received 13 November 2021| accepted 4 January 2021 | published 1 June 2021

ORIGINAL ARTICLE

Doi: https://doi.org/10.31157/archneurosciencesmex.v26i2.230

# Factors associated with cognitive performance in residents of long-term care facilities in Northeast Mexico

## Factores asociados con el rendimiento cognitivo en residentes de centros de cuidados a largo plazo en el Noreste de México

Coindreau-Frías Fernando [a] | Fernández-Garza Luis E. [b] | Botello-González Loubette [c]
Rodríguez-Fuentes David E. [d] | Barrera-Barrera Silvia A. [e] | Barrera-Saldaña Hugo A [b]

a. Asilo Luis Elizondo. Guadalupe, Nuevo León, Mexico.

b. National Laboratory of Specialized Services of Research Development, and Innovation for Chemical and Biotechnological Drugs at Innbiogem. SC, Monterrey, Mexico.

c. University of Monterrey. San Pedro Garza García, Nuevo León, Mexico.

d. School of Medicine and Health Sciences. Tecnologico de Monterrey. Monterrey, Nuevo León, Mexico.

e. National Institute of Pediatrics. Mexico City, Mexico.

**Correspondence**

Hugo A. Barrera Saldaña, PhD. National Laboratory of Specialized Services of Research, Development, and Innovation for Chemical and Biotechnological Drugs at Innbiogem. SC Boulevard, Puerta del Sol #1005, Colinas de San Jerónimo, C.P. 64630 Monterrey, Nuevo León, México.

habarrera@gmail.com

## Abstract

Objective: To investigate factors associated with cognitive impairment (CI) in institutionalized Mexican older adults.

Material and methods: Cross-sectional study of residents of three long-term care facilities in the metropolitan area of Monterrey, Mexico. A medical history, Mini-Mental State Examination (MMSE), Barthel index, geriatric depression scale, and a nutritional screening were performed. CI was defined as MMSE ≤24.

Results: Of 280 octogenarian residents (72.1% females) 61.1% had a MMSE ≤24. Older age (OR=1,047), functional dependence (OR=10,309), malnutrition (OR=2,202), urinary incontinence (OR=2,588), and history of fracture (OR=1.764) were directly associated to CI. While higher education level (OR=0.583) and the use of antihypertensives (OR=0.521), antihistamines (OR=0.322), antiprostatic hypertrophy (OR=0.219), and lipid-lowering drugs (OR=0.575) were inversely associated.

Conclusions: The high prevalence of CI and its association with other chronic conditions and medications that we find in the population of mexican institutionalized older adults demands the implementation of measures that help in the early identification of all these conditions.

**Keywords:** *mexican older adults, cognitive impairment, long-term care facilities.*

## Resumen

Objetivo: Investigar factores asociados con deterioro cognitivo (DC) en adultos mayores mexicanos institucionalizados.

Material y métodos: Estudio transversal de residentes de tres instituciones de cuidados a largo plazo en Monterrey, México. Se realizó historia clínica, Mini-Examen del Estado Mental (MMSE), índice de Barthel, escala de depresión geriátrica y tamizaje nutricional. El DC se definió como MMSE ≤24.

Resultados: De 280 residentes octogenarios (72.1% mujeres) 61.1% tenían MMSE ≤24. Edad mayor (OR = 1,047), dependencia funcional (OR = 10,309), desnutrición (OR = 2,202), incontinencia urinaria (OR = 2,588) y antecedente de fractura (OR = 1,764) se asociaron directamente con el DC. Mayor nivel educativo (OR = 0.583) y uso de fármacos antihipertensivos (OR = 0.521), antihistamínicos (OR = 0.322), antihipertrofia de próstata (OR = 0.219) e hipolipemiantes (OR = 0.575) se asociaron inversamente.

Conclusiones: La alta prevalencia de DC y su asociación con otras enfermedades crónicas y uso de medicamentos que encontramos en la población de adultos mayores mexicanos institucionalizados, demanda la implementación de medidas que ayuden en la identificación oportuna de todas estas condiciones.

