**Association between age associated cognitive decline and health related quality of life among Iranian older individuals**

Leila kazazi[1], Mahshid Foroughan[2], Vahid Nejati[3], Mohsen Shati[4]

[1] Ph.D. Student of Gerontology, Department of Aging, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[2] M.D., Iranian Research Center on Aging, Department of Aging, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[3] Ph.D., Associate Professor of Cognitive Neuroscience, Psychology Department, Shahid Beheshti University, Tehran, Iran
[4] MD, MPH, Ph.D. of Epidemiology, Department of Ageing, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

**Type of article:** Original

**Abstract**

**Background:** Age associated cognitive decline or normal cognitive aging is related with lower levels of functioning in real life, and may interfere with maintaining independence and health related quality of life (HRQL).

**Objective:** In this study, health related quality of life and cognitive function in community-dwelling older adults were evaluated with the aim of exploring the association between them by adjusting for potential confounders.

**Methods:** This cross-sectional study, was implemented on 425 community-dwelling older adults aged 60 and over, between August 2016 and October 2016 in health centers of the municipality of Tehran, Iran, using Mini Mental State Examination (MMSE) to assess cognitive function and Short Form-36 scales (SF-36) to assess HRQL. The relation between HRQL and cognitive function was evaluated by Pearson's correlation coefficient, and the impact of cognitive function on HRQL adjusted for potential confounders was estimated by linear regression model. All analyses were done using SPSS, version 22.0.

**Results:** A positive significant correlation between cognitive function and quality of life (r=0.434; p<0.001) and its dimensions was observed. Two variables of educational level (B=2.704; 95% CI: 2.09 to 3.30; p<0.001) and depression (B=2.554; 95% CI: 2.00 to 3.10; p<0.001) were assumed as potential confounder by changing effect measure after entering the model. After adjusting for potential confounders in regression model, the association between MMSE scores and quality of life persisted (B=2.417; 95% CI: 1.86 to 2.96; p<0.001).

**Conclusion:** The results indicate that cognitive function was associated with HRQL in older adults with age associated cognitive function. Two variables of educational level and depression can affect the relation between cognitive decline and HRQL.

**Keywords:** Quality of life, Cognitive function, Aging

## 1. Introduction

Cognition is defined as perceiving, processing and administrating information, and also a main component of self-determination and autonomy in older adults (1). Normal aging is accompanied by declines in cognitive abilities, such as processing speed, memory, language, and visuospatial and executive functions (2). With an increasing aged population which is susceptible to neurodegenerative disorders, age associated cognitive decline – not dementia and mild cognitive impairment – is considered as a major and immediate health problem, with considerable social

consequences (3). Aging is a stage of life in which a person encounters memory and other cognitive problems that influence the basic daily living activities of this population. These problems are a basis for loss of independence and autonomy with a consequent decrease of health-related quality of life (4), so it is important to raise our knowledge about those changes which engender independence and increase quality of life of older adults (5). The World Health Organization defined health related quality of life (HRQL) to be "a person's perceptions of his or her position in life in relation to his or her goals, expectations, standards and concerns" (6). It has been shown that conserved cognitive function is related to better status in HRQL, because memory and executive function which play important roles in a wide range of activities from simple self-care to more difficult and complicated functions, are domains of cognitive function (7). By an increasing elderly population in Iran, improving health status and quality of life in old age has become a more important issue (8) to the extent that several studies have shown a decrease in HRQL. (9). In the majority of the study on the Iranian elderly population, the QOL score was almost at an average level (10). The association between cognitive function and HRQL has been researched in some studies. Mitchell et al. found that specific cognitive functions can affect certain domains of QOL in neurological diseases (11), and Chouiter et al. showed the same results in Swiss nursing home residents (12). A study on Chinese elderly by Pan et al. showed that negative impact on HRQL was increased by the severity of cognitive dysfunction (13). Akday et al. also suggested cognitive impairment results in low scores in some areas of HRQL in Turkish elders (14); on the other hand, Missotten et al. found that only dementia, not mild cognitive impairment (MCI), is related to HRQL in older Belgian people (15), and Johansson et al. found low but significant correlation between HRQL and cognitive function in 85-year-olds in Sweden (16); finally, Elliot et al. suggested that cognitive impairment did not modify HRQL (17). As presented above, the results of previous studies vary considerably based on settings, study populations and conditions. The subjective nature of quality of life, different sample size, inclusion criteria, specific settings and age groups and inadequate controlling for possible confounder variables might be the reasons of getting different results. These conflicting results suggest that the nature of the relation between cognitive functioning and quality of life is complicated and has not been elucidated yet, therefore a need for more research in this area is felt. According to the best knowledge of the present authors, there is no similar study evaluating this relation in Iranian older adults, so in this study, we aimed to investigate the association between HRQL and cognitive function in Iranian elderly population by controlling potential confounder variables.

