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The Prevalence of Dementia in an Urban Turkish Population

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A cross-sectional, population-based, 2-stage prevalence study was conducted in a sample of 1019 community-dwelling persons over the age of 70 years living in Istanbul. In the first phase, participants were screened with the Mini-Mental State Examination for evidence of cognitive impairment. In the second phase, 79% of those who screened positive (n = 322) and 9% of screen-negatives (n = 63) underwent a standardized diagnostic workup. Diagnosis of dementia and Alzheimer's disease (AD) was made according to established criteria. Ninety-three cases of dementia were identified, 58 of whom were diagnosed with probable AD. Based on these numbers, the prevalence rates of probable AD and dementia were calculated to be 11.0% (95% CI, 7.0% to 15.0%) and 20.0% (95% CI, 14.0% to 26.0%), respectively, in this population. Prevalence rates of dementia and AD in Istanbul, Turkey, are comparable with those seen in the Western world.

Keywords: dementia; Alzheimer's disease; epidemiology; prevalence

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Introduction

Obtaining prevalence data for Alzheimer's disease (AD) and other dementing disorders is important in many respects, including the planning of health services especially in the face of aging population of the entire world. Differences in prevalence figures across different countries may provide hints with regard to etiology, population genetics, and pathogenesis. Although prevalence figures are available for developed regions of the world including Europe,[1] North America,[2-4] and Japan,[5] this information is largely missing for developing countries, which are expected to face an exponential increase in the number of patients with dementia as suggested by a recent consensus-based epidemiological survey.[6] This study estimated the rate of increase in the number of patients with dementia to be 3 to 4 times higher in developing countries than in developed regions of the world. Prince[7] also emphasized the need for dementia research estimating a comparable number of dementia sufferers in the developing and developed regions at the start of the current century. As there

Table 1. Demographic Features and Educational Status[a]

	Women	Men	Total
Mean age (years)	74.6 (±5.1)	75.3 (±5.0)	74.9 (±5.0)
70-74	406	228	634
75-79	124	88	212
80+	94	79	173
Total	624 (61.2%)	395 (38.2%)	1019
Mean years of education[b]	6.7 (±4.4)	10.3 (±4.7)	8.1 (±4.8)
No schooling[c]	137 (81.5%)	31 (18.5%)	168
Primary education[d]	168 (69.7%)	73 (30.3%)	241
Secondary education[e]	280 (67.9%)	132 (32.1%)	412
Higher education[f]	39 (19.7%)	159 (80.3%)	198

[a] Standard deviations are given in parentheses after the means.
[b] The difference between the gender groups is significant ($P < .000$).
[c] Under no schooling category there are illiterates (n = 108) as well as literate individuals without a grade school diploma (n = 60).
[d] Although primary education currently refers to 8 years, this is a relatively recent change in Turkey and for this population it corresponds to 5 years (grade school).
[e] 8 (junior high school) or 11 years (high school) of education.
[f] A university degree of 13 or more years.

have been no reliable prevalence figures in our country, we undertook the Turkish Alzheimer's Prevalence Study (TAPS), which is a prospective, cross-sectional epidemiological study, in a large district of Istanbul to assess prevalence rates of dementia in general and Alzheimer-type dementia in an urban Turkish elderly population.

Method

Sample Area and Population

This was a prospective, population-based, cross-sectional, door-to-door study conducted in the Kadıköy district of Istanbul. Istanbul is a megapolis that attracts large populations of domestic migrants from the entire country. Kadıköy is an older part of the city, where immigration rates are relatively low, resulting in a more stable population with a larger number of middle-class residents. Ethical issues regarding the study were discussed and the study design was approved in the usual meeting of the academic committee of the Department of Neurology of the Faculty of Medicine of Istanbul University, to which the majority of the authors are affiliated.

