, where the associations between overall AAI scores and the MCS scores were tested, no significant association was found. At the same model, however, being older and poor were found to be significantly associated with lower MCS score but no other association was found with gender, education, marital status and family size (*Table 5*).

[Table 5, here]

Discussion

Population ageing has a profound impact on societies particularly in labor market, health care, social security, sustainability of public goods and finances and the relationship between generations. Henceforth, societies, particularly those with rapid pace of ageing like Iran, have to be prepared for these consequences, especially on the health and life of older people themselves. The AA has been considered as a powerful instrument that will help tackling the consequences of population ageing. The eventual goal of AA is to enhance the QoL of older people and to guarantee the development of societies, through maximizing older people's participation in society and their contribution to the economy. Thus, policies on AA are intended to improve both individual QoL and societal welfare [11, 23].

However, the results of this study highlighted an overall relatively poor AAI score of older people in Iran (*Table 1*). In comparison with the overall AAI and its domain-specific scores of the EU-28 countries in 2018, which is available in the website of the AAI [24], the overall AAI score and the third and fourth domains of the AAI in Iran are considerably poorer, but are doing slightly better in the second domain and almost the same with the first domain of average of the EU-28 countries (*Figure 2*).

[Figure 2, here]

With regard to the first domain (employment) there is considerable variation among Iranian men and women living in the capital city, mostly because of men's breadwinner role in family; 45% of men versus only 10% of women and in total 27.2% of people aged 55+ are employed. This rate is almost the same as the average of the EU-28 countries. The difference of this indicator in the age range of 55–59 (66% of men and 20% of women) is much higher than the other age groups, attributable to the retirement age in Iran, which is 60. However, it seems that many of the retired men (44%) go back to work and continue to be economically active, most probably because of very low retirement pension in the economic crisis condition of the country. As shown in *Table 1*, almost one third of older men aged 70–74 years old in Tehran reported to be still employed and continue working. There is evidence that many of the unemployed older people reported that despite inability and unwillingness they need to work and earn

money, but there is no job for them available [25]. The above statistics and explanations probably justifies the results of this study shown in *Tables 4 and 5* indicating no significant association between the 1st domain of the AAI and MSC and a moderate association between it and the PCS. This is while 35% of the whole weight of the index is made by only the 1st domain, which perhaps needs to be modified in the Iranian context.

The average score of the second domain (participation in society) were higher than the average of the EU–28 countries, mainly in the indicators of “care to children” and “voluntary work”. A part of this could be cultural, but this also may reflect an increasing proportion of young women who recently are working outside and leave their children with their parents. It also may reflect a poor economic status of many families who are not able to get professional help for their elderly or children such as nursery and thus older people may have to contribute higher to help their families [6]. Possibly that is the reason why the direction of associations of this domain with both MCS and PCS, although not statistically significant, were negative, indicating a higher participation was associated with poorer quality of life (*Tables 4 and 5*). Therefore, the weight of this domain, which is again 35% in the original AAI, also needs to be modified for older people of Iran.

However, the 3rd and the 4th domains of the AAI were considerably behind than the average of the world, in particular, on the indicators of “access to health care”, “economic status and depravation”, and also in “life expectancy” and “educational attainment”. This is while, the highest effect on HRQoL in both physical and mental components with the strongest evidence observed by the 4th domain (capacity and enabling environment) and also the PCS score and the 3rd domain, while they share only 20% and 10% of the overall weight of the AAI score, respectively. This result suggests a need to paying an especial attention by policymakers to the 4th domain and then to the 3rd domain of the AAI to make the life of future older people of Iran more active and independent and get highest achievements in the HRQoL of older people. Also it is probably required to increase the weight of these domains compared to the first two domains of the overall AAI score.

The analyses on the associations between the AAI and its specific-domain scores with the component scores of HRQoL highlighted generally a stronger association with the physical aspect of HRQoL (PCS) than mental aspect (MCS) and the overall AAI score was only associated with the PCS (*Tables 4 and 5*). Looking at the components of the PCS (physical functioning, role physical, bodily pain and general health), compared to those of the MCS (vitality, social functioning, role emotional and mental health) justifies closer connections between the PCS and the AAI compared to the MSC; in order to have an active life in the community, it seems that physical functioning ability and physical health of older people is a key prerequisite, while it is relatively less imperative for measures of mental health in general.

