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Original Article

Factors Affecting Cognitive Function in Older Adults: A Turkish Sample☆

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SUMMARY

Background: The purpose of this study was to determine the influential factors of cognitive function in older adults.
Methods: In this study, 377 older adults (mean age: 74.71 ± 6.15 years) were examined. The Hodkinson Abbreviated Mental Test (HAMT) was used to describe cognitive function of the individuals. The Centers for Disease Control (CDC) Health-Related Quality of Life (HRQOL-4) survey tool was used to measure the quality of life. Possible influential factors of cognitive function were also detected. The following independent variables were included in the logistic regression analysis: age, gender, education level, residency, smoking habit, musculoskeletal pain, medication use, number of unhealthy mental days, number of unhealthy physical days, and activity limitation days.
Results: The results indicated that the elderly with cognitive impairment showed low scores in terms of the three parameters of the CDC HRQOL-4. The findings also indicate that the following variables were found to significantly affect cognitive function: (1) age, (2) residency (rest home), (3) smoking (yes or quit), and (4) number of unhealthy mental days.
Conclusion: Older adults should be assessed in terms of factors related to cognition, such as age, residency, smoking, and mood in order to plan the most suitable geriatric care.

1. Introduction

As our population grows older, the issue of improving the quality of life (QOL) of the elderly will become increasingly important. It is now well accepted that cognitive impairment is one of the indicators of QOL for the elderly[1]. While living a long life is desirable, more focus needs to be placed on the QOL of older people. The aging process should imply not only a longer life, but also normal overall functioning as a means to a healthy life. The health-related QOL (HRQOL) refers to the personal sense of physical and mental health and the ability to react to factors in physical and social environments. Since the most significant point in the care of older people is to maintain or improve their QOL, it is important to know how various health complaints interfere in terms of low QOL[2].

Cognitive dysfunction is a common problem among elderly people. Population-based studies report that most community-dwelling elderly people suffer from cognitive problems. Advancing age is associated with an increase in health complications that can lead to disability. The elderly may suffer from illness, disabilities, and functional impairments that are related to cognitive problems, which make them dependent on others for care and help in their daily life[3–6]. The impact of cognitive problems on HRQOL has been assessed in various studies[1,7]. Cognitive problems lead to a profound negative impact on an individual's emotion and social well-being[8].

The purpose of this study was to determine the influential factors of cognitive function of the elderly living in Denizli Province, Turkey.

2. Materials and methods

This study is the second leg of the study in which 900 elderly people were studied for a new tool measuring (HRQOL)[2].

2.1. Participants

Out of the 900 elderly people mentioned above, 377 were found to have the required criteria for inclusion to this study (the factors affecting cognitive function). Ninety-one people were living in a rest home, and 286 functionally independent older adults were living in their own homes in the community. All with a mean age of 74.71 ± 6.15 years (range; 65-94 yr.) were studied. The inclusion criteria were as follows: individuals who were 65+ years old, those who were not diagnosed with Alzheimer's disease, dementia, schizophrenia, Parkinson's, multiple sclerosis, those who had no cerebrovascular pathology, those who were not on continuous medication, and those who completed the Hodkinson Abbreviated Mental Test (HAMT) in full with no mistakes. All gave informed consent to participate in the study. This study was carried out in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki as revised in 2000. Table 1 shows the descriptive statistics of the older adults with or without cognitive impairment.

2.2. Study design

Ten trained final-year students (from Pamukkale University School of Physical Therapy and Rehabilitation in Denizli, Turkey) collected all the data using standardized instruments under the supervision of the authors. All the investigators were informed and trained about the purpose of this study, the use of the instruments, data collection, and interviews.

2.3. Outcome measures

2.3.1. Cognitive function

The HAMT was used to examine the cognitive function of older adults. The test consists of 10 questions, and it is a short and an easy test to examine the cognitive impairment in older adults. This test can be completed in approximately 3 minutes by the elderly. It includes components requiring intact short- and long-term memory, attention, and orientation. The score was collapsed into two levels in this study: 0−2 wrong answers indicated no cognitive impairment. and three or more wrong answers indicated cognitive impairment (Appendix 1)[9,10].