Highly variable prevalence rates have been reported for dementia, ranging from 8.5% to 59.4%.[1,2] Assuming a relatively high prevalence rate of 50%, we calculated that a sample size of 1067 drawn from individuals aged 70 years or older would provide sufficient confidence intervals to estimate a prevalence rate within 3% of the true values. The subjects were randomly selected from population registries that were accessed at neighborhood administrative offices. (In Turkey, communities such as villages and neighborhoods of a city are administered by locally elected officials, as the smallest adminisitrative unit. Detailed demograpic information along with addresses of the individuals living in that particular area is maintained in these local offices.) Residential addresses of all individuals who were 70 years or older at the time of the study and living in Kadiköy district were recorded until the predetermined number of 1067 subjects was reached. Only community-dwelling individuals were considered for the study. There are very few nursing homes in the area. The number of residents in these is negligible because traditionally vast majority of demented patients are kept and cared for in the family. Subjects with severe communication (ie, aphasia or no knowledge of Turkish) and perceptual (ie, deafness or blindness) problems were excluded from the study. In total 95.5% (n = 1019) of the sample population consented to participate in the study. Demographic data are shown in Table 1.

Screening Phase

A door-to-door survey was conducted by trained interviewers. The survey consisted of cognitive screening, screening for depression, a questionnaire focusing on demographic characteristics and potential risk factors for dementia, and a 10-item questionnaire to assess the attitude of elderly people toward symptoms of dementia. Informed consent forms were signed by the participants or caregivers. Depression was screened by the Geriatric Depression Scale (GerDS).[8] Following the administration of the screening tests and the questionnaire, buccal smears were obtained for apolipoprotein E genotyping. The results of these parts of the study have recently been published.[9-12] Evidence of cognitive impairment was screened using the validated Turkish version[13] of the standardized Mini-Mental State Examination (sMMSE)[14]; a modified version of sMMSE (sMMSE-il) was used for illiterate subjects[15] (n = 108). Screen positivity was

defined as a MMSE-il score of ≤23 and sMMSE score of ≤24. The sensitivity and specificity of these cutoff values had been previously established for both versions.[13,15]

In total, 322 (240 women) of 1019 participants were below the cutoff levels (screen-positives), 54 of whom were from the illiterate group. Of these, 69.9% (n = 225) were available for the second phase of the study (160 women, 39 illiterates). The main reasons for 97 nonresponders (80 women) were withdrawal of consent for the second phase, inaccessibility due to address change, and death. There was proportionally more women among the nonresponders compared with total group of second phase-screen-positives (82.5% vs 71.1%), but 2 groups were comparable in terms of age (75.8 ± 5.7 vs 76.6 ± 6.1 years) and education (6.2 ± 4.4 vs 5.2 ± 4.1 years). To have an estimate of false negative dementia cases in the screen-negative population, 9.0% of the screen-negative subjects (n = 63) were included in the second phase of the study who were randomly selected. The screen-negative group was comparable to the screen-positive responders in terms of age (76.1 ± 5.6 years) but showed a male preponderance (37 males) and was significantly more educated (11.2 ± 4.6 years, $P < .000$), largely because of the disinclination of the less-educated women to respond. There were 3 illiterate individuals in this group who were all women. The mean score of MMSE was 27.6 ± 1.5, and that of MMSE-il, 25.7 ± 2.9.

