

Original Article

Prevalence of Dementia and Associated Factors among Older Adults in Iran: National Elderly Health Survey (NEHS)

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Abstract

Background: The prevalence of cognitive impairment and dementia is increasing in Iran and the world. There is no study available on the prevalence of dementia at the national level in Iran. This study aimed to report the rate of dementia at the national level in Iran.

Methods: The National Elderly Health Survey (NEHS) was a cross-sectional study with multistage cluster random sampling on people aged ≥ 60 years in Iran. Dementia was diagnosed by trained general practitioners using Brief Cognitive Assessment Tool (BCAT). In this study, the dementia diagnosis rate was considered as the ratio of individuals previously diagnosed with dementia to individuals considered as dementia. Analyses were carried out using survey analysis method. The provincial rates were standardized based on the Iranian population in 2011 and the national rate was standardized based on WHO standard populations. Association between risk factors and dementia was assessed using a multivariable logistic regression model

Results: The overall crude prevalence of dementia among people aged ≥ 60 years was 7.9% (8.7% in women and 6.9% in men) and age standardized dementia prevalence rate in Iran based on WHO standard population was 8.1% (9.6% in women and 6.5% in men). The prevalence of dementia was observed as 3.7% among people aged 60–64 years, 6.2% in the age-group 65–69 years, 10.4% in the age-group 70–74 years, 14.4% in the age-group 75–79 years, and 13.0% in the age-group ≥ 80 years. West Azerbaijan had the lowest and North Khorasan had the highest age-sex adjusted prevalence rate of dementia. Our results indicated that only 21.2% of subjects with dementia were diagnosed. We observed that diabetes mellitus, depressed mood, illiteracy, and increased age were associated with dementia.

Conclusion: It seems that dementia is more common in Iran than many other countries. However, the rate of dementia diagnosis is much lower than that in developed countries.

Keywords: Dementia, dementia diagnosis rate, Iran, prevalence

Cite this article as: Sharifi F, Fakhrzadeh H, Varmaghani M, Arzaghi SM, Alizadeh Khoei M, Farzadfar F, Taheri Tanjani P. Prevalence of Dementia and Associated Factors among Older Adults in Iran: National Elderly Health Survey (NEHS). *Arch Iran Med.* 2016; 19(12): 838 – 844.

Introduction

Dementia is a chronic disease that greatly affects the quality of life in the individuals involved.¹ This syndrome imposes a huge financial and clinical burden on the health systems worldwide² and its financial burden will rise during the next years with the aging of communities and increase in dementia diagnosis rates.³

In 2012, the World Health Organization (WHO) introduced dementia as a health priority and recommended health systems, particularly in developing countries, to provide a sound estimation of the prevalence of dementia in their countries.⁴

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Accepted for publication: 10 November 2016

The number of people with dementia rises dramatically with aging of the population.⁵ Accordingly, with every five-year increase in age of individuals aged 65 years, the age-specific prevalence of dementia is duplicated.⁶ Iran is experiencing a rapid growing rate of the elderly population, due to the rapid decrease in fertility rate and increase in life expectancy.⁷ It is expected that individuals aged ≥ 65 years will increase from 5.7% in 2011⁸ to 9.7% in 2030, and to 25.2% in 2060.⁹

To our knowledge, no study has reported the prevalence of dementia and few studies have reported the prevalence of cognitive impairment among the Iranian population.^{10–12} All of these studies were at provincial or district levels. According to these reports, the prevalence of cognitive impairment is higher than the dementia prevalence estimated for countries of the Eastern Mediterranean region.¹³ In addition, the global burden of diseases (GBD) study 2010 and 2013 have estimated the prevalence and burden of dementia in Iran.^{14–16} Based on the results of the GBD study, the prevalence of dementia in our country was approximately as high as the other Eastern Mediterranean Region countries.^{14–16}