## 2. Material and Methods

### 2.1. Study design

This cross-sectional study was implemented on older people who presented to the health centers of the municipality of Tehran between August 2016 and October 2016. These centers have been established mostly to increase social participation and recreational activities of older adults in different locales of Tehran, but also to check their blood pressure and glucose as side services. The sampling was stratified design sampling and in order to provide a represented sample, the sampling with probability proportional to size (PPS) was used, so after obtaining the necessary permissions from the socio-cultural deputy of Tehran municipality, first, two regions from each one of 5 areas of the city of Tehran (north, west, east, center and south) were selected; then by considering the population of older adults in each region, the sample size for each stratum was calculated. We invited the center members to participate in our study, calling them by phone. The minimum sample required was calculated 425 considering an age related cognitive decline prevalence of 21% (18), a margin of error of 5%, a 95% level of confidence and entering potential confounders as covariate into the model of regression. The 425 community-dwelling older adults aged 60 years and over, who were presented in the health centers of Tehran Municipality for baseline medical assessments and social and recreational services, were selected to enter the study. Data was gathered by a trained researcher with expertise in the gerontology field.

### 2.2. Selection criteria

#### 2.2.1. Inclusion criteria

The following were set as the inclusion criteria: Older people 60 years old and over (10), who were able to communicate in Persian, with at least four years of education (responding to the items of Mini Mental State Examination requires the ability to read and write), with MMSE score >21 and Clock Drawing Test (CDT) score >3.

#### 2.2.2. Exclusion criteria

The following were adopted as exclusion criteria: Having diseases which may lead to extreme functional decline such as a stroke episode within the last 12 months or end stage cancer; affected by uncorrected visual and/ or auditory impairment; having a major psychiatric disorder, such as schizophrenia or bipolar disorder; affected by a major neurodegenerative illness, including Parkinson's disease; use of medications known to impair cognition and self-report diagnosis of Alzheimer's disease or subjective complaints of memory impairment.

## 2.3. Instruments

To obtain the data, we used questionnaires. We administrated MMSE and CDT to assess cognitive function, and the SF-36 questionnaire to evaluate quality of life of older adults. To indicate potential confounders, based on the existing literature, the Geriatric Depression Scale (GDS), self-efficacy questionnaire and a check list including the variables which supposedly could affect the association between cognition and HRQL, including demographic variables, health conditions and lifestyle habits were applied. The HRQL questionnaire, GDS and self-efficacy questionnaire were filled in by participants as they were self-report, the data related to socio demographic variables, health conditions and lifestyle variables were gathered by interview, and MMSE and CDT were implemented on the participants by the research assistant.

### 2.3.1. Health related quality of life:

We used the Iranian version of the short form health survey (SF-36) questionnaire to collect data on HRQL. The SF-36 is derived from the work of RAND Corporation (Research and development) of Santa Monica during the 1970s. It is a multipurpose health survey questionnaire, which is originally constructed in order to use in the medical outcomes studies, and measures eight health concepts: physical functioning, role limitations due to physical health, pain, general health, energy/fatigue, social functioning, role limitations due to emotional problems, and emotional well-being, and the total score of SF- 36 ranging from 0 to 100 (19). The psychometric properties of the Iranian version of SF-36 are well documented in the study of Montazeri et al., the internal consistency (to test reliability) showed that all eight SF-36 scales met the minimum reliability standard, the Cronbach's coefficients ranging from 0.77 to 0.90. Known groups' comparison showed that in all scales the SF-36 discriminated between male and female, and old and young participants ($p<0.05$). Convergent validity showed satisfactory results (all correlations were above 0.40 ranging from 0.58 to 0.95). Factor analysis identified two principal components that jointly accounted for 65.9% of the variance (20), another study on the validity and reliability of SF-36 questionnaire among Iranian elderly, showed that the internal consistency was more than 0.7. Evidence for reliability of the questionnaire was good, but validity appeared moderately satisfactory (21).