Diagnostic Phase

The second phase of the study consisted of a diagnostic interview including mental state and neurological examinations. The medical team consisted of 2 neurologists (HS and HH) and 3 senior neurology residents (BB, EG, and ST), all of whom were experienced in diagnosing dementia and were specifically trained to use the semistructured mental state examination battery. Examinations were performed at the residences of the subjects and included detailed personal, medical, and family history taken from the subject and an immediate family member/caregiver when deemed necessary. Mental status examination was consisted of bedside tests tapping different cognitive functions, including orientation to time and place, forward and backward digit span for attention, general information about current events and a short word list learning (number of words = forward digit span − 1) with delayed recall and recognition for memory, a short list for confrontation naming and verbal fluency (both categorical and lexical) for language, a number of gestures for praxis, imitating hand and finger positions, and copying geometrical shapes for visuospatial abilities, Luria's alternating patterns for set shifting, proverb interpretation and similarities for abstraction, and finally certain situational questions (eg, "What would you do if you were lost in a forest?") for reasoning. In addition to these tests, a number of scales were used to measure overall cognitive, affective, and functional status. These included Blessed Orientation-Memory-Concentration Test (BOMC)[16] for cognition, GerDS for depression, and Blessed Dementia Rating Scale—Consortium for the Establishment of a Registry of the Alzheimer's Disease version (BDRS-CERAD)[17] for the activities of daily living (ADLs). The diagnostic procedure was concluded with a somatic neurological examination. Final diagnoses were made in a consensus conference with the team leader (HG) after a thorough chart review. One of the following diagnoses was agreed on: normal individual, cognitive impairment not dementia (CIND), non-AD dementia, probable AD, or possible AD. The *Diagnostic and Statistical Manual of Mental Disorders*, 3rd edition (DSM-III)[18] criteria were used to diagnose dementia. National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) criteria[19] were used to diagnose possible and probable AD (PRAD and PosAD). Non-AD dementia was diagnosed if a subject fulfilled established criteria for any of the distinct non-AD dementias [ie, vascular dementia (VaD) according to the National Institute of Neurological Disorders and Stroke—Association Internationale pour la Recherche et l'Enseignement en Neurosciences (NINCDS-AIREN),[20] dementia associated with Lewy bodies (DLB) according to Consensus criteria[21] and frontotemporal dementia (FTD) according to Neary criteria[22]]. CIND was defined as an overt cognitive impairment not severe enough to cause impairment in ADLs. In the CIND cases, who had an isolated amnesia with otherwise normal cognition, ADLs and neurological examination were labeled as amnestic CIND (aCIND). CIND associated with other disorders such as depression and other neurologic or systemic disorders were also noted. We avoided use of the term "mild cognitive impairment" (MCI) for this condition because its criteria require formal neuropsychological testing.[23] Both Clinical Dementia Rating Scale[24] (CDR) and

Table 2. Diagnoses in Clinically Examined Subjects

	Total	PRAD	PosAD	Non-AD	aCIND	CIND[a]	Normal
Screen +	225	55	9	22	42	59	80
Screen –	63	3	3	1	7	11	45
Total	288	58	12	23	49	70	125

Abbreviations: PRAD, probable Alzheimer's disease; PosAD, possible Alzheimer's disease; non-AD, dementia other than Alzheimer's disease; CIND, cognitive impairment not dementia; aCIND, amnestic CIND.
[a] Including aCIND subjects.

Global Deterioration Scale[25] (GDS) were rated to determine the severity of cognitive impairment.

Diagnostic Categories and Age-Stratification

For the estimation of prevalence rate, we reclassified the diagnostic categories into 3 groups as follows: 1, PRAD; 2, total AD (PRAD + PosAD); and 3, total dementia (PRAD + PosAD + non-AD). We stratified the groups according to sex and 3 age groups (70-74, 75-79, and 80 or more years). We only report demographics of the CIND groups, but not prevalence rates, because screening tests and cutoff values were tailored to detect dementia rather than any cognitive impairment.

Prevalence Estimation and Statistical Analysis

The prevalence rates were estimated using the following formula:

$$\text{Prevalence} = (A1 \times B1) + (A2 \times B2)$$

In this formula, A1 corresponds to the ratio of the diagnosed cases to the screen positives, and A2, to the screen negatives, whereas B1 stands for the ratio of the total screen positives to the total population, and B2 for that of the total screen negatives. For each subgroup (age, sex, and diagnostic groups) the estimates were calculated from the corresponding subsets of the data, A1, A2, B1, and B2 varying accordingly. The only exception was for the PRAD group, where A2 was always the same, that of the total group. Age and sex stratified A2 values were not used because there were too few patients diagnosed in the screen-negative PRAD group for the cases to be included for reasonable estimates. Ninety-five percent confidence intervals (CIs) were calculated using bootstrapping. Finally, independent *t* test was used for two-group, one-way analysis of variance (ANOVA) for multiple group comparisons. Logistic regression analyses were performed to assess the association between age, sex, and education variables and diagnostic categories of dementia. Each diagnostic category and no-diagnosis group were the dependent variables, age, years of education, and sex were the covariates. The same analyses were also repeated separately for the two sexes. SPSS for Windows, version 11.5 (SPSS Inc., Chicago, IL) was used for the analyses.

