Prevalence of dementia and Alzheimer's disease in elders of nursing homes and a senior center of Durango City, Mexico
Cosme Alvarado-Esquivel*1, Ana Berthina Hernández-Alvarado1, Rosa Oralía Tapia-Rodríguez2, Ángel Guerrero-Iturbe1, Karina Rodríguez-Corral1 and Sergio Estrada Martínez1

Address: 1Facultad de Medicina, Universidad Juárez del Estado de Durango. Durango City, Mexico and 2Hospital Psiquiátrico "Miguel Vallebuena", Secretaría de Salud. Durango City, Mexico

Email: Cosme Alvarado-Esquivel* - alvaradocosme@yahoo.com; Ana Berthina Hernández-Alvarado - alvaradocosme@yahoo.com; Rosa Oralía Tapia-Rodríguez - ssadgo@dgo1.prodigy.net.mx; Ángel Guerrero-Iturbe - medicina@terra.com.mx; Karina Rodríguez-Corral - alvaradocosme@yahoo.com; Sergio Estrada Martínez - alvaradocosme@yahoo.com

* Corresponding author

Abstract

Background: Epidemiological reports about dementia and Alzheimer’s disease (AD) in elderly people from developing countries are scarce. Therefore, we sought to determine the prevalences of dementia and AD in a population of nursing home residents and senior center attendees of Durango City, Mexico, and to determine whether any socio-demographic characteristics from the subjects associated with dementia or AD exist.

Methods: One hundred and fifty-five residents of two nursing homes and 125 attendees of a senior center were examined for dementia and Alzheimer’s disease. All subjects were tested by the mini-mental state examination, and those who scored twenty-four or less underwent psychiatric and neurological evaluations. Diagnosis of dementia, AD and vascular dementia (VaD) was based on the DSM-IV criteria. Socio-demographic characteristics from each participant were also obtained.

Results: Residents of nursing homes found to suffer from dementia were 25 out of 155 (16.1%). Eighteen of them (11.6%) had AD, and seven (4.5%) had VaD. None of the attendees of the senior center suffered from dementia. Dementia (pooled AD and VaD cases) correlated with white ethnicity (OR = 3.2; 95%CI = 1.28–8.31), and a history of unemployment (OR = 6.46; 95%CI = 1.42–25.97), while AD correlated with journeymen occupations (OR = 4.55; 95%CI = 1.00–19.29).

Conclusion: Prevalence of dementia in residents of nursing homes found in this study is much lower than reported from more industrialized countries. AD was more frequent than VaD. Ethnicity and occupation showed effects on the prevalence figures. The prevalence of dementia found has implications for the optimum kind of health care that nursing homes should provide to their residents.
We have studied 280 elderly persons including 155 residents of 2 nursing homes and 125 attendees of a senior center. All elders were inhabitants of Durango City and represented the totality of residents and attendees of the two largest nursing homes and the only one senior center of Durango City. In this study, we considered a senior center as a place which elders use to attend courses such as handicraft, dancing, primary school, high school, singing, etc., and to organize local and national travels for pleasure. One nursing home takes care of women only while the other nursing home has a mixed population of women and men. Residents of the two nursing homes have the same level of care. Characteristics of facilities and the level of care, in both nursing homes and the senior center explored, are similar to those found in the majority of nursing homes and senior centers in Mexico. All 280 participants were studied from the year 2000 until 2002.

Socio-demographic data, mini mental state examination, and neuropsychiatric evaluation

This work was performed in two phases. Phase I was a screening survey carried out by trained psychologists who administered the validated Spanish version of the mini mental state examination (MMSE) [17,18] to all 280 elders. We used the MMSE because it has proven to be an efficient, widely accepted instrument for the screening and assessment of cognitive impairment in the elderly [3,19-21]. We used a MMSE cut off point of 24 or less, thus subjects who had MMSE scores below 25 were recruited into the phase II study. Subjects with MMSE scores of 25 or more were not studied further. Although false negative subjects might exist in the study population, the likelihood that they were missed for further evaluation is low since a high MMSE cut off point was used.

All nursing home residents and senior center attendees were allowed to be studied at any time. Although some elders died during the 2 years of the screening period, we were able to study them all before they died. Therefore, none of the elders was excluded from the study. Since all subjects were screened, response bias and length-based sampling bias were avoided.