2.3.2. Health-related quality of life (HRQOL)

The Centers for Disease Control (CDC) in the United States of America has developed a set of survey measures to assesso a person's sense of well-being through four questions (Appendix 2). The CDC HRQOL-4, which has studied its validity and reliability in previous studies,was selected as an outcome measure. Because it is easy to use in studies in older population[2,11]. The tool includes four questions. Question 1 focuses on self-rated health that has been found to be predictive of mortality. Questions 2 and 3 relate to recent physical and mental health symptoms, respectively. Question 4 provides a global measure of disability. While not designed to be aggregated into a summary score, Healthy Days Index (combining Questions 2 and 3) has been used to calculate the number of good healthy days (during the past 30 days) experienced by older adults. Each question of CDC HRQOL-4 was collapsed into different levels, corresponding to similar studies in previous literature that used this scale, and served as the independent variable. For example, self-rated health was collapsed into two levels: excellent-very good-good; fair-poor. The number of unhealthy physical days, unhealthy mental days, and activity limitation days were collapsed into three levels: 0 (zero), 1−13, and 14 or more days[2]. Question 1 was not included in this study's statistical analysis. The following scores of the three sub-parameters of this scale were considered:

Recent physical health.

For how many days during the past 30 days was your physical health not good?

Recent mental health.

For how many days during the past 30 days was your mental health not good?

Recent activity limitation.

During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

2.4. Statistical analysis

Descriptive statistics are given as frequency, percentage, and mean ± standard deviation. To determine the influential factors of cognitive function (HAMT Score), the binary logistic regression method was used. When the dependent variable is a categorical one (for example, two or more levels), logistic regression is used. When the dependent variable has two levels, it is called a binary (or Bernoulli) variable. The independent or predictor variables in logistic regression can take any form. In other words, the independent variables can be either a categorical or measurable property. The variables used in binary logistic regression analysis were as follows. The dependent variable is cognitive impairment and the independent variables are age, gender, education level, residency, smoking habit, musculoskeletal pain (last 3 months), medication, number of unhealthy mental days (last 1 month), and number of unhealthy physical days (last 1 month), and activity limitation days (last 1 month). To compare differences between the two independent groups (with no cognitive impairment and with cognitive impairment) for scores was obtained using the CDC HRQOL-4, the Mann-Whitney U test was used. Statistical significance was accepted as $p < 0.05$. The SPSS 10.0 package program was used for analysis.

3. Results

The descriptive statistics of the older adults are summarized in Table 1. The scores obtained using CDC HRQOL-4 are given in

Table 1
Descriptive statistics (frequency, %) and mean ± standard deviation.

Independent variables	Category	No cognitive impairment ($n = 183$) mean ± SD	With cognitive impairment ($n = 194$) mean ± SD
Age (y)[a]		72.46 ± 5.47	76.84 ± 6.01
Number of unhealthy mental days[a]		13.82 ± 10.42	19.11 ± 10.52
Number of unhealthy physical days		15.39 ± 10.09	20.92 ± 10.33
Number of activity limitation days		16.31 ± 10.58	21.61 ± 9.42
		Frequency (%)	
Gender	Male	133 (72.7%)	79 (40.7%)
	Female	50 (27.3%)	115 (59.3%)
Education level	Illiterate	9 (4.9%)	99 (51.0%)
	Can read and write	20 (10.9%)	48 (24.7%)
	Primary school	93 (50.8%)	42 (21.6%)
	Middle school	29 (15.8%)	3 (1.5%)
	High school	21 (11.5%)	2 (1.0%)
	University	11 (6.0%)	—
Residency[a]	Rest home	19 (10.4%)	72 (37.1%)
	Own home	164 (89.6%)	122 (62.9%)
Smoking habit[a]	Yes	43 (23.5%)	24 (12.4%)
	Quit	69 (37.7%)	44 (22.7%)
	Never	71 (38.8%)	126 (64.9%)
Musculoskeletal pain	Yes/no	131 (71.6%)/52 (28.4%)	152 (78.4%)/42 (21.6%)
Medication use	Yes/no	82 (62.6%)/49 (37.4%)	113 (74.3%)/39(25.7%)

[a] Statistically significant.

Table 2
CDC HRQOL-4 scores of older adults.