Results

Demographics

Demographic features are shown in Table 1. There were slightly more number of women (61.2%), and 62.2% of the subjects were under the age of 75 and 83% was under 80 years (mean: 74.9 ± 5.0 years, range: 70-100 years). Men were slightly older (75.3 ± 5.0 vs 74.6 ± 5.1 years). The study population was relatively well educated (59.9% had secondary or higher education; mean, 8.1 ± 4.8 years), men having significantly more years of education than women (10.3 ± 4.7 years vs 6.7 ± 4.4 years; $P < .001$). In total, 79.7% of the subjects reported the longest duration of their residency to be in the 2 major cities of Turkey, Istanbul and Ankara, which indicates a rather urbanized nature of the study population.

Prevalence of Alzheimer-Type Dementia and Dementia

Out of the 288 clinically examined individuals (186 women), 58 were diagnosed with PRAD (3 screen negative subjects), 12 with PosAD (3 screen negatives), and 23 (1 screen negative) with other dementing disorders (9 DLB, 7 VaD, 1 FTD, 4 dementia with psychiatric conditions such as chronic psychosis,

Table 3. Educational Status of the Second Phase Subjects and Number of Demented Cases Across a Severity Scale

	Females	Males	Total
No schooling			
Dementia	25 (86.2%)	4 (13.8)	29
CIND	6 (50%)	6 (50%)	12
Normal	19 (67.8%)	9 (32.2%)	28
Primary education			
Dementia	24 (72.7%)	9 (27.3%)	33
CIND	14 (82.4%)	3 (17.6%)	17
Normal	21 (67.7%)	10 (32.3%)	31
Secondary education			
Dementia	15 (65.2%)	8 (34.8%)	23
CIND	20 (64.5%)	11 (35.5%)	31
Normal	30 (78.9%)	8 (21.1%)	38
Higher education			
Dementia	0 (0%)	8 (100%)	8
CIND	4 (40%)	6 (60%)	10
Normal	8 (28.6%)	20 (71.4%)	28
CDR 0.5 dementia	5	0	5
CDR 1	33	22	55
CDR 2	12	6	18
CDR 3	14	1	15

Abbreviations: CIND, cognitive impairment not dementia; CDR, clinical dementia rating scale.

2 atypical dementia not further classified), yielding a total of 93 dementia cases (64 women, 7 from screen negatives). Seventy cases, 44 of whom were women, were diagnosed with CIND (49 aCIND, 14 CIND with depression, 7 CIND with other causes such as cerebrovascular disease, Parkinson's disease, and systemic disorders) and the rest of the 124 individuals were judged to be cognitively normal (78 women). These results are shown in Table 2. Based on these figures the prevalence rates with 95% CIs of PRAD were calculated to be 0.11 (0.07-0.15), of PRAD + PosAD, 0.16 (0.11-0.21), and of dementia in general, 0.20 (0.14-0.26).

All 7 cases of dementia in the screen-negative group (Table 3) were rated as mild in terms of severity (CDR 1). In the screen negative group there were no significant differences in terms of age; years of education; and sMMSE scores between screen-negative normals, CIND, and dementia cases.