### 2.3.2. Cognitive function:

The MMSE and CDT were implemented to determine cognitive function. The MMSE is the most used cognitive assessment instrument in clinical and research domains and evaluates cognition in areas of orientation, memory, attention and calculation, language and visual construction, some items of MMSE are related to the ability of reading and writing, so it is not applicable to illiterate subjects. The score ranges between 0 to 30, with 25 or more considered as normal cognition, 20 to 25 mild, 10 to 20 moderate, and 0 to 10 indicates severe cognitive function. Since the obtained score is related to baseline educational level, the patients with low educational level may be wrongly classified as dementia (22). We assumed at least four years of education as inclusion criteria to be sure of the level of literacy required for responding to the MMSE items. The psychometric properties of MMSE in the Iranian older population was investigated, and results showed good reliability ($\acute{a}=0.78$) of this instrument. At a cut-off point of 21, the sensitivity of 90% and specificity of 80% was calculated (23). The lack of capacity to evaluate frontal/executive or visuospatial function by this instrument (22) lead to use of CDT as another cognitive instrument for including the participants into the study. The CDT is a screen test for verbal understanding, memory, spatial knowledge, abstract thinking, planning, and concentration and visuospatial skills (24). The validation of the Persian version of CDT with Shulman modified grading method was documented by a cut-off point of ⩽3 in the Iranian elder population; Kappa statistics for test retest reliability was 0.554 ($p<0.001$). ICC for inter rater reliability was 0.964 ($p<0.001$) (25). We included older adults which obtained the normal score ranges of cognition in both MMSE and CDT evaluation.

### 2.3.3. The Potential Confounders checklist:

We included 17 covariates to be assured that the estimated relation between cognitive functions and HRQL would be independent of the effects of the confounding variables. Socio-demographic variables (e.g. age, gender, marital status, educational level, job, family monthly income) were assessed based on the participants' self-report (26), information regarding health conditions [history of heart disease, blood pressure (systolic/ diastolic blood pressure ≥ 140/90 mmHg) (27), diabetes (fasting glycaemia≥ 1.26 g/l (7.0 mmol/l) (28), hyperlipidemia (self-report of physician diagnosis), obesity (Body Mass Index≥ 30) obtained through the existing medical records (29) and self-perceived health (30) evaluated by a three state single question], lifestyle habits including smoking, physical activity (Several times a week = high, Once a week = medium, Once a month or Less often = low) (31), quality of sleep (evaluated by a three state single question) (13), and finally, to gather data on depression and self-efficacy, we used a Geriatric Depression Scale (GDS≤ 8), and a General Self-Efficacy Beliefs Scale (GSE-10), respectively. The validation of the Iranian version of GDS revealed its good reliability with Cronbach's coefficients reaching to 92%, also, the ROC analysis showed that cut-off point of 8 with sensitivity of 0.9 and specificity of 0.83 was the most desirable cut point for the Iranian version of GDS (32). Reliability and validity of Iranian version of GSE-10 were

also investigated and Cronbach's alpha for the whole scale was 0.80 and the concurrent validity coefficient between the GSE-10 and the Rosenberg Self-Esteem Scale (RSES) was 0.30 (33).

### 2.4. Statistical Analyses

Descriptive statistics were employed to describe the subjects' characteristics. The normality of distribution of the data was verified by Kolmogorov-Smirnov test. The correlation between MMSE and QOL score and its dimension was evaluated using the Pearson correlation coefficient. The association between MMSE and QOL scores adjusted for potential confounders was evaluated by a multivariate analyzing method in a way that each of the potential confounders that could change the effect measure, remained in the linear regression model. By entering these variables in the final regression model, the effectiveness of these probable potential confounders in association between cognitive function and quality of life was evaluated, to discover how much of this association is defined by those variables. Level of significance <0.05 was assumed. All analyses were implemented using SPSS, version 22.0.

### 2.5. Ethics

Written informed consents of participants were obtained and ethical approval was obtained from the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences (Ethical code: IR.USWR.REC.1395.88).

### 3. Results

Overall, 506 older adults were investigated to find out which participants had the inclusion criteria. The effect of missing data in the present study was examined by exploratory analysis and the result showed that the missing data was less than 3%, so we ignored the missing data of the study, and adding incomplete answers to SF36, GSE-10 and GDS questionnaires, final sample size was 425. Table 1 contains socio-demographic, clinical and health related information and health related conditions of the participants.