Socio-demographic data including age, gender, birth place, ethnic group, marital status, schooling, occupation during their productive age, socioeconomic level, history of alcohol use, history of smoking, and history of drug use from all 280 subjects studied were obtained [see Additional file 1]. This data was obtained during the screening stage, and of this data such as age, history of alcohol, of drug use, etc were verified during stage II. In a few cases, information from informants was used. Socioeconomic level was evaluated by using the Bronfman criteria [22]. Briefly, six socioeconomic variables were evaluated: number of persons in the house, number of rooms in the house, floor material of the house, availability of potable water, presence and type of plumbing in the house, and educational level of the head of the family. In nursing
home residents, data corresponded to that found in the house where the person lived prior to the nursing home.

Phase II involved the assessment for dementia by a neurologist and a psychiatrist of all subjects who scored 24 or less in the MMSE. The diagnosis of dementia and AD was performed through clinical interview, and was based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria [23]. Laboratory tests (complete blood count, electrolytes, glucose, calcium and TSH), medical record examinations, and information from informants were used to support the diagnosis. The diagnosis of VaD was determined by clinical examination, and was based on the DSM-IV criteria [23].

Statistical Analysis

Results were analyzed with the aid of the software Epi Info 6. For age comparison among the groups, the t student test was used. To assess the association between the characteristics of the subjects and the disease, the crude odds ratio with a 95% exact confidence interval was used. We calculated the exact confidence interval because the cell value (number of cases) was less than 5 in some comparisons. Odds ratio is the ratio between the probability of having disease among those exposed and the probability of having the disease among those not exposed [24]. Odds ratio was used because it is an important instrument as a measure of association [25]. Since the number of cases were too low, we did not perform multivariate analysis for age and gender adjustment. In addition, comparison of the frequencies between groups was performed by the χ² test. A level of P < 0.05 was considered significant.

Results

Socio-demographic data

Of the 155 residents of the 2 nursing homes studied, 110 were women and 45 were men. The mean age was 72.5 years (range: 61 to 99 years). A low socioeconomic status was found in eighty-six participants (55.6%), a medium status in fifty-five (44.0%), and a high status in three (2.4%). Most people studied (n = 83) were mestizos, followed by whites (n = 41), and indigenous (n = 1). Their occupations were: eighty-four housewives, seventeen retired, four employees, eight professionals, seven journeymen, four businessmen, and one had a history of unemployment. Their marital status included forty-one married (32.8%), sixty widowed (48.0%), nineteen never married (15.2%), and five divorced (4.0%). Most of the participants (66.4%) were born in Durango State, and the rest in other Mexican states (32.8%) or abroad (0.8%). Twenty seven participants (21.6%) had a history of alcohol use, and eight had a history of smoking (6.4%). None of these participants had a history of drug use.

With respect to the 125 attendees of the senior center studied, 103 were women and 22 were men. The mean age was 69.0 years (range: 50 to 88 years). A low socioeconomic status was found in sixty-seven of these participants (53.6%), a medium status in fifty-five (44.0%), and a high status in three (2.4%). Most people studied (n = 83) were mestizos, followed by whites (n = 41), and indigenous (n = 1). Their occupations were: eighty-four housewives, seventeen retired, four employees, eight professionals, seven journeymen, four businessmen, and one had a history of unemployment. Their marital status included forty-one married (32.8%), sixty widowed (48.0%), nineteen never married (15.2%), and five divorced (4.0%). Most of the participants (66.4%) were born in Durango State, and the rest in other Mexican states (32.8%) or abroad (0.8%). Twenty seven participants (21.6%) had a history of alcohol use, and eight had a history of smoking (6.4%). None of these participants had a history of drug use.

Discussion

Studies on the prevalence of dementia and AD are encouraged. The results of such studies are useful to estimate the psychiatric and neurological needs of the population [8,26,27]. The overall prevalence of dementia and AD found in this study is comparable with those reported in elders from other countries [2,3,28]. The frequencies of dementia and AD were significantly higher in residents of
Table 1: Summary of the Mini-Mental State Examination (MMSE) and clinical results in residents of nursing homes.