Overall, both dementia (mean 76.9 ± 6.1 years) and CIND groups (mean 76.9 ± 6.4 years) were significantly older ($P < .000$ for both) than the "normals," that is, subjects who were examined and found to be normal plus unexamined screen-negative subjects (n = 856, mean age, 74.5 ± 4.7 years). The dementia group (mean 5.5 ± 4.5 years) was also significantly less educated than both the CIND group (mean 7.5 ± 4.5 years; $P < .05$) and the "normal" group (8.5 ± 4.8 years; $P < .000$). The percentage of illiterate cases was almost 2-fold in the dementia group, for both sexes, compared with the entire study population (for women 21.9% vs 39.1%, for men 7.8% vs 13.8%). In contrast, illiteracy rate was 23.1% among CIND men and 13.6% among women. With regard to severity of dementia, 65% of the dementia subjects were rated as very mild to mild according to CDR (stages 0.5 and 1). Women were more likely to be rated as moderate to severe (stages 2 and 3) as 40% of female subjects were in these categories versus 24% of males (Table 3).

Prevalence rates for all diagnostic categories were higher for women and tend to increase with age (see Table 4). Logistic regression analysis showed that increased age and lower education, but not sex, were significant variables for all 3 diagnostic categories (age for PRAD and total AD $P < .001$, age for total dementia and years of education for all 3 categories $P < .001$). When the same analysis was repeated separately for 2 gender groups, age and education stayed as significant variables for women ($P < 0.01$ for both variables in PRAD and total AD, $P < .001$ for both variables in total dementia), however for men, although years of education was still a significant variable for all the diagnostic categories ($P < .01$ for all), the significance of age disappeared. The odds ratios for having a diagnosis of PRAD, any

Table 4. Age-Dependent and Sex-Dependent Prevalence Rates With 95% Confidence Intervals[a]

	PRAD	Total AD	Total dementia
Age groups combined			
All	0.11 [0.07-0.15]	0.16 [0.11-0.21]	0.20 [0.14-0.26]
Male	0.09 [0.04-0.14]	0.13 [0.07-0.20]	0.17 [0.11-0.24]
Female	0.13 [0.09-0.17]	0.17 [0.12-0.23]	0.22 [0.16-0.27]
Sex groups combined			
70-74	0.09 [0.05-0.14]	0.14 [0.08-0.20]	0.18 [0.12-0.25]
75-79	0.14 [0.09-0.20]	0.19 [0.12-0.26]	0.22 [0.15-0.29]
80+	0.13 [0.08-0.19]	0.17 [0.11-0.24]	0.23 [0.16-0.30]
Male			
70-74	0.08 [0.03-0.13]	0.12 [0.06-0.19]	0.16 [0.09-0.24]
75-79	0.09 [0.03-0.16]	0.12 [0.05-0.20]	0.15 [0.07-0.24]
80+	0.11 [0.04-0.19]	0.16 [0.08-0.24]	0.20 [0.11-0.29]
Female			
70-74	0.10 [0.06-0.15]	0.15 [0.09-0.21]	0.19 [0.13-0.26]
75-79	0.18 [0.11-0.26]	0.23 [0.15-0.32]	0.26 [0.18-0.35]
80+	0.15 [0.07-0.24]	0.20 [0.11-0.29]	0.25 [0.15-0.35]

Abbreviations: PRAD, probable Alzheimer's disease; total AD, PRAD plus possible AD; total dementia, total AD plus non-AD.
[a] Ninety-five percent confidence intervals are given in brackets.

AD, and any dementia are shown in Figures 1, 2, and 3, respectively. Briefly, whereas age was associated with an 8% to 11% increased risk, education was associated with a 9% to 13% decreased risk.

Association With ApoE Alleles

The full results of the association of AD with ApoE alleles were reported elsewehere.[12] Briefly, the frequency of ApoE4 allele was twice as high (14.7%) in total AD group as compared with nondementia controls (8.3%).