The mean age (in years) of the participants was 65.36±5.76; 45.6% were women, 77.9% were married, the educational level of 26.4% was elementary school and below, 34.1% had high school diploma and 23.1% had a bachelor degree or more, 80% were retired, and the monthly income of 20.2% was under $250, whereas 10.4% had an income more than $750 a month. The smokers consisted of 14.4%; quality of sleep in 43.1% and perceived health in 45.6% were normal. Physical activity was high in 65.9% and was low in 17.9%. History of heart disease, hypertension, hypercholesterolemia, and diabetes were 21.9%, 36.7%, 35.3% and 20.5%, respectively. In 17.4%, Body Mass Index was more than 30. The mean scores of GDS and GSE-10 were 3.69±3.63 and 27.07±6.45, respectively. The average score of HRQL was 65.91±16.40 and the mean score of MMSE was 26.55±2.34. The highest mean scores of HRQL dimension were obtained for the dimensions of social functioning (75.176±24.644) and physical functioning (72.644±22.892). The highest mean scores of dimensions of HRQL obtained for social functioning (75.176±24.644) and physical functioning (72.644±22.892) and the lowest obtained for general health (52.445±14.862). A positive and significant correlation was found between crude MMSE and HRQL scores, and also its dimensions, using Pearson correlation coefficient (r=0.434; p<0.001) (Table 2). The association between MMSE and QOL scores was investigated by linear regression, and Beta was calculated about 2.997 (95% CI: 2.37 to 3.58; p<0.001) (Table 3). Then, variables which had been considered as potential confounders were entered into the model one by one. The results showed that by entering two variables of educational level (B=2.704; 95% CI: 2.09 to 3.30; p<0.001) and depression (B=2.554; 95% CI: 2.00 to 3.10; p<0.001) into the model, the effect measure was changed noticeably. So, these variables were confirmed as confounders for the relation between QOL and MMSE scores. After adjusting for these two potential confounders in the regression model, the relation between MMSE scores and health related quality of life persisted (B=2.417; 95% CI: 1.86 to 2.96; p<0.001), in a way that by controlling two variables of educational level and depression, the effect size of MMSE score on HRQL score is equal to 2.41.

**Table 1.** Socio-demographic and clinical characteristics of the participants

| Socio-demographic data | | Participants with the cognitive function within normal range |
|---|---|---|
| Age (year) (mean±SD) | | 65.36±5.76 |
| Gender (women); n (%) | | 194 (45.6) |
| Marital status; n (%) | Married | 331 (77.9) |
| | Single | 12 (2.8) |
| | Separated | 69 (16.2) |
| | Widower | 13 (3.1) |
| Education; n (%) | Elementary school and below | 130 (26.4) |
| | High school degree | 30 (7.1) |
| | High school diploma | 145 (34.1) |
| | Associate degree | 40 (9.4) |
| | Bachelor degree and more | 98 (23.1) |
| Job (retirement); n (%) | | 340 (80) |
| Monthly income (US Dollars); n (%) | ≤250 | 86 (20.2) |
| | 250-500 | 192 (45.2) |
| | 500-750 | 85 (20.0) |
| | >750 | 44 (10.4) |
| Current smoker; n (%) | | 61 (14.4) |
| Quality of sleep; n (%) | Not good | 75 (17.6) |
| | Normal | 183 (43.1) |
| | Good | 166 (39.1) |
| Physical activity; n (%) | High | 280 (65.9) |
| | Medium | 63 (14.8) |
| | Low | 76 (17.9) |
| History of heart disease; n (%) | | 93 (21.9) |
| History of hypertension; n (%) | | 156 (36.7) |
| History of hypercholesterolemia; n (%) | | 150 (35.3) |
| History of diabetes; n (%) | | 87 (20.5) |
| Obesity (BMI ≥30); n (%) | | 74 (17.4) |
| Self- perceived health; n (%) | Not good | 38 (8.9) |
| | Normal | 194 (45.6) |
| | Good | 189 (44.5) |
| GDS (0-15) (Mean±SD) | | 3.69±3.63 |
| GSE-10 (0-40) (Mean±SD) | | 27.07±6.45 |
| MMSE (0-30) (Mean±SD) | | 26.55±2.34 |
| CDT (0-5) (Mean±SD) | | 4.21±0.77 |
| SF-36 (0-100) (Mean±SD) | | 65.91±16.40 |
| Physical functioning | | 72.644±22.892 |
| Role limitations due to physical health | | 62.759±36.839 |
| Role limitations due to emotional problems | | 65.507±36.863 |
| Energy/ fatigue | | 64.087±19.282 |
| Emotional well being | | 68.506±18.434 |
| Social functioning | | 75.176±24.644 |
| Pain | | 65.089±28.761 |
| General health | | 52.445±14.862 |

BMI: Body Mass Index; GDS: Geriatric Depression Scale; GSE- 10: General Self-Efficacy Beliefs Scale; MMSE: Mini Mental State Examination; CDT: Clock Drawing Test; SF36: Short Form Health Survey.