We used the National Elderly Health Survey (NEHS) data to estimate the prevalence of dementia at national level in Iran. We also detected the dementia diagnosis rate among patients with dementia. The results of this study may be used by researchers and policymakers, and it could also be utilized in an ongoing

study, NASBOD study, which is aimed to estimate the burden of diseases.¹⁷ The prevalence of some diseases, including dementia and asthma, will be estimated based on total drug consumption in Iran.^{18,19}

Materials and Methods

Population and sampling

This study was a national survey, carried out in 2012 in five provinces of Iran, including West Azerbaijan, North Khorasan, Sistan and Baluchistan, Khuzestan, and Alborz. The samples of this study were selected from the urban and rural older population who were aged ≥ 60 years. The multistage stratified cluster proportionate random sampling method was used in 109 health centers in 63 districts from the total 69 districts of the mentioned provinces and in three age-groups of 60–69, 70–79, and ≥ 80 years. The primary sampling units of the study were the health centers. The sample size from each province was collected weighted to the elderly population living in that province. Finally, a door-to-door knocking method was employed to identify and then invite subjects to health centers for the interview. Inclusion criteria of the study included people aged ≥ 60 years, who were community dwellers and could communicate with evaluators and consent to participation. Bed ridden older people and end-stage subjects with less than 6 months of life expectancy were excluded. The study population response rate was 93%

Data collection

The data was collected through physical examinations and interviews with the participants and one of their informant family members. To collect demographic information such as age, education level, marital status, and living arrangement, we used an expert approved form. The participants' weights were measured with minimal clothing using calibrated scales. Participants' height was measured in the standing position on a flat surface without shoes and using a flexible tape measure. The blood pressure of the participants was checked once and diagnoses of hypertension were defined by recorded blood pressure $\geq 140/90$ mmHg or history of high blood pressure or use of antihypertensive drugs. Diabetes mellitus was defined as history of diabetes mellitus and also use of anti-diabetes drugs. Trained general practitioners performed a three-word recall test (including apple, table and shoes) and evaluated the functional status of the participants. Furthermore, the participants were asked about the history of the physician diagnosed hypertension and diabetes mellitus.

Diagnosis of dementia

The diagnosis of dementia was performed based on two phases: first, using the brief cognitive assessment tool (BCAT) that had previously been developed in Iran²⁰ and second, diagnosis of dementia by general practitioners based on DSM IV criteria for dementia. The BCAT includes the three-word recall test and functional status examination. The three-word recall test is a simple test for assessment of memory status. For performing this test, the subjects should first register three independent words and five minutes later, they were requested to recall the words. This test is utilized as a part of many cognitive assessment tools such as the Mini Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA). Another part of the BCAT is functional assessment. In order to evaluate functional status, three

domains of instrumental and basic activity of daily living (IADL and ADL) were assessed, including ability to use telephone, responsibility for own medications, ability to dress, which was assessed for both sexes, ability to handle financial items for men, and ability to prepare food for women. A diagnosis of dementia was based on the impairment in the three-word recall test as well as the inability in one of the mentioned domains of ADLs. According to a study, the BCAT's sensitivity and specificity for diagnosis of dementia are 88.6% and 82.4%, respectively.²⁰ The details about survey design and sampling method are discussed elsewhere.^{21,22}

Assessment of depressed mood was carried out using the 15-item Persian version of the geriatric depression scale (GDS-15). This tool contains 15 binary questions; the maximum score of 15 demonstrates the worst depression status while zero score indicates the best condition.²³ Scores 12 and higher were considered as severe depression. Malakouti *et al.* approved the validity of the Persian version of the GDS-15 in Iran.²⁴

Dementia diagnosis rate

"Dementia diagnosis rate" was defined as the ratio of subjects with dementia who had been previously diagnosed by a physician to patients with dementia who were diagnosed in this study.

Statistical analysis

The significance levels were set at $\alpha < 0.05$. All analyses were conducted using Stata 11 (Texas, USA). We used survey analysis based on a two-stage cluster (provinces and cities) and one stratified (age-groups 60–69 years, 70–79 years, and ≥ 80 years) sampling method. The statistics were reported with 95% confidence interval. All rates were standardized based on the Iranian general population aged ≥ 60 years (2011 census). Overall prevalence rates of Iran were directly standardized based on standard population of World Health Organization 2000–2025. Univariate and multivariable logistic regression models were used for assessing the association between various factors and dementia. Age, gender, marital status, literacy, urban or rural status, diabetes status, hypertension, and BMI were finally entered in multivariate mode.