CDC HRQOL-4	With no cognitive impairment, $n = 183$ (48.5%)	With cognitive impairment, $n = 194$ (51.4%)	p^a
Question 2: Number of unhealthy mental days	13.82 ± 10.42	19.11 ± 10.52	0.001
Question 3: Number of unhealthy physical days	15.39 ± 10.09	20.92 ± 10.33	0.001
Question 4: Number of activity limitation days	16.31 ± 10.58	21.61 ± 9.42	0.004

CDC HRQOL-4 = Centers for Disease Control (CDC) Health-Related Quality of Life (HRQOL-4) survey tool.
a Mann−Whitney U Test was used.

Table 2. The cut-off point for this scale is 14. As expected, older adults with cognitive impairment reported higher scores in terms of all three sub scores than those without cognitive impairment. The results of the binary logistic regression analysis show that age, residency (rest home), smoking (yes or quit), and number of unhealthy mental days are found to be influential factors of the HAMT score (Table 3).

The observed risks from the analysis were as follows:

- One unit of aging creates **1.1** times more risk for mental burnout.
- It is expected that the older adults living in a rest home are prone to be at higher risk in terms of cognitive impairments than those living in a community dwelling. Although the model included the living area residency variable, its odds ratio was below 1.
- The older adults who were smoking (current or quit) are expected to have more cognitive impairments that those of older adults who never smoked. However, the odds ratio for this variable was found to be below 1.
- Increase in the number of unhealthy mental days creates **1.04** more risk in older adults.

The Mann−Whitney U test results revealed that the older adults with cognitive impairment show worse scores in terms of the three parameters of the CDC HRQOL-4 (Table 2).

Table 3
Results of logistic regression analysis.

Independent variables	Odds ratio	95% Confidence interval	p
Age	1.100	1.046−1.157	0.0001
Gender			
Female	—	—	0.467
Education level			
Illiterate	—	—	0.452
Can read and write	—	—	0.519
Primary school	—	—	0.625
Middle school	—	—	0.718
High school	—	—	0.682
Residency			
Rest home	0.385	0.188−0.791	0.009
Smoking habit			
Yes	0.454	0.209−0.986	0.046
Quit	0.456	0.234−0.889	0.021
Musculoskeletal pain			
Yes	—	—	0.624
Medication use			
Yes	—	—	0.626
Number of unhealthy mental days	1.038	1.011−1.066	0.005
Number of unhealthy physical days	—	—	0.634
Number of activity limitation days	—	—	0.805

4. Discussion

The results of this study, conducted in the province of Denizli, Turkey, were found to parallel previous studies in the literature. In our study, age and mental health were found to affect cognitive function in the older adults. At the same time, the older adults living in a rest home, who are currently smoker or have quit smoking, were found to be at risk in terms of cognitive impairments. All results from the literature, as well as our study, show that it is of vital importance to take health providers concerns seriously.

Cognitive impairment is generally considered as a normal part of brain aging[12]. The relation between age and cognitive functions has been proved in many previous studies. Van Hooren et al (2007) determined that age had an important impact on all cognitive measurements in the study conducted on 578 healthy elderly individuals, whose age varied between 64 and 81 years[13]. Dore et al used 22 different test batteries to evaluate the cognitive function during the study conducted on 945 people, whose age varied between 20 and 79 years[14]. However, it is reported that cognitive problems do not always cause dementia. Moreover, there are individuals with continued cognitive ability despite very old age[15]. In our study, 48.5% ($n = 183$) of the older adults show no cognitive impairment (Table 1).

It is reported that high education level, social participation, and work life help to preserve cognitive function in elderly individuals[15]. In the literature, there are many studies analyzing the effect of education level and sex on cognitive functions during old age. In many of these studies, the positive impact of high education level on cognitive studies are determined[14,16,17]. Although most of older adults just evaluated in this study were of a low education level, education was not an important factor affecting cognitive functions in the model for this study. Dore et al determined that education has a significant effect on cognitive function; however, they noted that this relation is not valid for all cognitive tests[14]. They found out that education level does not affect cognitive functions of people aged between 70 and 79 years according to the Mini-Mental State Examination, which is a test similar to the HAMT.