**Table 2**. Correlation between the MMSE score and the dimensions of the SF-36

| SF-36 (Short Form Health Survey) dimensions | Coefficient | p-value |
|---|---|---|
| SF-36 score | 0.434 | <0.001 |
| Physical functioning | 0.321 | <0.001 |
| Role limitations due to physical health | 0.264 | <0.001 |
| Role limitations due to emotional problems | 0.296 | <0.001 |
| Energy/ fatigue | 0.308 | <0.001 |
| Emotional well being | 0.259 | <0.001 |
| Social functioning | 0.255 | <0.001 |
| Pain | 0.255 | <0.001 |
| General health | 0.275 | <0.001 |

**Table 3.** Association between QOL and MMSE score before/ after adjusted for GDS score and educational level

| Model | Variable | Unstandardized Coefficients | | p-value |
|---|---|---|---|---|
| | | Beta | Std. Error | |
| Model 1 (Crude association) | MMSE score | 2.997 | 0.308 | <0.001 |
| Model 2 (adjusted for GDS and educational level) | MMSE score | 2.417 | 0.282 | <0.001 |
| | GDS score | -1.779 | 0.180 | <0.001 |
| | Educational level | 3.955 | 1.401 | 0.005 |

Dependent Variable: QOL score; GDS: Geriatric Depression Scale; MMSE: Mini Mental State Examination

## 4. Discussion

The highest scores of HRQL in our study were observed in dimensions of physical function and social function, and the lower scores were assigned to general health, therefore, the association between cognitive function and HRQL could be explained by high probability with two dimensions of physical and social functions. It seems that in community dwelling elderly, the physical and social function are a better determinant for QOL than psychological and emotional factors. The same results were obtained in the study of Villanueva et al. on a non-institutionalized older population without cognitive impairment in the Basque region of Spain (34). In the study of Saccomann et al. on elderly patients with heart failure, they reported more impairment in dimensions of physical health and general health, which may be due to chronic pain and intolerance of physical activities (35). The inconsistent results in dimension of physical function, may be related to different settings and age groups, or elderly people with special health conditions such as heart failure. Some diseases such as multiple sclerosis and Parkinson's may have direct influence on physical function so the gradual decrease in physical function scores, by increasing disability, is not seen by a stepwise decrease in other health dimensions (36). A main finding of this study at first step, was the significant correlation between the crude scores of HRQL and its dimensions with the MMSE scores, without considering the effects of potential confounders in this association. This indicates that the overall quality of life of older adults with age associated cognitive decline in this study population is related to the level of their cognitive function. The results also showed that MMSE scores, a measure of cognitive function, were significantly associated with HRQL scores after accounting for known covariates in a way which, changes in MMSE scores resulted in changes in HRQL scores after adjusting for potential confounders. In a similar community based survey, Pan et al. found that QOL scores were significantly lower in older adults with cognitive dysfunction (13), while in another study in Sweden, cognitive decline was not associated with all dimensions of HRQL in nursing home residents (16); and Davis et al., in a study on community dwelling older adults found relation between only cognitive function and well-being and not HRQL (37). Doordian found that not only cognitive function, but also changes in cognitive function had significant crude association with HRQL, but after adjusting for covariates of depression, age and functional dependence, this association lost its significant (38). Waldorff, found that lower QOL score could be one of the strong predictors of self-report memory impairment among elderly patients (39). These differences may be explained by the different instruments which were used for assessing HRQL and cognitive function; and it is worthy to mention that our study was implemented on a community dwelling non-institutionalized population which were in better health status and cognitive function compared to institutionalized elderly. In fact, considering inclusion criteria (MMSE score >21 and CDT score >3) reveals that we exclude older people with cognitive dysfunction, so our findings refer to community dwelling elderly with age-associated cognitive function, as we had aimed.

In this study, as previously mentioned, we aimed to determine the association between HRQL and cognitive function by finding the potential confounders, through reviewing the related literature, we prepared a list of covariates which potentially could affect the association between HRQL and MMSE scores. We found, by using the regression model, two variables of educational level and depression could change this association, and can be considered as potential cofounders. In a survey by Jeong and Sohn on older adults in Korea, higher educational level was related to higher living standards and higher quality of life (40). In an ACTIVE randomized controlled trial which was conducted by Wolinsky et al, education and depressive symptoms along with age and race had statistically significant effect on HRQL (26). Our findings about depression and education are in line with the results of the study by Pan et al. (13). The educational level is a complex and personal variable which is in close relation with the ability of the person to manage environmental risks (exposure to threatening living situation, lack of stimulation and inappropriate nutrition), so it can influence elders' lives and help them in preventing intellectual decline (1). Education is one of the most important factors affecting physical and cognitive function, and influences the quality of life indirectly through achieving knowledge and expertise, life habits, job situations and income levels (31). It is reported that there is a strong relation between lower quality of life and depression. (41) Mental conditions like depression are strong predictors of quality of life compared to physical disabilities (42). Literature review