**Palabras clave**: adultos mayores mexicanos, deterioro cognitivo, instituciones de cuidados a largo plazo.

## Introduction

The population of individuals over 65 years of age is continuously growing in Mexico. In 2015 there were 8.2 million, and the number is expected to grow to 24.6 million by the year 2050.[1] In Mexico, the majority of this population lives with their nuclear families (49.7%) or in extended families (38.1%), around 12% lives alone, and only a minimal proportion lives in Long-Term Care Facilities (LTCFs).[2] In Northeastern Mexico, in the state of Nuevo León in 2015, this population was 332,252 (6.4%) and expected to grow to 1.2 million (16.5%) by the year 2050.[3] Greater longevity of this segment of the population also implies that there will be a more significant disability caused by a higher rate of chronic diseases that require professional attention leading the families to institutionalize their older relatives in LTCFs.[4] There are no current official statistics regarding the population of older adults that are institutionalized in LTCFs. Nevertheless, this situation implies a higher demand for socio-economical and medical services to provide a better quality of life to this growing population.[5]

Cognitive impairment (CI) is a prevalent public health problem in older adults living in LTCFs[6] and the prevalence of this condition will increase in the coming years due to the rapid increase in life expectancy worldwide.[7] CI is defined as the decline of cognitive functions such as orientation, memory, language, abstract thinking, calculation, judgment and reasoning capacities, and learning and visuospatial abilities. It is classified according to its severity: mild, moderate, and severe.[8,9] In Mexico, about 3-29% of the adults aged over 60 years of age are estimated to have mild CI, compared with the worldwide prevalence of around 10-20%.[10] However, the prevalence of CI increases to 66% in LTCFs [11]. Each year, 10-15% of the patients with mild CI develop Alzheimer's disease, a frequency ten times higher than the average population.[12] Therefore, mild CI is a relevant risk factor for dementia.

Further risk factors for CI increase with age and include depression, polypharmacy, and malnutrition[13,14,15]. Also, males seem to be at a higher risk than females[16]. Other risk factors such as diabetes mellitus and hypertension are also associated with the progression from mild CI to Alzheimer's disease [17]. Several chronic diseases such as angina pectoris, lung disease, stroke, and hearing problems have also been associated with CI, but the exact mechanism of this relationship is unknown [18]. Also, there are reports that chronic kidney disease is a potential cause of CI [19]. CI is related to a substantial decline in elders' quality of life and causes an increase in the risk of disability and dependence. It is essential to say that given the increase of disability and dependence of older adults as cognitive levels decrease, the patient's ability to self-report pain and discomfort decreases significantly, which leads to a notable reduction in the diagnosis of other relevant conditions.[20] The expected increase in the prevalence of CI demands preventive and early geriatric evaluation strategies of cognitive functions in older adults in LTCFs. The difficulties resulting from CI such as dependence, lack of communication skills, and the impossibility of performing daily life activities such as taking medications, require special care and, if not received, treatment and evolution of other relevant health conditions may be compromised. The aim of this study is to investigate sociodemographic factors, comorbidities, and medication associated with CI in institutionalized Mexican older adults.

## Material and methods

A cross-sectional descriptive study was carried out in three non-profit geriatric residences in the metropolitan area of Monterrey, Nuevo Leon, Mexico, with similar characteristics in architectural dimensions, staff, and daily assistance of a geriatrician. The patients enrolled in the study were residents of the three LTCFs between April and June 2016.

A clinical record of all residents is maintained from the time of admission and throughout their stay. This clinical record includes an initial medical history that covers all socio-demographic information, hereditary-family history, pathological and non-pathological personal history, and the evolution of diagnosed diseases and their prescribed medications.

Cognitive status was assessed with the Folstein Mini-Mental State Examination (MMSE).[21] Functional independence was obtained with the Barthel Index (BI) for Activities of Daily Living (ADL).[22] Depression was measured by the Geriatric Depression Scale (GDS).[23] Finally, nutritional status was evaluated by the Mini Nutritional Assessment (MNA), including measuring weight and height and calculating body mass index (BMI).[24]

Statistical analyses were performed using *IBM SPSS* software (*version 22; SPSS Inc, Chicago, IL*). Continuous variables were summarized as the median and interquartile range (IQR) or the mean ± standard deviation (SD), while the categorical variables as percentages. Distribution normality was analyzed with the Kolmogorov-Smirnov test. The differences between the groups were tested using the independent Student t-test

for normally distributed variables and the Mann-Whitney U test for the comparison of non parametrically distributed variables. The difference between categorical variables was determined using the Chi-square test. Pearson's or Spearman's correlation analysis was adopted to assess the relationship between MMSE and other variables. Cognitive impairment was defined as MMSE ≤24.[25] Binary logistic regression was performed to determine predictors of cognitive impairment. A p-value <0.05 was considered statistically significant.