Ethical considerations

This study was approved by the Research Ethical Committee of the Ministry of Health. All the participants were enrolled in the study after signing or finger printing an informed consent form. Before presenting the data to analyzers and researchers, individual identifiers were removed from the dataset

Results

This survey was carried out using a geographic cluster sampling. Over 1350 participants were enrolled in the study; a total of 93 (6.9%) individuals were excluded from the analysis due to incomplete data. Finally, the data collected from 1257 participants was used for analysis. Of all, 52.9% (664 individuals) were female. Mean age of the participants was 69.2 years. Most of the participants were illiterate (67%) and the percentage of illiteracy was higher in patients with dementia (64.4% in normal cognitive versus 81.8% in illiterate participants, $P < 0.01$). Self-reported diabetes mellitus was more common in the participants with dementia than those with normal cognitive status (29.3% in

normal participants vs. 46.5% in those with cognitive impairment; $P < 0.01$) (Table 1). The national crude prevalence of dementia was calculated as 7.9%. In women and men, the national crude prevalence of dementia was calculated as 8.7% and 6.9%, respectively. The prevalence of dementia increased with population aging, as the rate was 3.7% in the age group 60–64 years while it reached 13.0% in the age group ≥ 80 years (Table 2).

The age standardized prevalence rate of dementia in Iran (based on the WHO's Standard Population 2000–2025) in people aged ≥ 60 years was obtained as 8.1%; CI 95%; 6.2% – 10.0%. This rate was 9.6%; CI 95% 6.2 – 12.9% for women and 6.5%; CI 95% 4.9 – 8.2% for men. Moreover, the age-sex adjusted prevalence rate in people aged ≥ 60 years (based on the population of Iran in 2011) was 8.2%; CI 95%; 6.2% – 10.2% that were 9.5%; CI 95% 6.2 – 12.8% among women and 6.8%; CI 95% 5.2 – 8.5% among men. Because of the probability of pseudo-dementia, subjects with severe depressed mood (GDS-15 ≥ 12) were removed from analyses so that the prevalence rate of dementia without depression in people aged ≥ 60 years was 7.3%; CI 95% 5.6 – 9.1%. The age standardized prevalence of dementia without depression according to the WHO standard population was estimated as 7.5%; CI 95% 5.8 – 9.3% (9.0%; CI 95% 6.0 – 12.1% among women and 6.0%; CI 95% 4.4 – 7.7% among men)

After age-sex adjustment, the lowest prevalence rate of dementia was observed in East Azerbaijan and the highest was observed in North Khorasan (Table 3). The total diagnosis rate of dementia in Iran was 21.2%. The highest was 40% and belonged to Alborz and the lowest belonged to Khuzestan (9.7%). Furthermore, the

diagnosis rate was similar among men and women (20.7% in women vs. 22.0% in men) (Table 4). In a multivariate logistic regression analysis, the strongest association was observed between dementia and depression. Moreover, age, diabetes mellitus and illiteracy were related to dementia (Table 5).

Discussion

This study is the first attempt to estimate the national prevalence of dementia in Iran using individual data. We found that the prevalence of dementia was higher than the estimates reported by the global burden of disease study in 2010. According to this study, 309,301 (CI 95%; 215,101 – 429,728) individuals with dementia are living in Iran (5.02% of the population aged ≥ 60 years).¹⁴ Whereas the GBD study 2013 estimated 503,400 (CI 95%; 434,200 – 573,100) subjects with dementia in Iran that is equal to 7.7%.¹⁶ The lower prevalence rate of dementia reported by the GBD 2010 might be due to lack of valid data about epidemiologic properties of dementia in Iran. This rate was corrected in 2013 and the GBD estimation is much closer to our estimation.