findings suggest an obvious and consistent connection between depression and quality of life in both community dwelling and institutional older adults (43). The study of Baker et al. on older people who presented in family healthcare centers in Turkey, showed significant relations between having lower educational level and depression and worse scores in quality of life and its sub-dimensions (44). It seems that our results are closely consistent with other studies in different settings. The present study found that level of age associated cognitive function in older individuals is related to their health related quality of life , but the variations in this relationship are better explained by incorporating factors such as depression and educational level. In this study, we used two different instruments for evaluation of the participant's cognitive function, MMSE and CDT, so we can claim that we found our defined study cases, older adults with age associated cognitive decline, more meticulously.  Also, we considered multiple potential cofounders, to an extent that few previous studies did.

## 5. Limitations
The present study has some limitations; first, as a cross sectional study, it cannot explain the casual relation between quality of life and cognitive function. Second, we could not consider medication usage as a potential confounder because of our inaccessibility to the complete medical records of the participants; the same limitations could be mentioned for nutrition and alcohol consumption, so we were forced to omit these variables. Third, the results of this study cannot be generalized to an institutionalized elder population or community older adults with cognitive dysfunction.

## 6. Conclusions
Cognitive function is a determinant of health-related quality of life among community dwelling elderly people with age associated cognitive decline. The relation between HRQL and cognition are affected by educational level and depression, so they should be considered as potential confounders of this association. Further prospective studies are needed to evaluate HRQL of older adults with dementia and/or mild cognitive impairments, and compare them with elderlies who have age associated cognitive decline. We also suggest designing interventions to enhance cognitive function, implementing them, and investigating their impacts on HRQL of normal and cognitively impaired older adults.

## Conflict of Interest:
There is no conflict of interest to be declared.

## Authors' contributions:
All authors contributed to this project and article equally. All authors read and approved the final manuscript.

## References:
1) Chaves AS, Santos AMd, Alves MTSSd, Filho NS. Association between cognitive decline and the quality of life of hypertensive elderly individuals. Rev bras geriatr gerontol. 2015; 18(3): 545-56. doi: 10.1590/1809-9823.2015.14043.
2) Harada CN, Natelson Love MC, Triebel KL. Normal cognitive aging. Clin Geriatr Med. 2013; 29(4): 737-52. doi: 10.1016/j.cger.2013.07.002. PMID: 24094294, PMCID: PMC4015335.
3) Deary IJ, Corley J, Gow AJ, Harris SE, Houlihan LM, Marioni RE, et al. Age-associated cognitive decline. Br Med Bull. 2009; 92: 135-52. doi: 10.1093/bmb/ldp033. PMID: 19776035.
4) Pereira RR, Pontes MdLF, Silva AO, Monteiro EA, da Silva CR, Silva LM, et al. Quality of Life and the Cognitive Condition of Elderly Served in Family Health Unit. Int Arch Med. 2015; 8: 1755-82. doi: 10.3823/1854.
5) Williams KN, Kemper S. Exploring interventions to reduce cognitive decline in aging. J Psychosoc Nurs Ment Health Serv. 2010; 48(5): 42-51. doi: 10.3928/02793695-20100331-03. PMID: 20415290, PMCID: PMC2923489.

6) Wlodarczyk JH, Brodaty H, Hawthorne G. The relationship between quality of life, Mini-Mental State Examination, and the Instrumental Activities of Daily Living in patients with Alzheimer's disease. Arch Gerontol Geriatr. 2004; 39(1): 25-33. doi: 10.1016/j.archger.2003.12.004. PMID: 15158578.

7) Stephan Y, Caudroit J, Jaconelli A, Terracciano A. Subjective age and cognitive functioning: A 10-year prospective study. Am J Geriatr Psychiatry. 2014; 22(11): 1180-7. doi: 10.1016/j.jagp.2013.03.007. PMID: 23871114.

8) Darvishpoor Kakhki A, Abed Saeedi J, Delavar A, Saeed-O-Zakerin M. Tools for measurement of health status and quality of life of elderly people. Research in Medicine. 2010; 33(3): 162-73.

9) Aghamolaei T, Tavafian SS, Zare S. Health related quality of life in elderly people living in Bandar Abbas, Iran: a population-based study. Acta Med Iran. 2010; 48(3):185-91. PMID: 21137656.

10) Farajzadeh M, Ghanei Gheshlagh R, Sayehmiri K. Health Related Quality of Life in Iranian Elderly Citizens: A Systematic Review and Meta-Analysis. Int J Community Based Nurs Midwifery. 2017; 5(2): 100-11. PMID: 28409164, PMCID: PMC5385233.