| Age group | Subjects tested with MMSE | Subjects with grades below the 25 MMSE cut off point | Patients with dementia (pooled cases) | Patients with AD\textsuperscript{a} | Patients with VaD\textsuperscript{b} |
|-----------|---------------------------|-----------------------------------------------------|---------------------------------------|---------------------------------|---------------------------------|
| 51–64     | 4                         | 2 (50.0%)                                           | 1 (25.0%)                            | 1 (25.0%)                       | 0 (0.0%)                       |
| 65–74     | 26                        | 14 (53.8%)                                          | 3 (11.5%)                            | 1 (3.8%)                        | 2 (7.7%)                       |
| 75–84     | 72                        | 49 (68.1%)                                          | 10 (13.9%)                           | 8 (11.1%)                       | 2 (2.8%)                       |
| 85–94     | 46                        | 32 (69.6%)                                          | 8 (17.4%)                            | 7 (15.2%)                       | 1 (2.2%)                       |
| 95–99     | 7                         | 5 (71.4%)                                           | 3 (42.9%)                            | 1 (14.3%)                       | 2 (28.6%)                      |
| Total (%) | 155                       | 102 (65.8%)                                         | 25 (16.1%)                           | 18 (11.6%)                      | 7 (4.5%)                       |

\textsuperscript{a}AD: Alzheimer’s disease. \textsuperscript{b}VaD: Vascular dementia.

Table 2: Comparison of characteristics of the patients with dementia (pooled cases) and the elders without dementia.

| Socio-demographic Characteristics | Persons with Dementia n = 25 (%) | Persons without dementia n = 255 (%) | OR\textsuperscript{a} | 95% CI\textsuperscript{b} |
|----------------------------------|----------------------------------|--------------------------------------|-----------------------|--------------------------|
| Gender                           |                                  |                                      |                       |                          |
| Female                           | 21 (84.0%)                       | 192 (75.3%)                          | 1.72                  | 0.55–7.15                |
| Male                             | 4 (16.0%)                        | 63 (24.3%)                           |                       |                          |
| Place of birth                   |                                  |                                      |                       |                          |
| Durango State                    | 21 (84.0%)                       | 193 (75.7%)                          | 1.69                  | 0.54–7.00                |
| Other Mexican states or abroad\textsuperscript{c} | 4 (16.0%)                        | 62 (24.3%)                           |                       |                          |
| Socioeconomic level              |                                  |                                      |                       |                          |
| Low                              | 14 (56.0%)                       | 139 (54.5%)                          | 0.92                  | 0.35–2.33                |
| Medium                           | 10 (40.0%)                       | 108 (42.4%)                          | 1.24                  | 0.03–10.48               |
| High                             | 1 (4.0%)                         | 8 (3.1%)                             |                       |                          |
| Ethnic group                     |                                  |                                      |                       |                          |
| Mestizo                          | 10 (40.0%)                       | 173 (67.8%)                          | 3.2                   | 1.28–8.31                |
| White                            | 15 (60.0%)                       | 81 (31.8%)                           |                       |                          |
| Indigenous                       | 0 (0.0%)                         | 1 (0.4%)                             |                       |                          |
| Marital Status                   |                                  |                                      |                       |                          |
| Married                          | 4 (16.0%)                        | 61 (23.9%)                           | 0.93                  | 0.23–4.50                |
| Widowed                          | 7 (28.0%)                        | 115 (45.1%)                          | 3.01                  | 0.88–13.12               |
| Never married                    | 14 (56.0%)                       | 71 (27.8%)                           |                       |                          |
| Divorced                         | 0 (0.0%)                         | 8 (31.4%)                            |                       |                          |
| Occupation (historical)          |                                  |                                      |                       |                          |
| Housewife                        | 9 (36.0%)                        | 128 (50.2%)                          | 1.14                  | 0.11–5.98                |
| Retired                          | 2 (8.0%)                         | 25 (9.8%)                            |                       |                          |
| Employee                         | 2 (8.0%)                         | 43 (16.9%)                           | 0.66                  | 0.07–3.38                |
| Professional                     | 2 (8.0%)                         | 15 (5.9%)                            | 1.9                   | 0.18–10.44               |
| Journeyman                       | 5 (20.0%)                        | 24 (9.4%)                            | 2.96                  | 0.71–10.82               |
| Businessman                      | 0 (0.0%)                         | 9 (3.5%)                             |                       |                          |
| Unemployed                       | 5 (20.0%)                        | 11 (4.3%)                            | 6.46                  | 1.42–25.97               |
| History of alcohol use           |                                  |                                      |                       |                          |
| Yes                              | 6 (24.0%)                        | 73 (28.6%)                           | 0.79                  | 0.25–2.16                |
| No                               | 19 (76.0%)                       | 182 (71.4%)                          |                       |                          |
| History of smoking               |                                  |                                      |                       |                          |
| Yes                              | 3 (12.0%)                        | 39 (15.3%)                           | 0.76                  | 0.14–2.70                |
| No                               | 22 (88.0%)                       | 216 (84.7%)                          |                       |                          |