Discussion

The prevalance rates of PRAD, all AD dementia (PRAD plus PosAD) and total dementia in a Turkish urban population over the age of 70 years were comparable with those reported from other countries. Our figures for prevalence rates of AD and dementia are relatively high for a developing country. There may be several reasons for this. First, this study was conducted in an urban, relatively middle-class population with grossly Western standards of living. There have been several studies, showing higher prevalence rates for developed countries versus developing ones, or in urban populations versus rural ones (for a review see Kawas and Katzman[26]). Another reason may be the inclusion of screen-negative cases in our prevalence estimates. This has inflated our prevalence figures: prevalence rate of PRAD in screen-positive population is 7.7% versus 11.0% when the cases from the screen-negative group are included. However, we think that when MMSE is used as a screening instrument in a population study, it is essential to examine a certain percentage of screen negatives to have a more accurate estimation of true prevalence rates. The sensitivity of MMSE is particularly low in highly educated populations and can easily be subject to a ceiling effect, influenced also by factors such as socioeconomic status.[27-30] In another recent prevalence study reported from a developing country, screen negatives were not included in the second phase[31] and quite low prevalance rates of dementia were reported in a large urban population from India (1.81% over 65 years). In Taiwan, Lin and colleagues[32] found 108 cases of dementia among 2915 mixed urban and rural population of individuals. They examined 51 cases, whose MMSE scores had been 1 to 2 points above the cutoffs and found no additional dementia cases and reported 3.7% prevalence rate over the age of 65. Illiterate individuals comprised an unusually high proportion of their study population (60.1%). In China, Zhang and coworkers[33] screened 34 807 persons over the age of 55 using MMSE and reported a prevalence rate of 4.8% for AD over the age of 65, corrected for negative screening errors. Our efforts to detect mild dementia cases and to discriminate

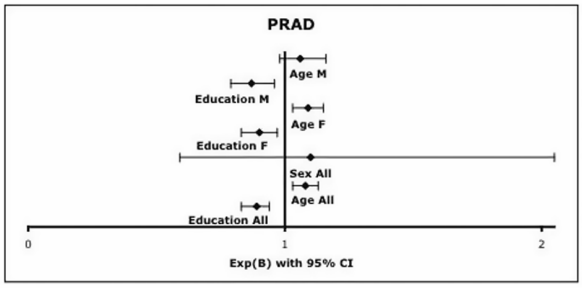

Figure 1. Odds ratios [Exp(B)] for PRAD diagnosis. PRAD, probable Alzheimer's disease; M, male; F, female; CI, confidence interval.

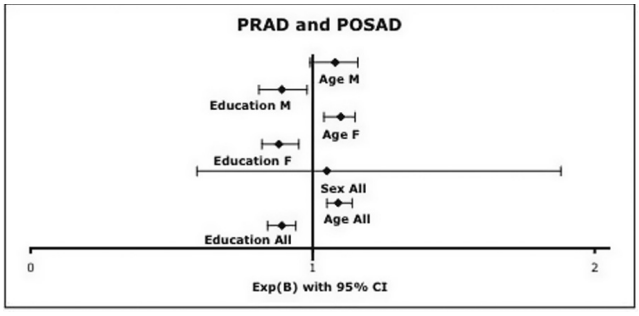

Figure 2. Odds ratios [Exp(B)] for any AD diagnosis. AD, Alzheimer's disease; PRAD, probable Alzheimer's disease; POSAD, possible Alzheimer's disease; M, male; F, female; CI, confidence interval.

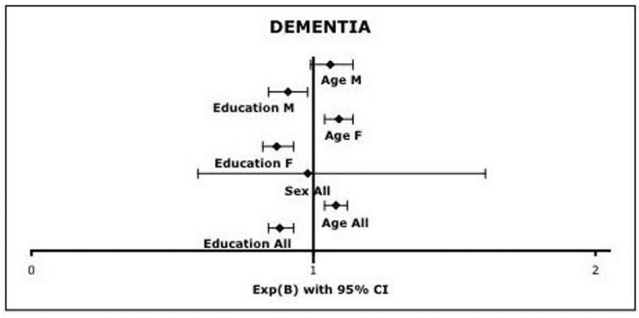

Figure 3. Odds ratios [Exp(B)] for any dementia diagnosis. M, male; F, female; CI, confidence interval.