All residents and relatives were informed of the intention of this study and signed an informed consent which was required to participate in the study. The study complied with the national law of personal data protection and was approved by the Ethics Committee of the institution legally responsible for the participating LTCFs (Fomento Moral y Educativo, A.C.).

## Results

A total of 280 residents (LTCF1=99, LTCF2=93, and LTCF3=88) were included in the study period. The median age was 85 years (IQR 80-90), 202 (72.1%) were females, and widowed was the most prevalent (52.1%) civil status. Regarding the education level, 122 (43.5%) declared elementary school or less while 124 (44.4%) mentioned high school or higher. The time living in the residence was >36 months for 164 (58.6%), 12 to 36 months for 67 (23.9%), and <12 months for 49 (17.5%) residents. With respect to monthly income, 92 (32.9%) had no income, 24 (8.6%) less than $100 USD, 119 (42.4%) between $110 and 220 USD, and 45 (16.1%) with more than $220 USD. Most of the residents (84.2%) had public health insurance.

Concerning geriatric syndromes, 80 was the median BI (IQR 20-95), 74 (26.4%) had a total dependency, and 88 (31.4%) had total independence. The median MMSE was 22 (IQR 14-27) and 109 (38.9%) had a normal cognitive function. The median GDS was 3 (IQR 1-6) and 88 (31.4%) had a score of depression. The median MNA was 22.5 (IQR 19-25), 116 (41.4%) were at risk of malnutrition, and 35 (12.5%) were malnourished. Regarding BMI, 18 (7.1%) were underweight and 118 (42.1%) were overweight or obese. Polypharmacy was confirmed in 183 (65.4%) of the residents, urinary incontinence in 117 (41.8%), constipation in 113 (40.4%), 84 (30%) have had a fracture during their life, 42 (15%) had suffered at least one fall in the last year, and 11 (3.9%) had pressure ulcers.

The most frequent comorbidities were arterial hypertension in 164 (58.6%), hypercholesterolemia in 99 (35.4%), diabetes mellitus in 75 (26.8%), kidney disease in 52 (18.6%), and chronic venous insufficiency (CVI) in 51 (18.2%). The most frequently consumed prescription drugs were antihypertensives in 149 (53.2%), antidepressants in 132 (41.7%), proton-pump inhibitors (PPI) in 128 (45.7%), antiplatelet agents in 120 (42.9%), and benzodiazepines in 95 (33.9%), Table 1.

Table 1. Baseline characteristics of residents in the LTCFs

| Sociodemographic features | N=280 |
|---|---|
| Age | 85 (80-90) |
| Sex, female | 202 (72.1) |
| Civil status | |
| Single | 82 (29.3) |
| Married | 33 (11.8) |
| Widow or widower | 146 (52.1) |
| Education level | |
| No formal education | 6 (2.1) |
| Elementary school | 116 (41.4) |
| Junior high school | 34 (12.1) |
| High school | 67 (23.9) |
| University | 52 (18.6) |
| Post-graduate | 5 (1.8) |
| Length of stay | |
| <12 months | 49 (17.5) |
| 12 – 36 months | 67 (23.9) |
| >36 months | 164 (58.6) |
| Income (USD($)/month) | |
| Without income | 92 (32.9) |
| <$100 | 24 (8.6) |
| $100-220 | 119 (42.4) |
| >$220 | 45 (16.1) |
| Health insurance | |
| Public | 236 (84.2) |
| Private | 28 (10) |
| Other | 16 (5.7) |
| Geriatric syndromes | |
| BI | 80 (20-95) |
| BI >90 | 88 (31.4) |
| BI 61-90 | 69 (24.6) |
| BI 21-60 | 49 (17.5) |
| BI <21 | 74 (26.4) |
| MMSE | 22 (14-27) |
| MMSE >24 | 109 (38.9) |
| MMSE 17-24 | 86 (30.7) |
| MMSE 10-16 | 24 (9.6) |
| MMSE <10 | 58 (20.7) |
| GDS Yesavage | 3 (1-6) |
| GDS Yesavage >5 | 88 (31.4) |
| MNA | 22.5 (19-25) |
| MNA 24-30 | 121 (43.2) |
| MNA 17-23.5 | 116 (41.4) |
| MNA <17 | 35 (12.5) |
| Weight | 58.67 ± 12.77 |
| BMI | 24.43 ± 4.22 |
| BMI <18.5 | 18 (7.1) |
| BMI >24.9 | 118 (42.1) |
| Falls in the last year | 42 (15) |
| Urinary incontinence | 117 (41.8) |