\textsuperscript{a}OR: Odds ratio. \textsuperscript{b}CI: Confidence interval. \textsuperscript{c}Includes 1 subject from the United States with Mexican ancestry.
nursing homes (16.1% and 11.6%, respectively) than those found in attendees of the senior center (0% and 0%, p < 0.0001 and p < 0.001, respectively). The prevalences of dementia and AD in residents of the nursing homes found in this study are lower than those reported in the United States [8] and Japan [11,12]. In contrast, our prevalences of dementia and AD are higher that those reported in France [3]. It is not clear why the residents of the nursing homes showed a higher frequency of dementia than the attendees of the senior center. There are no admission policies in the nursing homes and the senior center that reject demented subjects. Nevertheless, attendees of the senior center had more stringent behavioral rules for permanency than residents of the nursing homes. Therefore, exclusion of some subjects with psychiatric illnesses might explain the lower prevalences found in the senior center. In addition, all attendees of the senior center had social interaction and intellectual stimulation whereas residents of the nursing homes did not. These factors could influence the frequency of dementia as reported by other authors [29,30]. Similar age between the senior center attendees and the nursing home residents was observed (p > 0.5). Since white ethnicity and history of unemployment were associated with dementia (all causes), we compared the frequency of these characteristics among the groups. The frequency of white ethnicity was significantly higher in nursing home residents than that found in attendees of the senior center (51.6% vs 32.8%, p < 0.01). The association between white ethnicity and dementia observed in this study conflicts with those reported by Gurland [31] and Weintraub [32] that found higher frequencies of dementia in Latino and African-American.

Table 3: Comparison of characteristics of the patients with Alzheimer's disease (AD) and the elders without AD.

| Socio-demographic characteristics | Persons with AD n= 18 (%) | Persons without AD n= 262 (%) | ORa | 95% CIb |
|----------------------------------|--------------------------|--------------------------------|-----|---------|
| Gender                           |                          |                                |     |         |
| Female                           | 15 (83.3%)               | 198 (75.6%)                    | 1.62| 0.44–8.97|
| Male                             | 3 (16.7%)                | 64 (24.4%)                     |     |         |
| Place of birth                   |                          |                                |     |         |
| Durango State                    | 15 (83.3%)               | 199 (76.0%)                    | 1.58| 0.43–8.79|
| Other Mexican states or abroadc | 3 (16.7%)                | 63 (24.0%)                     |     |         |
| Socioeconomic level              |                          |                                |     |         |
| Low                              | 11 (61.1%)               | 142 (54.2%)                    | 0.69| 0.20–2.12|
| Medium                           | 6 (33.3%)                | 112 (42.7%)                    | 1.61| 0.03–14.06|
| High                             | 1 (5.6%)                 | 8 (3.1%)                       |     |         |
| Ethnic group                     |                          |                                |     |         |
| Mestizo                          | 9 (50.0%)                | 174 (66.4%)                    | 2   | 0.67–5.90|
| White                            | 9 (50.0%)                | 87 (33.2%)                     |     |         |
| Indigenous                       | 0 (0.0%)                 | 1 (0.4%)                       |     |         |
| Marital Status                   |                          |                                |     |         |
| Married                          | 2 (11.1%)                | 63 (24.0%)                     | 1.35| 0.21–14.50|
| Widowed                          | 5 (27.8%)                | 117 (44.7%)                    |     |         |
| Never married                    | 11 (61.1%)               | 74 (28.2%)                     | 4.68| 0.96–44.66|
| Divorced                         | 0 (0.0%)                 | 8 (3.1%)                       |     |         |
| Occupation (historical)          |                          |                                |     |         |
| Housewife                        | 6 (33.3%)                | 131 (50.0%)                    | 1.75| 0.16–10.47|
| Retired                          | 2 (11.1%)                | 25 (9.5%)                      |     |         |
| Employee                         | 1 (5.6%)                 | 44 (16.8%)                     | 0.5 | 0.01–4.38|
| Professional                     | 1 (5.6%)                 | 16 (6.1%)                      | 1.36| 0.03–12.40|
| Journeyman                       | 5 (27.7%)                | 24 (9.2%)                      | 4.55| 1.00–19.29|
| Businessman                      | 0 (0.0%)                 | 9 (3.4%)                       |     |         |
| Unemployed                       | 3 (16.7%)                | 13 (5.0%)                      | 5.04| 0.72–26.73|
| History of alcohol use           |                          |                                |     |         |
| Yes                              | 3 (16.7%)                | 76 (29.0%)                     | 0.49| 0.09–1.81|
| No                               | 15 (83.3%)               | 186 (71.0%)                    |     |         |
| History of smoking               |                          |                                |     |         |
| Yes                              | 1 (5.6%)                 | 41 (15.6%)                     | 0.32| 0.01–2.14|
| No                               | 17 (94.4%)               | 221 (84.4%)                    |     |         |