As the AAI is a rather new instrument, there is little study in the world examining the effects of the AA measured by the AAI and the QoL of older people. Also, most of those that examined the association of the AA with the QoL used different measures such as “loneliness”, “happiness”, and “life satisfaction”, as measures of the QoL [11, 26], instead of a specific measurement tool, such as SF–36, making their

results less comparable with the results of our study. The study of Frolova and Malanina [26] indicated that increasing the score of the AAI in Russia, was correlated with lower loneliness, higher happiness, and higher life satisfaction. Similarly, the study of Nunes [11] found that the overall AAI, and its 1st, 2nd and 4th domains were positively associated with the QOL indicators including life satisfaction and happy feelings. The AAI was also strongly correlated with life satisfaction as measured by the European Quality of Life Survey [21]. Associations were also found between the AAI and Quality of Life Synthetic Index in Spain [27]. However, in the study of Donno and colleagues in Italy [28], they found relationship only between the third domain of the AAI and the QoL, as measured by the CASP index, for both men and women. This study suggested to the UN to evaluate the possibility of increasing the explicit weight for the third domain, given its robust correlation with old people's self-rated level of well-being. Another study concluded that the first domain (employment), despite having a significant position in the index, did not show a relationship with QoL. According to this study, putting significance on employment leads to overestimation of the position of countries which despite considerable employment rate of older adults are behind other countries in other indicators [29]. Therefore, there is an inconsistency between the results of the existing literature and further studies are required for understanding the likely effects of the context in this issue.

The results of this study, as the first study in Iran measuring the AAI at the individual level using a relatively large cross-sectional survey in Tehran, is valuable. However, the main weakness of this study is its cross-sectional design, so that the temporal relationships between the overall AAI and its domains with HRQoL of older people cannot be ascertained. It is highly possible that poor HRQoL of older people prevent them to be active and productive, so the direction of causality could be reversed. Undertaking a longitudinal study in future would help to address this concern. Additionally, the results of this study may not be generalisable to whole older people of Iran, as it is conducted only in Tehran. The next survey should be conducted at the national level to be able to have a broader view on the status of the AAI among older people of whole country. Before doing the next study, another recommendation is to conducting a qualitative study using unstructured interviews with older people and other relevant policymakers to first understand whether the concept of the AA differs in the context of Iran and which further indicators should be included or excluded. A localized AAI questionnaire should then be developed based on that qualitative study and then its reliability and validity should be checked in the Iranian context. Finally, the weight of the indicators or domains may also be different than the original AAI which is used in the EU–28 countries. It is also recommended for further study to do analysis for data of men and women separately, as they had considerable differences in many of the indicators of the AAI.

Conclusions

The main hypothesis of this study was to have an active life by older people is associated with higher HRQoL among them. This hypothesis was mainly approved for the PCS aspect of HRQoL but for the MCS aspect, only an association was found with the 4th domain. With regard to the domains of the AAI, the results of this study indicated that Iranian older people compared to their European age-mate had on

average slightly higher score in the 2nd domain and almost the same status in the 1st domain, but in the overall AAI score and in the 3rd and 4th domains had considerably lower scores. It is important to consider that, while the 1st and 2nd domains with little or no association with the HRQoL, each comprises 35% of the overall score, the 4th and 3rd domains with a strong association with the HRQoL, altogether comprise only 30% of the overall score of the AAI. Consequently the results of this study, first of all suggest to policymakers to pay an special attention to improve the capacity and enabling environment for active ageing (4th domain) and then to provide better conditions for older people’s independence, healthy and secure living (3rd domain), if they have a real intention to make the future ageing population of Iran active and provide conditions for their contribution to the economy of the country for societal welfare. Additionally, the results of this study strongly suggest a considerable modification in the indicators and weights of the domains of the original AAI for the Iranian context and to provide a culturally more suitable tool to measurement of active ageing in Iran.

Abbreviations

- TFR
- Total Fertility Rate
- SF–36
- 36-item Short Form Health Survey
- SCI
- Statistical center of Iran
- PF
- Physical functioning
- UN
- United Nations
- RP
- Role physical
- AAI
- Active Ageing Index
- BP

Bodily pain

AA

Active Ageing

GH

General health

WHO

World Health Organization

VT

Vitality

HRQoL

Health related quality of life

SF

Social functioning

OR

odds ratio

RE

Role emotional

PCS

Physical Component Summary

MH

Mental health

MCS

Mental Component Summary

MANCOVA

Declarations

- Ethics approval and consent to participate

Ethical approval for this study was received from the ethical committee of the Tehran University of Medical Sciences (Ethics number: IR.TUMS.SPH.REC.1397.4974.). All participants of the study signed the consent form before interviews.

- Consent for publication

Not applicable.

- Availability of data and material

The dataset used and/or analysed during the current study are enclosed to the submission as an additional file.

- Competing interests

The authors declare that they have no competing interests.