| | |
|---|---|
| Constipation | 113 (40.4) |
| Pressure ulcers | 11 (3.9) |
| Polypharmacy | 183 (65.4) |
| Comorbidities | |
| Arterial hypertension | 164 (58.6) |
| Diabetes mellitus | 75 (26.8) |
| Hypercholesterolemia | 99 (35.4) |
| Hypertriglyceridemia | 25 (8.9) |
| Hypothyroidism | 42 (15) |
| Ischemic heart disease | 34 (12.1) |
| Heart failure | 14 (5) |
| Stroke | 33 (11.8) |
| COPD | 22 (7.9) |
| Kidney disease (Cr >1.2) | 52 (18.6) |
| CVI | 51 (18.2) |
| Fractures | 84 (30) |
| Hip fracture | 36 (12.9) |
| Other fracture | 61 (21.8) |
| Cancer | 28 (10) |
| BPH | 35 (48.) |
| Parkinson's disease | 16 (5.7) |
| Medications | |
| Antihypertensive | 149 (53.2) |
| Beta-blockers | 52 (18.5) |
| ACE inhibitors | 47 (16.7) |
| ARBs | 68 (24.2) |
| CCB | 38 (13.5) |
| Alpha-2 blockers | 2 (0.7) |
| Antiplatelet agents | 120 (42.9) |
| Diuretics | 60 (21.4) |
| Benzodiazepines | 95 (33.9) |
| Antipsychotics | 58 (20.7) |
| Antidepressants | 132 (47.1) |
| Lipid-lowering agents | 77 (27.5) |
| Antidiarrheal | 2 (0.7) |
| Anti-dementia | 38 (13.6) |
| PPI | 128 (45.7) |
| Antihistamines | 21 (7.5) |
| Analgesics | 63 (22.5) |
| Vitamins | 89 (31.8) |
| Anticonvulsants | 23 (8.3) |
| Oral antidiabetics | 37 (13.2) |
| Insulin | 30 (10.7) |
| Antiarrhythmic | 17 (6.1) |
| Antiprostatic hypertrophy agents | 21 (26.9) |
| Calcium fixatives | 43 (15.4) |
| Vitamin D | 32 (11.4) |
| Calcium | 17 (6.1) |
| Antiparkinson | 22 (7.9) |

*Other variables investigated but lacking associations were: Atrial fibrillation, Diverticulitis, Deep vein thrombosis, Peripheral artery disease, Prosthetic use, Glaucoma, and use of Bronchodilators, Laxatives, Prokinetics, Nitrates, Antispasmodics, and Antineuritics.
BI: Barthel Index; MMSE: Mini-Mental State Examination; GDS: Geriatric Depression Scale; MNA: Mini Nutritional Assessment; BMI: Body Mass Index; COPD: Chronic Obstructive Pulmonary Disease; Cr: Creatinine; CVI: Chronic venous insufficiency; BPH: Benign prostatic hyperplasia; ACE: Angiotensin-converting enzyme; ARBs: Angiotensin II receptor blockers; CCB: Calcium channel blockers; PPI Proton-pump inhibitors.

When comparing normal cognitive function with CI, the CI group was associated with older age, elementary school education or no education, lower BI, lower MNA, lower weight and BMI, presence of urinary incontinence, history of pressure ulcers and fractures, and the use of antipsychotics, antidepressants, anti-dementia, and antiparkinsonians medications. High school education or advanced education, high score of GDS, the presence of hypercholesterolemia, and the use of antihypertensives (beta-blockers, angiotensin II receptor blockers [ARBs], and calcium channel blockers [CCB]), antihistamines, anti-prostatic hypertrophy agents, and cholesterol medication were associated with the group of normal cognitive function, Table 2.

Table 2. Comparison of characteristics of residents between MMSE >24 and MMSE ≤24.