11) Mitchell AJ, Kemp S, Benito‐León J, Reuber M. The influence of cognitive impairment on health‐related quality of life in neurological disease. Acta Neuropsych. 2010; 22(1): 2-13. doi: 10.1111/j.1601-5215.2009.00439.x.

12) Chouiter L, Wodchis WP, Abderhalden C, Von Gunten A. Resident health-related quality of life in Swiss nursing homes. Eur Psychiatry. 2015; 30(5): 549-54. doi: 10.1016/j.eurpsy.2014.10.001. PMID: 25801468.

13) Pan CW, Wang X, Ma Q, Sun HP, Xu Y, Wang P. Cognitive dysfunction and health-related quality of life among older Chinese. Sci Rep. 2015; 5: 17301. doi: 10.1038/srep17301. PMID: 26601612, PMCID: PMC4658548.

14) Akdag B, Telci EA, Cavlak U. Factors affecting cognitive function in older adults: a Turkish sample. Int J Gerontol. 2013; 7(3): 137-41. doi: 10.1016/j.ijge.2013.01.002.

15) Missotten P, Squelard G, Ylieff M, Di Notte D, Paquay L, De Lepeleire J, et al. Quality of life in older Belgian people: comparison between people with dementia, mild cognitive impairment, and controls. Int J Geriatr Psychiatry. 2008; 23(11): 1103-9. doi: 10.1002/gps.1981. PMID: 18213606.

16) Johansson MM, Marcusson J, Wressle E. Cognition, daily living, and health-related quality of life in 85-year-olds in Sweden. Neuropsychol Dev Cogn B Aging Neuropsychol Cogn. 2012; 19(3): 421-32. doi: 10.1080/13825585.2011.629290. PMID: 22126333.

17) Elliott AF, McGwin G Jr, Owsley C. Health-related quality of life and visual and cognitive impairment among nursing-home residents. Br J Ophthalmol. 2009; 93(2): 240-3. doi: 10.1136/bjo.2008.142356. PMID: 18971236, PMCID: PMC2745735.

18) Bischkopf J, Busse A, Angermeyer MC. Mild cognitive impairment–a review of prevalence, incidence and outcome according to current approaches. Acta Psychiatr Scand. 2002; 106(6): 403-14. PMID: 12392483.

19) McHorney CA, Ware JE Jr, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. Med Care. 1993; 31(3): 247-63. doi: 10.1097/00005650-199401000-00004. PMID: 8450681.

20) Montazeri A, Goshtasebi A, Vahdaninia M, Gandek B. The Short Form Health Survey (SF-36): translation and validation study of the Iranian version. Qual Life Res. 2005; 14(3): 875-82. doi: 10.1007/s11136-004-1014-5. PMID: 16022079.

21) Eshaghi SR, Ramezani MA, Shahsanaee A, Pooya A. Validity and reliability of the Short Form-36 Items questionnaire as a measure of quality of life in elderly Iranian population. Am J Appl Sci. 2006; 3(3): 1763-6. doi: 10.3844/ajassp.2006.1763.1766.

22) Woodford HJ, George J. Cognitive assessment in the elderly: a review of clinical methods. Qjm. 2007; 100(8): 469-84. doi: 10.1093/qjmed/hcm051. PMID: 17566006.

23) Foroughan M, Jafari Z, Bayan PS, Faraahani Z, Rahgozar M. Validation of mini- mental state examination (mmse) in the elderly population of tehran. Advances in Cognitive Science. 2008; 10(2): 29-37.

24) Pinto E, Peters R. Literature review of the Clock Drawing Test as a tool for cognitive screening. Dement Geriatr Cogn Disord. 2009; 27(3): 201-13. doi: 10.1159/000203344. PMID: 19225234.

25) Roodsari MS, Kamrani AA, Foroughan M, Mohammadi F, Karimloo M. Validity and Reliability of the Clock Drawing Test in Older People. IJA. 2013; 8(2): 48-53.

26) Wolinsky FD, Unverzagt FW, Smith DM, Jones R, Wright E, Tennstedt SL. The effects of the ACTIVE cognitive training trial on clinically relevant declines in health-related quality of life. J Gerontol B Psychol Sci Soc Sci. 2006; 61(5): S281-7. doi: 10.1093/geronb/61.5.S281. PMID: 16960242.

27) Lionakis N, Mendrinos D, Sanidas E, Favatas G, Georgopoulou M. Hypertension in the elderly. World J Cardiol. 2012; 4(5): 135-47. doi: 10.4330/wjc.v4.i5.135. PMID: 22655162, PMCID: PMC3364500.