- Funding

A partial fund was provided by Tehran University of Medical Sciences, covering most of the costs of this study including costs of data collection such as payment to interviewers, transportation and materials. However the grant was not covered other costs such as payment to researchers (staffing) or costs of publications, etc.(Grant No: 97-01-27-37803)

- Authors' contributions

MT designed the study protocol, supervised all the stages of study and provided the first draft of the paper. MY is the statistical advisor of the study. He supervised all the analysis and approved the results. RM had the main contribution in fieldwork stage and data collection. MA advised us in study design and interpretation of study findings. AZ provided technical comments in application of the AAI in Iran and also interpretation of its results. All authors read and approved the final manuscript.

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Tables

Table 1- Domains, indicators and overall scores of AAI (raw and weighted) of people 55+ years old in Tehran-2018

Domains	Indicators	Indicator Score			Indicator weight within domain	Weighted Indicator Score			Domain Score	Domain weight within overall AAI	Domain Weighted Score
		Total	Male	Female		Total	Male	Female			
1. Employment	1.1 Employment rate 55-59	37.5	65.7	19.8	25	9.4	14.4	4.9	Total: 27.2	35	Total: 9.5
									M: 45.2		M: 15.8
									F: 10.4		F: 3.6
	1.2 Employment rate 60-64	24.5	44.0	6.6	25	6.1	11.0	1.6			
	1.3 Employment rate 65-69	24.5	39.3	8.6	25	6.1	9.8	2.1			
	1.4 Employment rate 70-74	22.5	32.0	6.6	25	5.6	8.0	1.6			
2. Participation in society	2.1 Voluntary work (aged 55+)	31.0	38.3	23.5	25	7.7	9.6	5.9	Total: 21.4	35	Total: 7.5
									M: 23.2		M: 8.1
									F: 21.0		F: 7.3
	2.2 Care to children (aged 55+)	34.4	30.9	37.8	25	8.6	7.7	9.4			
	2.3 Care to older adults (aged 55+)	12.5	11.7	13.3	30	3.7	3.5	4.0			
	2.4 Political participation (aged 55+)	6.9	8.0	5.8	20	1.4	2.4	1.7			
3. Independent, healthy and secure living	3.1 Physical exercise (aged 55+)	49.6	57.5	41.6	10	5.0	5.7	4.2	Total: 41.4	10	Total: 4.1
									M: 41.7		M: 4.2
									F: 41.2		F: 4.1
	3.2 Access to health and dental care (aged 55+)	26.5	21.0	32.0	20	5.3	4.2	6.4			
	3.3 Independent living (aged 75+)	44.8	42.8	48.3	20	9.0	8.5	9.7			
	3.4 Relative median income (aged 65+)	55.0	60.0	50.0	10	5.5	6.0	5.0			
	3.5 No poverty risk (aged 65+)	50.0	60.0	40.0	10	5.0	6.0	4.0			
	3.6 No material deprivation (aged 65+)	22.9	23.6	22.2	10	2.3	2.4	2.2			
	3.7 Physical safety (aged 55+)	76.1	73.4	78.8	10	7.6	7.3	7.9			
	3.8 Lifelong learning	16.9	15.8	17.9	10	1.7	1.6	1.8			

(aged 55-74)											
4. Capacity and enabling environment for active ageing	4.1 Life expectancy at age 55	24.2	23.6	24.7	33	8.0	7.8	8.1	Total: 28.7	20	Total: 5.7
	4.2 Share of healthy life expectancy at age 55	13.9	13.2	14.5	23	3.2	3.0	3.3	M: 29.2		M: 5.8
	4.3 Mental well-being (aged 55+)	42.8	42.7	43.0	17	7.2	7.3	7.3	F: 28.2		F: 5.6
	4.4 Use of ICT (aged 55-74)	34.6	36.6	32.8	7	2.4	2.5	2.3			
	4.5 Social connectedness (aged 55+)	45.2	47.1	43.3	7	5.9	6.1	5.6			
	4.6 Educational attainment (aged 55+)	29.0	35.4	23.2	13	2.0	2.5	1.6			
Overall score of AAI										100	Total: 26.8
											M: 33.9
											F: 20.6

Table 2- Mean (SD) of scales and summary scores of HRQoL of people 55+ years old in Tehran (measured by the SF-36) – 2018

Scales	All (n=590)		Men (n=297)		Women (n=293)	
	Means	SD	Means	SD	Means	SD
Physical functioning (PF)	57.9	30.0	60.1	30.4	55.7	29.4
Role physical (RP)	40.3	42.7	44.1	42.8	36.4	42.3
Bodily pain (BP)	66.1	22.9	68.2	21.7	63.9	23.8
General health (GH)	46.6	16.1	47.9	14.5	45.1	17.5
Physical Component Summary (PCS)	52.7	23.2	55.1	22.8	50.3	23.4
Vitality (VT)	57.1	15.8	57.1	14.1	57.1	17.4
Social functioning (SF)	63.6	21.9	65.8	20.2	61.3	23.3
Role emotional (RE)	45.9	43.6	47.3	42.4	44.4	44.7
Mental health (MH)	56.8	16.4	56.9	14.3	56.8	18.3
Mental Component Summary (MCS)	55.8	19.8	56.8	18.2	54.9	21.4