According to a study in Turkey, the prevalence of dementia was 20% in older adults aged ≥ 70 years.²⁵ Another study in Turkey showed that the overall prevalence of dementia was 8.4%.²⁶ These rates are close to what we observed in our study. Two studies in Egypt reported the prevalence of dementia as 5.08% and 3.83% among the population aged ≥ 60 years.^{27,28} Furthermore, the prevalence of dementia was estimated as 2.44% in India.²⁹ The fairly higher frequency in our study compared to the Egyptian and

Table 1. General characteristics of the participants in National Elderly Health Survey (NEHS) Study.

Variables	Total Participants Ω N= 1257	Individuals with normal cognition Ω N=1158	Patients with dementia Ω N = 99	P-Value Ω	
Age (years) means (SD)	69.2 (68.7 – 69.7)	68.9 (68.4 – 69.3)	72.7 (71.2 – 74.1)	< 0.01	
Gender (%)	Male	47.1 (43.1 – 51.1)	47.6 (43.4 – 51.9)	0.17	
	Female	52.9 (48.9 – 56.9)	52.4 (48.2 – 56.6)		58.6 (49.1 – 68.1)
Education Level (%)	Illiterate	67.0 (61.2 – 72.7)	64.4 (60.0 – 70.9)	81.8 (70.6 – 93.0)	< 0.01
	Elementary	23.2 (19.3 – 27.0)	23.9 (20.2 – 27.7)	12.1 (4.0 – 20.3)	
	High school	4.7 (3.3 – 6.0)	5.3 (3.8 – 6.7)	3.0 (1.8 – 5.9)	
	Diploma	3.7 (2.1 – 5.3)	3.8 (2.2 – 5.4)	2.0 (0 – 4.3)	
Academic	1.5 (0.7 – 2.3)	1.6 (0.7 – 2.4)	1.0 (0 – 2.1)		
Diabetes (%)	30.7 (27.8 – 33.6)	29.3 (26.4 – 32.3)	46.5 (36.1 – 56.5)	< 0.01	
Hypertension (%)	47.7 (43.1 – 52.2)	45.6 (42.0 – 50.0)	55.6 (46.8 – 64.3)	0.05	
BMI (%)	< 19 kg/m ²	6.0 (3.6 – 8.3)	5.7 (3.5 – 7.9)	9.3 (3.6 – 15.0)	< 0.01
	19 – 20.9 kg/m ²	10.2 (7.3 – 13.1)	9.8 (6.7 – 12.9)	14.4 (9.3 – 19.6)	
	21 – 22.9 kg/m ²	16.4 (13.0 – 19.8)	16.0 (12.6 – 19.4)	20.6 (14.2 – 27.0)	
	≥ 23 kg/m ²	67.5 (60.2 – 74.7)	68.5 (61.2 – 75.7)	55.7 (47.0 – 64.4)	
Living alone (%)	8.7 (7.0 – 10.3)	8.6 (6.9 – 10.4)	9.1 (5.2 – 13.0)	0.79	
Depressed mood (%)	24.1 (20.6 – 27.5)	21.9 (18.7 – 25.1)	53.6 (43.1 – 64.1)	< 0.01	
Smoker (%)	7.9 (5.9 – 9.9)	7.6 (5.7 – 9.4)	8.3 (2.7 – 13.9)	0.77	
Marital status (%)	Married	70.6 (67.6 – 73.7)	71.8 (68.7 – 74.8)	52.4 (41.2 – 63.5)	0.01
	Non-married	29.3 (26.3 – 32.4)	28.2 (25.2 – 31.3)	47.6 (36.5 – 58.8)	
Living location (%)	Rural	45.8 (33.0 – 58.6)	44.8 (32.3 – 57.3)	59.5 (44.2 – 74.9)	0.01
	Urban	54.2 (41.4 – 67.0)	55.2 (42.7 – 67.7)	40.5 (25.1 – 55.8)	
Ω Results of survey analysis					

Table 2. Prevalence of Dementia by age-group.