28) Chentli F, Azzoug S, Mahgoun S. Diabetes mellitus in elderly. Indian J Endocrinol Metab. 2015; 19(6): 744-52. doi: 10.4103/2230-8210.167553. PMID: 26693423, PMCID: PMC4673801.

29) Woo J. Nutritional strategies for successful aging. Med Clin North Am. 2011; 95(3): 477-93, ix-x. doi: 10.1016/j.mcna.2011.02.009. PMID: 21549873.

30) Johansson Y. self-Perceived Health and Nutritional Status among Home-Living Older People : A Prospective Study. Linköping University Medical Dissertations. 2009.

31) Herrera Ponce MS, Barros Lezaeta C, Fernández Lorca MB. Predictors of quality of life in old age: a multivariate study in Chile. J Popul Ageing. 2011; 4(3): 121-39. doi: 10.1007/s12062-011-9043-7.

32) Malakouti K, Fathollahi P, Mirabzadeh A, Salavati M, Kahani S. Validation of Geriatric Depression Scale (GDS-15) in Iran. Pejouhesh dar Pezeshki (Research in Medicine). 2006; 30(4): 361-9. [in Persian].

33) Rajabi G. Reliability and validity of the general self-efficacy beliefs scale (gse-10) comparing the psychology students of shahid chamrin university and azad university of marvdasht. New thoughts on education. 2006; 2(1-2): 111-22.

34) García Villanueva MZ, Uterga Valiente JM, Rodríguez-Antigüedad Zarranz A. Quality of Life in an Adult Population of More than 60 Years of Age without Cognitive Impairment. Dement Geriatr Cogn Dis Extra. 2014; 4(3): 355-63. doi: 10.1159/000365505. PMID: 25337078, PMCID: PMC4202608.

35) Saccomann IC, Cintra FA, Gallani MC. Health-related quality of life among the elderly with heart failure: a generic measurement. Sao Paulo Med J. 2010; 128(4): 192-6. doi: 10.1590/S1516-31802010000400003. PMID: 21120428.

36) Riazi A, Hobart JC, Lamping DL, Fitzpatrick R, Freeman JA, Jenkinson C, et al. Using the SF-36 measure to compare the health impact of multiple sclerosis and Parkinson's disease with normal population health profiles. J Neurol Neurosurg Psychiatry. 2003; 74(6): 710-4. doi: 10.1136/jnnp.74.6.710. PMID: 12754336, PMCID: PMC1738466.

37) Davis JC, Bryan S, Li LC, Best JR, Hsu CL, Gomez C, et al. Mobility and cognition are associated with wellbeing and health related quality of life among older adults: a cross-sectional analysis of the Vancouver Falls Prevention Cohort. BMC Geriatr. 2015; 15: 75. doi: 10.1186/s12877-015-0076-2. PMID: 26142897, PMCID: PMC4491415.

38) Doorduin J. Cognition: Not a determinant of health related quality of life in middle to old aged men. Nursing Science University Medical Centre Utrecht; 2011.

39) Waldorff FB, Rishoj S, Waldemar G. If you don't ask (about memory), they probably won't tell: if elders do self-report memory problems, their quality of life is probably suffering. J Fam Pract. 2008; 57(1): 41-4. PMID: 18171569.

40) Jeong WM, Sohn TY. Analysis of the Factors Affecting the Quality of Life of Elderly in the "Senior Citizen Academies". Asian JOT. 2005; 4(1): 13-23. doi: 10.11596/asiajot.4.13.

41) Ormel J, Rijsdijk FV, Sullivan M, Van Sonderen E, Kempen GI. Temporal and reciprocal relationship between IADL/ADL disability and depressive symptoms in late life. J Gerontol B Psychol Sci Soc Sci. 2002; 57(4): 338-47. doi: 10.1093/geronb/57.4.P338. PMID: 12084784.

42) Saraçlı Ö, Akca AS, Atasoy N, Önder Ö, Şenormancı Ö, Kaygisız İ, et al. The relationship between quality of life and cognitive functions, anxiety and depression among hospitalized elderly patients. Clin Psychopharmacol Neurosci. 2015; 13(2): 194-200. doi: 10.9758/cpn.2015.13.2.194. PMID: 26243848, PMCID: PMC4540029.

43) Sivertsen H, Bjørkløf GH, Engedal K, Selbæk G, Helvik AS. Depression and quality of life in older persons: a review. Dement Geriatr Cogn Disord. 2015; 40(5-6): 311-39. doi: 10.1159/000437299. PMID: 26360014.

44) Bakar N, Aşılar R. Factors Affecting Depression and Quality of Life in the Elderly. J Gerontol Geriatr Res. 2015; 4(249): 2. doi: 10.4172/2167-7182.1000249.