Table 3- Correlations among domains and overall scores of AAI and the summary scores of HRQOL of people 55+ old in Tehran

	Physical Component Summary (PCS)		Mental Component Summary (MCS)	
	r	(P. Value)	r	(P. Value)
Employment	0.11	(0.006)	0.04	(0.333)
Participation in society	- 0.01	(0.728)	0.01	(0.774)
Independent, healthy and secure living	0.22	(0.000)	0.20	(0.000)
Capacity and enabling environment	0.46	(0.000)	0.49	(0.000)
Overall score of AAI	0.19	(0.000)	0.17	(0.000)
. Correlation is significant at the 0.01 level (2-tailed).				
Correlation is significant at the 0.05 level (2-tailed).				

Table 4- Associations between domains and overall scores of AAI and PCS scores using JCOVA analysis

	Model 1	Model 2	Model 3	Model 4
PCS	Crude analysis	Association with domains	Association with domains + covariates	Association with overall AAI+ covariates
	Coefficient (p)	Coefficient (p)	Coefficient (p)	Coefficient (p)
Age	0.05 (0.01)	0.05 (0.003)	0.04 (0.01)	-
Participation in society	- 0.03 (0.43)	- 0.07 (0.03)	- 0.02 (0.51)	-
Dependent, healthy and safe living	0.37 (0.000)	0.23 (0.000)	0.13 (0.02)	-
Security and enabling environment	0.80 (0.000)	0.73 (0.000)	0.50 (0.000)	-
Overall AAI score	0.19 (0.000)	-	-	0.14 (0.005)
Gender (older)	-	-	- 0.37 (0.001)	- 0.45 (0.000)
Gender (women)	-	-	- 1.11 (0.58)	0.11) 0.97(
Income (poor)	-	-	- 3.68 (0.05)	- 3.54 (0.08)
Marital stat (married)	-	-	1.75 (0.44)	0.57) 0.81(
Household size (larger)	-	-	- 0.13 (0.25)	- 0.15 (0.23)
Education (illiterate)	-	-	0.04 (0.98)	- 3.16 (0.12)

Table 5- Associations between domains and overall scores of AAI and MCS scores using MANCOVA analysis

	Model 1	Model 2	Model 3	Model 4
MCS	Crude analysis	Association with domains	Association with domains + covariates	Association with overall AAI+ covariates
	Coefficient (p)	Coefficient (p)	Coefficient (p)	Coefficient (p)
Employment	0.02 (0.26)	0.01 (0.38)	- 0.003 (0.86)	-
Participation in society	0.008 (0.80)	- 0.02 (0.36)	- 0.03 (0.29)	-
Independent, healthy and secure living	0.26 (0.000)	0.10 (0.02)	0.06 (0.26)	-
Capacity and enabling environment	0.75 (0.000)	0.72 (0.000)	0.45 (0.000)	-
Overall AAI score	0.14 (0.001)	-	-	0.02 (0.61)
Age (older)	-	-	- 0.19 (0.07)	- 0.26 (0.01)
Gender (women)	-	-	- 0.90 (0.63)	0.28 (0.88)
Income (poor)	-	-	- 4.68 (0.01)	- 4.46 (0.01)
Marital stat (married)	-	-	1.17 (0.58)	- 0.11 (0.95)
Family size (larger)	-	-	- 0.17 (0.12)	- 0.19 (0.10)
Education (illiterate)	-	-	- 0.60 (0.74)	- 3.40 (0.07)

Figures

Figure 1

ran's age distribution of population in 2005 and 2050 (projected) Source: [5*] * This graph is copied from the United Nations website [5]. According to the terms and conditions of the website of the UN organization, any information from this website is free for non-commercial use.

Source: the data of this study and [24*]

* The figures of the EU-28 countries are made based on the AAI project data, which is available in the website of this project [24]. According to this website, any use of the information of this project is free, subject to giving a reference and URL of the project.

Figure 2

the AAI overall, dimensions and indicators status in Tehran and comparison with the EU28 countries -2018 Source: the data of this study and [24*] * The figures of the EU-28 countries are made based on the AAI project data, which is available in the website of this project [24]. According to this website, any use of the information of this project is free, subject to giving a reference and URL of the project.

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