aOR: Odds ratio. bCI: Confidence interval. cIncludes 1 subject from the United States with Mexican ancestry.
American groups than in whites. Similarly, the frequency of a history of unemployment was significantly higher in nursing home residents than the one observed in the senior center attendees (6.5% vs. 0.8%, p < 0.05). The association between dementia and unemployment found in this study agrees with data reported by Li [33]. It is not clear why unemployment relates to dementia, however, associated factors such as illnesses might contribute and this observation deserves further study. Remarkably, AD was associated with a history of journeyman occupations (OR = 4.55; 95% CI = 1.00–19.29). To the best of our knowledge, this association has not been reported elsewhere. Nevertheless, this observation must be taken with care, since a low educational level was present with most journeymen. Other characteristics such as never married status [34,35], reported to be related to AD, and alcohol consumption [36] that may reduce the risk for AD were also analyzed. There were more never married subjects in the nursing homes than in the senior center (50.3 vs 15.2%, p < 0.0000001). In addition, we observed a higher frequency of never married subjects in the group of AD patients (61.1%) than in the group of subjects without AD (28.2%), and these results agree with data reported by Kristjansson [34] and Helmer [35]. However, the difference found in our study was not statistically significant (OR = 4.68; 95% CI = 0.96–44.66). Never married elders seem to need more support than married elders who had family, this may explain why we found a higher frequency of never married elders in the nursing homes than in the senior center. History of alcohol use was equally distributed among residents and attendees, and among AD patients and non AD subjects in our study. This latter result agrees with a previous report [36], but conflicts with data reported by Lindsay [38] and Ruitenberg [36], since they found that alcohol consumption was associated with a reduced risk of AD. Although the frequency of smoking was low, we observed a higher frequency of smoking in males than in females. Nevertheless, we did not find any positive or negative association between smoking and AD in our elderly population study. Other authors have shown similar results [38,39]. The most common cause of dementia in our study population was AD (72%). This finding is comparable with those findings reported in India [1] and France [40], but our frequency is higher than those reported in Japanese [12] and American-Chinese populations [41]. In the elderly people studied, AD was more frequently observed in women than in men (although not statistically significant). This finding agrees with previous observations that AD is more common in females [1,7,15].

Characteristics of facilities and level of care of the nursing homes and the senior center of Durango are similar to those found in nursing homes and senior centers of other Mexican states. Results of this study may reflect, although to a limited extent, the frequencies of dementia and AD in elders of nursing homes and senior centers of Mexico; however, further studies should be conducted in order to determine the national magnitude of dementia as a public health problem in the elderly people of Mexico. The prevalence of dementia among the nursing home residents found in this study has implications for health care provision in nursing home residents, and resource implications for those responsible for publicly funded care. Similarly, the study identified factors to consider that may be useful when identifying subjects at risk for dementia.

Conclusions
We concluded that prevalences of dementia and AD in elderly people from Durango, Mexico are comparable to those reported in developed countries. AD was the most frequent cause of dementia followed by VaD. Dementia (pooled AD and VaD cases) correlated with white ethnicity, and a history of unemployment. Similarly, AD correlated with journeyman occupations.

Competing interests
None declared.

Authors’ contributions
CAE conceived and designed the study protocol, participated in the coordination and management of the study, and wrote the manuscript. ABHA applied the questionnaires, and performed the data analysis. ROTr performed the clinical evaluation of the elders. AGI performed the questionnaire, and performed the data analysis. SEM performed the statistical analysis of the data.

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