Age-groups	prevalence % (CI 95%) Ω	Prevalence in female % (CI 95%) Ω	Prevalence in male % (CI 95%) Ω	Prevalence in rural % (CI 95%) Ω	Prevalence in urban % (CI 95%) Ω
60 – 64 years (%)	3.7 (2.1 – 5.2)	4.9 (2.5 – 7.3)	1.8 (0.4 – 3.2)	4.3 (1.6 – 7.0)	2.9 (1.6 – 4.2)
65 – 69 years (%)	6.2 (3.6 – 8.7)	7.6 (4.7 – 10.6)	4.2 (1.0 – 7.5)	5.4 (0 – 11.0)	5.8 (3.0 – 8.6)
70 – 74 years (%)	10.4 (6.0 – 14.8)	11.3 (5.9 – 16.7)	9.3 (3.9 – 14.8)	14.6 (8.0 – 21.3)	5.6 (2.1 – 9.0)
75 – 79 years (%)	14.4 (10.2 – 18.6)	15.9 (5.6 – 26.0)	13.3 (8.8 – 17.9)	15.7 (8.2 – 23.2)	11.8 (4.6 – 18.9)
≥ 80 years (%)	13.0 (6.6 – 19.5)	15.7 (2.3 – 29.1)	11.5 (5.7 – 17.3)	15.8 (7.0 – 24.5)	8.2 (2.4 – 14.0)
Ω Results of survey analysis					

Table 3. Crude and age-adjusted prevalence of dementia by province*.

Province	Sample size	Crude prevalence (CI 95%)	Age-sex adjusted prevalence§ (CI 95%)	Age-adjusted prevalence men (CI 95%)	Age-adjusted prevalence female (CI 95%)	P-Value
Alborz (%)	227	6.6 (5.6 – 7.7)	5.4 (4.7 – 6.2)	4.2 (3.1 – 5.3)	6.7 (6.1 – 7.2)	0.25 □
E. Azerbaijan (%)	403	5.0 (2.9 – 7.1)	5.2 (3.1 – 7.2)	4.9 (1.9 – 7.8)	5.4 (2.5 – 8.4)	0.97 □
Khuzestan (%)	353	9.8 (4.2 – 13.4)	9.8 (4.9 – 14.8)	5.6 (3.3 – 8.0)	13.9 (4.9 – 22.8)	0.02 □
N. Khorasan (%)	96	14.6 (8.9 – 20.3)	16.2 (10.1 – 22.4)	16.3 (6.0 – 26.6)	16.1 (10.4 – 21.8)	0.49 □
S. & Balouchestan (%)	178	10.7 (8.1 – 13.4)	11.5 (8.7 – 14.4)	12.4 (7.8 – 17.0)	10.6 (5.1 – 16.2)	0.82 □
Total (%)	1257	7.9 (6.5 – 9.7)	8.2 (6.2 – 10.2)	6.8 (5.2 – 8.5)	9.5 (6.2 – 12.8)	0.17 Ω
* Results of survey analysis; §Adjusted based on the Iranian population in 2011; □ Survey analysis no used because provinces were levels of clustering; Ω using Survey analysis						

Table 4. Dementia diagnosis rate total and by sex in provinces Ω.

Province	Dementia diagnosis rate	Dementia diagnosis rate in men	Dementia diagnosis rate in women	P-value
Alborz (%)	40.0 (36.0 – 44.0)	50.0 (42.4 – 57.6)	20.0 (-)	0.26 □
East Azerbaijan (%)	30.0 (6.8 – 53.2)	33.0 (0 – 83.2)	25.0 (0.0 – 52.6)	0.69 □
Khuzestan (%)	9.7 (0.0 – 20.7)	30.0 (0.0 – 63.1)	-	< 0.01 □
North Khorasan (%)	28.6 (8.8 – 48.4)	28.6 (17.9 – 39.3)	28.6 (0.0 – 61.3)	1.0 □
Sistan and Balouchestan (%)	10.5 (2.0 – 19.0)	12.5 (2.7 – 22.3)	9.1 (0.0 – 21.0)	0.81 □
Total (%)	21.2 (11.5 – 31.0)	22.0 (10.2 – 33.7)	20.7 (5.2 – 36.2)	0.87‡
□ Survey analysis no used for calculating of P values because provinces were levels of clustering.‡ P value calculated by survey analysis				