| Characteristic | MMSE >24 (N=109) | MMSE ≤24 (N=171) | p-Value |
|---|---|---|---|
| Age | 83 (78-89) | 86 (81-91) | 0.003* |
| Sex, female | 80 (73.4) | 122 (71.3) | 0.709 |
| Civil status | | | |
| Single | 30 (27.5) | 52 (30.4) | 0.604 |
| Married | 10 (9.2) | 23 (13.5) | 0.279 |
| Widow or widower | 60 (55) | 86 (50.3) | 0.437 |
| Education level | | | |
| Elementary school or less | 38 (34.9) | 84 (49.1) | 0.018* |
| High school or more | 59 (54.2) | 65 (38) | 0.008* |
| Length of stay | | | |
| <12 months | 24 (22) | 25 (14.6) | 0.112 |
| 12-36 months | 27 (24.8) | 40 (23.4) | 0.792 |
| >36 months | 58 (53.2) | 106 (62) | 0.146 |
| Income (USD($)/month) | | | |
| Without income | 34 (31.2) | 58 (33.9) | 0.635 |
| <$100 | 9 (8.3) | 15 (8.8) | 0.880 |
| $100-220 | 46 (42.2) | 73 (42.7) | 0.935 |
| >$220 | 20 (18.3) | 25 (14.6) | 0.407 |
| Geriatric syndromes | | | |
| BI | 95 (80-100) | 40 (10-90) | <0.001* |
| BI >90 | 57 (52.3) | 31 (18.1) | <0.001* |
| BI <21 | 6 (5.5) | 68 (39.8) | <0.001* |
| GDS Yesavage | 4 (2-7) | 3 (0-6) | 0.010* |
| GDS Yesavage >5 | 38 (34.9) | 50 (29.2) | 0.323 |
| MNA | 24 (21.5-25.75) | 22 (18-24.5) | <0.001* |
| MNA 24-30 | 56 (51.4) | 65 (38) | 0.027* |
| MNA <17 | 10 (9.2) | 33 (19.3) | 0.022* |
| Weight | 62.75 ± 12.12 | 56.07 ± 12.52 | <0.001* |
| BMI | 25.61 ± 3.91 | 23.68 ± 4.25 | <0.001* |
| BMI <18.5 | 3 (2.8) | 17 (9.9) | 0.022* |
| BMI >24.9 | 55 (50.5) | 63 (36.8) | 0.024* |
| Falls in the last year | 15 (13.8) | 27 (15.8) | 0.643 |
| Urinary incontinence | 29 (26.6) | 88 (51.5) | <0.001* |
| Constipation | 50 (45.9) | 63 (36.8) | 0.133 |
| Pressure ulcers | 1 (0.9) | 10 (5.8) | 0.038* |
| Polypharmacy | 76 (69.7) | 107 (62.6) | 0.220 |
| Comorbidities | | | |
| Arterial hypertension | 65 (59.6) | 99 (57.9) | 0.773 |
| Diabetes mellitus | 32 (29.4) | 43 (25.1) | 0.438 |
| Hypercholesterolemia | 48 (44) | 51 (29.8) | 0.015* |

| Characteristic | MMSE >24 (N=109) | MMSE ≤24 (N=171) | p-Value |
|---|---|---|---|
| Hypertriglyceridemia | 10 (9.2) | 15 (8.8) | 0.908 |
| Hypothyroidism | 21 (19.2) | 21 (12.3) | 0.110 |
| Ischemic heart disease | 16 (14.7) | 18 (10.5) | 0.300 |
| Heart failure | 6 (5.5) | 8 (4.7) | 0.757 |
| Stroke | 12 (11) | 21 (12.3) | 0.748 |
| COPD | 11 (10.1) | 11 (6.4) | 0.267 |
| Kidney disease (Cr >1.2) | 19 (17.4) | 33 (19.3) | 0.695 |
| CVI | 26 (23.9) | 25 (14.6) | 0.051 |
| Fractures | 25 (22.9) | 59 (34.5) | 0.039* |
| Hip fracture | 12 (11) | 24 (14) | 0.460 |
| Other fracture | 17 (15.6) | 44 (25.7) | 0.045* |
| Cancer | 14 (12.8) | 14 (8.2) | 0.205 |
| BPH | 15 (51.7) | 20 (40.8) | 0.349 |
| Parkinson's disease | 4 (3.7) | 12 (7) | 0.239 |
| Medications | | | |
| Antihypertensive | 69 (63.3) | 80 (46.8) | 0.007* |
| Beta-blockers | 27 (24.7) | 25 (14.6) | 0.033* |
| ACE inhibitors | 15 (13.7) | 32 (18.7) | 0.279 |
| ARBs | 34 (31.1) | 34 (19.8) | 0.031* |
| CCB | 21 (19.2) | 17 (9.9) | 0.026* |
| Alpha-2 blockers | 2 (1.8) | 0 | 0.075 |
| Antiplatelet agents | 49 (45) | 71 (41.5) | 0.571 |
| Diuretics | 27 (24.8) | 33 (19.3) | 0.277 |
| Benzodiazepines | 44 (40.4) | 51 (29.8) | 0.069 |
| Antipsychotics | 16 (14.7) | 42 (24.6) | 0.047* |
| Antidepressants | 42 (38.5) | 90 (52.6) | 0.021* |
| Lipid-lowering agents | 39 (35.8) | 38 (22.2) | 0.013* |
| Antidiarrheal | 2 (1.8) | 0 | 0.075 |
| Anti-dementia | 5 (4.6) | 33 (19.3) | <0.001* |
| PPI | 49 (45) | 79 (46.2) | 0.838 |
| Antihistamines | 14 (12.8) | 7 (4.1) | 0.007* |
| Analgesics | 27 (24.8) | 36 (21.1) | 0.468 |
| Vitamins | 36 (33) | 53 (31) | 0.722 |
| Anticonvulsants | 9 (8.3) | 13 (7.6) | 0.842 |
| Oral antidiabetics | 18 (16.5) | 19 (11.1) | 0.193 |
| Insulin | 9 (8.3) | 21 (12.3) | 0.288 |
| Antiarrhythmic | 10 (9.2) | 7 (4.1) | 0.083 |
| Antiprostatic hypertrophy agents | 12 (41.3) | 9 (18.3) | 0.026* |
| Calcium fixatives | 21 (19.3) | 22 (12.9) | 0.147 |
| Vitamin D | 16 (14.7) | 16 (9.4) | 0.172 |
| Calcium | 9 (8.3) | 8 (4.7) | 0.221 |
| Antiparkinson | 4 (3.7) | 18 (10.5) | 0.038* |