While it is noted in some previous studies that females showed better cognitive functioning than males[16−18], some noted otherwise[19]. It is observed that the test battery used to evaluate cognitive functions might also change results. Van Hooren et al reported that females are better than males in verbal memory tasks[13]. However, they stated no difference was noted for other cognitive measurements. Dore et al determined that sex is a slight indicator for cognitive function[14]. Gender was not found as an affecting factor of cognitive functions for this study.

There are a few studies that compare the effect of staying at home and nursing homes on the cognitive functions of elderly individuals. In our study, cognitive burnout risk of the elderly people living in rest homes was higher than those staying at home. Engberg et al determined in their study that the cognitive performance of home-dwelling elderly was better than those living in nursing homes[20]. Bannister et al reported that there was a regression in the cognitive functions of those who moved to nursing homes from their own homes during the 1-year follow-up period[21]. We believe that factors such as being away from family, depression, and economic status affect cognitive functions despite the seemingly high change in social communication in the nursing homes where many elderly live together. For instance; Gruber-Baldini et al determined that the depressive symptoms in elderly individuals with dementia living in profit-oriented nursing/retirement homes are more common than those living in non-profit nursing/retirement homes[22].

No consensus has been reported in the studies that investigated the relationship between cognitive impairments, dementia, and smoking[23]. However, there have been few case−control studies

showing that smoking decreased the risk of dementia or Alzheimer's disease[24,25]. However, in some prospective studies, smoking increased the risk of Alzheimer's disease[26]. Almeida et al had reported that there is a conflict in the related literature[27]. We found that smoking (current or quit) was a risk factor for cognitive impairments in the model used in this study. Although smoking habit has been found to be an important risk factor affecting the cognitive status of the older adults in this study, it showed a lower odds ratio (<1). The results show that smoking habit is a risk factor but it does not have a severe impact on the cognitive status. In addition, smoking habit had a lower odds ratio, which shows that smoking is not a preventive reason or factor that decreases cognitive impairments in older adults. Hence, further studies are needed to clarify the impact of smoking in older adults.

It is a well-known fact that depression adversely affects health in old age, just like for other age groups. The frequency of depression in the patients with cognitive disorder is reported to vary between 8% and 74%[8]. Several studies showed that depression and cognitive functions are related to each other[22,28,29]. The number of unhealthy mental days showing mental burnout was also found to be a factor that affects cognitive impairment. Our results also support these studies in terms of mental burnout.

There is a limitation to this study. The HAMT is generally treated as a screening tool for cognitive function. Although it cannot be considered a comprehensive measure of cognition, it can be used to evaluate cognitive status of the elderly; moreover, it is very easy to use.

A summary of important points of this study is given as follows:

- Cognitive impairment is common in later life across the world as well as in Turkey.
- Risk factors for cognitive impairment include age, living in a rest home, increased number of unhealthy mental days, and smoking status
- Cognitive impairment also affects health-related quality of life in Turkish older adults.

The cognitive function of the older adults living in Turkey was found to be affected by age, residency, mental burnout, and smoking status. Therefore, health providers should carefully study older adults living in rest homes and in the community and make accurate observations in terms of the risk factors mentioned above. Additional studies examining the effects of physical activity on cognitive function in older adults will help in providing additional guidance to health providers in evaluating the ability of elderly people with or without cognitive impairments.

Appendix 1

Hodkinson Abbreviated Mental Test (One point for each correct answer)
Questions
1. How old are you?
2. What is the time?
3. Address for recall (Atatürk Caddesi 26)[a]
4. What year are we in?
5. What is the name of this place or city?
6. Do you recognize these people?
7. When is your birthday?
8. What is year of First World War?
9. What is the name of the President of the Turkish Republic?[b]
10. Count backwards from 20 to 1
Recall address above.

Total Score
[a] In the original version, the sentence "42 West Street" is present instead of "Atatürk Caddesi 26."
[b] In the original version, the question "name of the present Monarch" appears instead of "name of the President."

Appendix 2

Questions of the Centers for Disease Control (CDC) Health Related Quality of Life-4 (HR-QOL) Survey
1. Self-perceived health
Would you say that in general your health is?
Excellent
Very good
Good
Fair
Poor
2. Recent physical health
Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
3. Recent mental health
Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
4. Recent activity limitation
During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities; such as self-care, work, or recreation?

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