Indian studies may be due to differences in methods of screening and diagnosis of dementia. The estimated prevalence of dementia in our study is dramatically lower than that in previous studies in Iran.^{11,12} This could be attributed to the use of different tools and methods for diagnosis of dementia or cognitive impairment. Previous studies used the MMSE as a tool for diagnosis of dementia, while we used a combined tool that assessed both the memory and function that is according to its definition in DSM-IV; in addition, we used physicians' judgment as a diagnosis criterion. The MMSE scoring and interpretation is related to literacy.³⁰ Furthermore, its score is associated with cultural issues, i.e. serial 100-7s subtraction is very difficult for older adults, who have not learned mathematics³¹ or the significance of the time orientation is various in different cultures.³²

According to our experience, MMSE is not suitable for cognitive screening among Iranian older adults and its cutoff point for detecting cognitive impairment is much lower than other

countries.³³ Some studies have revealed that age-sex education cutoff points for the MMSE are more valid than the single cutoff point.³⁴ We used a newly introduced tool that is highly valid for detecting dementia among the Iranian population.²⁰ This tool was constructed based on the concept of the DSM IV criteria for diagnosis of dementia; memory impairment was assessed using a three-word recall test and function was assessed using some items taken from IADL and ADL that were more related to higher brain function than the physical function. Diagnosis of dementia and Alzheimer's disease based on a functional decline is approved by many studies. Barberger-Gateau *et al.* used four domains of IADL (telephone use, using means of transportation, ability to take responsibility for medication intake, and ability to handle finances) for diagnosis of dementia and reported a sensitivity of 94% and a specificity of 71%.³⁵ Resberg *et al.* developed two tools; Global Deterioration Scale (GDS) and Functional Assessment State Test (FAST) that can diagnose dementia only based on the decline of

Table 5. Associated factors with dementia in univariate and multivariable logistic regression.

	Compared groups	Univariate analysis	Multivariate analysis
		Odds ratio (95% Confidence interval) Ω	Odds ratio (95% Confidence interval) Ω
Age (year) (continues)		1.063 (1.043 – 1.084)	1.057 (1.023 – 1.093)
Gender	Male	reference	Reference
	Female	1.287 (0.848 – 1.952)	0.907 (0.518 – 1.588)
Literacy status	Illiterate	reference	Reference
	Literate	0.406 (0.206 – 0.798)	0.585 (0.349 – 0.981)
Urban/ Rural	Rural	reference	Reference
	Urban	0.532 (0.350 – 0.812)	0.848 (0.468 – 1.537)
Living alone	No	reference	-
	Yes	1.057 (0.619 – 1.805)	-
Marriage status	Married	reference	Reference
	Non-married	1.981 (1.302 – 3.015)	1.721 (0.883 – 3.354)
Smoking	No	reference	-
	Yes	1.089 (0.509 – 2.327)	-
Diabetes Mellitus(yes/no)	No	reference	Reference
	Yes	2.095 (1.390 – 3.156)	2.010 (1.375 – 3.551)
Hypertension (yes/no)	No	reference	Reference
	Yes	1.484 (1.010 – 2.211)	1.269 (0.664 – 2.426)
Depressed Mood (yes/no)	No	reference	Reference
	Yes	4.576 (2.892 – 7.241)	4.280 (2.033 – 9.011)
BMI	< 23 kg/m ²	reference	Reference
	≥ 23 kg/m ²	0.627 (0.450 – 0.874)	0.886 (0.546 – 1.439)
Ω Results of survey analysis			

functional status.^{36,37}

We found that overall, only slightly more than 20% of cases are diagnosed by physicians in Iran. This low diagnosis rate is due to the general population's lack of knowledge about dementia and it is also due to an incorrect assumption saying that aging is normally associated with memory loss and thus the elderly with memory impairment do not need to seek health services. The other likely cause of low diagnosis rate is lack of clinical knowledge about dementia among clinicians. Furthermore, this phenomenon is a worldwide problem of health systems, as despite the integration of dementia screening program into the primary health system, the dementia diagnosis rate in the United Kingdom is not more than 45%.³⁸ Furthermore, it seems that the diagnosis rate is lower in women than men in most provinces. It may be due to the fact that most older women are far from the complex tasks failing which could help with early detection of mild cognitive impairment or even mild dementia.