them from cognitively impaired but not dementia individuals might have also contributed to our relatively high figures: 60/93 of our dementia cases were rated as very mild to mild (5 CDR 0.5 and 55 CDR 1). Andersen and coworkers[34] reported 7.1% dementia prevalence for people over 65 years in Odense, Denmark and concluded that inclusion of very mild cases of dementia had resulted in a higher prevalence rate than generally reported. It is unlikely that some patients with CIND were mislabeled as dementia because preservation of ADLs is a core feature of CIND and BDRS scores, which we used for rating ADLs, were significantly different for aCIND (1.17 ± 0.68) and very mild to mild AD (3.03 ± 1.06; $P < .001$) cases.[35]

Although prevalence figures for women were higher for all diagnostic categories and age groups, we did not find female sex to be a significant variable in any of the dementia categories. We had also reported in the case–control study[9] using the same data set that sex was not a significant independent risk factor. Although higher prevalence rates of dementia have been reported in women compared with men,[1,36] this has been suggested to reflect a bias due to differential survival rates. This bias, which is inherent to prevalent case studies is avoided in incidence studies, but their results are not uniform, with some studies showing higher risks of dementia in women[3,37-39] whereas others showing no difference.[40,41] The EURODEM Incidence Research Group suggested that these discrepancies are due to small sample sizes, particularly in the older age groups, when the incidence of dementia is the highest. They reported that in the pooled analysis of the EURODEM Studies significant sex differences in the incidence of AD become apparent at the age of 85 and further increase at the age of 90.[42] Our sample size representing the upper end is too small to demonstrate an increased risk for women (women/men = 47/29 over age 85, 15/5 over age 90).

Age is established as an undisputable risk factor for AD and dementia.[26] Yet there is an ongoing debate whether dementia is age related and inevitable beyond a certain age or ageing-related, and individuals who pass beyond a certain age are protected against dementia. A study favoring the former view,[43] found that 15 of the 17 centenarians were demented, whereas the latter view is supported by a meta-analysis by Ritchie and Kildea,[44] in which the rate of increase in dementia prevalence was found to fall in the age range of 80 to 84 years, and to level off around 40% at the age of 95. Our results indicate that age is a significant risk factor for all 3 diagnostic categories in women and in both sexes combined but not for men. This is probably related to small sample size for men in the older age group. Alternatively, an earlier leveling off for men is a possibility but cannot

be proven with our data because our population starts from age 70. A likely leveling off after age 80 can be inferred from the rates of women after a somewhat sharp increase for the 75 to 79 age group. The fact that our older male group was exceptionally well educated (43% of 79 men over age 80 years had college degree, compared with 39.5% of 316 men under 80) might also be a contributor to this finding. In the case–control study[9] mentioned earlier, we had reported higher education as protective against the diagnosis of PRAD with an adjusted odds ratio of 0.02 (CI 0.02 to 0.5) when no schooling was taken as the reference.

Years of education was a significant variable for the diagnosis of any type of dementia in both sexes. This result is compatible with earlier findings.[45-48] Few exceptions are the EURODEM Study,[49] where low education was a significant risk factor only for women and the Framingham Study where the education was not associated with dementia.[50]

An association of AD with ApoE4 allele was found also in our Turkish population. The percentage of subjects with at least one ApoE4 allelle was twice as high in the AD group. It was, however, conspicuous that this rate was almost half of that typically reported in Western populations. A North to South gradient has been suggested with regard to the frequency of ApoE4 allele in the general population, ranging from 24% in Finland to 6.5% in Greece.[51] Our results are in line with this hypothesis. The interesting observation is that although the frequency of ApoE4 allele in the Turkish population is lower in general, the 2:1 ratio in AD versus non-AD is still preserved strongly suggesting that ApoE4 allele is also a risk factor in this population.

In conclusion, we found that in a Turkish urban population over the age of 70, the prevalence rates of probable and possible AD as well as dementia in general were quite comparable with those reported in developed countries for an urban population of people over the age of 70 years. Although the sample size was relatively modest, we think that this door-to-door study with careful case ascertainment provides valuable findings and complements European prevalence data from the southeastern end of the continent. Before generalizing these figures to represent the whole of Turkey, however, more studies involving diverse geographical regions and sociocultural classes are needed.

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