Our results are very important for the ongoing national and sub-national study of the burden of diseases (NSBOD) in Iran.¹⁷ In the NSBOD study, it is aimed to estimate the prevalence of diseases and then years lost due to disability and years lost due to premature death of each disease in Iran.¹⁷ The prevalence of dementia¹⁸ and some other chronic diseases such as asthma and COPD¹⁹ will be estimated based on the amount of specific prescribed drugs and use of some data mining methods such as neural network and decision tree models.³⁹ To achieve a final estimate of the prevalence of dementia by the mentioned method, we will need dementia diagnosis rate in Iran, which is reported in this study.

We observed that with every one-year increase in age, there is an increase of about 6% in the prevalence of dementia. This finding is in line with the findings of other studies.⁵ Aging is the best-known risk factor for dementia.⁴⁰ Moreover, we found a strong

relationship between diabetes mellitus and dementia. Crane *et al.* showed that when fasting plasma glucose exceeds 100 mg/dL, there was a relationship between dementia and serum glucose.⁴¹

Some studies have reported an exponential increase in the trend of dementia prevalence with aging; however, we observed an association between aging and the increasing trend in the age group younger than 80 years. However, the trend did not continue in those aged ≥ 80 years. It may be due to a problem in our sampling. It means that the very old subjects with dementia might be less likely to participate in our study. In addition, our method of diagnosis could be another cause of this discrepancy. We also found that the depressed mood had a strong coincidence with dementia. This finding has concordance with the findings of other studies.^{42,43} The relationship between illiteracy and dementia, which was seen in our study, was detected in other studies.^{44,45} The higher risk of dementia in this group may be due to their lower cognitive reservoirs and with declining of cognitive function with aging, the signs of dementia earlier appear.

Our estimates have some uncertainties. The most important source of uncertainty might be attributed to our sampling method. We used a stratified cluster sampling method, which was based on the health centers. This method may be very effective in rural populations, but may have some problems when generalizing the data to urban communities. The other source of uncertainty is caused by the method of dementia diagnosis. Furthermore, we excluded bed ridden and end-stage subjects due to the problems in communicating with them. This could be a resource of selection bias and may have caused a lower estimation of the prevalence of dementia.

It can be concluded that the prevalence of dementia in Iran, is perhaps higher than other countries in our region. On the other hand, only about one out of ten subjects with dementia had been diagnosed. These results could help policy makers and other health

providers to pay more attention to this disease and the services required for the patients with dementia and their caregivers.

Acknowledgment

This study was funded and supervised by the Iran Ministry of Health. Hereby, we would like to appreciate the people who helped us to conduct this study.

Authors' contributions

Farshad Sharifi contributed to designing the study and wrote the first and revised drafts and approved the final draft of the manuscript. He performed all analyses and designed all tables.

Hossein Fakhrazadeh contributed to general designing of paper and writing the first and final drafts.

Mehdi Varmaghani contributed to general designing of paper and writing the first draft and revising drafts. He approved the final draft.

Mohamad Esmaeil Motlagh contributed to designing the study and supervising of the data gathering and approved the final version of manuscript.

Seyed Masoud Arzaghi contributed to writing of the first draft and approved the final draft.

Mahtab Alizadeh Khoei contributed to writing the first draft and approved the final draft.

Farshad Farzadfar contributed to general designing of paper and guided to write first draft and revised several times the manuscripts and approved the final version of the manuscript.

Parisa Taheri Tanjani was the principle designer of the study and supervised gathering of the data and approved the final version of the manuscript.

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