BI: Barthel Index; MMSE: Mini-Mental State Examination; GDS: Geriatric Depression Scale; MNA: Mini Nutritional Assessment; BMI: Body Mass Index; COPD: Chronic Obstructive Pulmonary Disease; Cr: Creatinine; CVI: Chronic venous insufficiency; BPH: Benign prostatic hyperplasia; ACE: Angiotensin-converting enzyme; ARBs: Angiotensin II receptor blockers; CCB: Calcium channel blockers; PPI Proton-pump inhibitors.

Univariate analysis revealed the following significant correlations: MMSE and age (rho=0.241, p<0.001), MMSE and weight (rho=0.359, p<0.001), MMSE and BMI (rho=0.318, p<0.001), MMSE and BI (rho=0.579, p<0.001), MMSE and GDS (rho=0.312, p<0.001), and MMSE and MNA (rho=0.368, p<0.001), Table 3. In the multiple logistic regression analyses after adjustments for age and sex, low education level, low BI score, low MNA score, low weight, and low BMI, urinary incontinence, fractures, use of antipsychotics, antidepressants, anti-dementia, and antiparkinsonians were associated with CI. On the other hand, the use of antihistamines, antiprostatic hypertrophy agents, lipid-lowering agents, and antihypertensive drugs, specifically CCB were associated with normal cognitive function , Table 4.

Table 3. Correlation between MMSE and age, anthropometric characteristics, and clinical scales

| Comparison | The correlation coefficient (r or rho) | p-Value |
|---|---|---|
| MMSE and Age | 0.241 | <0.001* |
| MMSE and Weight | 0.359 | <0.001* |
| MMSE and BMI | 0.318 | <0.001* |
| MMSE and BI | 0.579 | <0.001* |
| MMSE and MNA | 0.368 | <0.001* |
| MMSE and GDS Yesavage | 0.312 | <0.001* |

MMSE: Mini-Mental State Examination; BMI: Body Mass Index; BI: Barthel Index; MNA: Mini Nutritional Assessment; GDS: Geriatric Depression Scale.

Table 4. Regression analyses of the relationship between cognitive impairment and demographic and clinical variables.

| Feature against Cognition impairment | OR (95% CI) | p-Value |
|---|---|---|
| Age | 1.047 (1.011-1.083) | 0.010* |
| Education level | 0.583 (0.352-0.964) | 0.035* |
| BI | 0.971 (0.963-0.980) | <0.001* |
| BI >90 | 0.223 (0.128-0.392) | <0.001* |
| BI <20 | 10.309 (4.255-25.000) | <0.001* |
| GDS | 0.935 (0.871-1.004) | 0.065 |
| MNA | 0.913 (0.859-0.970) | 0.004* |
| MNA <24 | 1.689 (1.020-2.796) | 0.042* |
| MNA <17 | 2.202 (1.021-4.745) | 0.044* |
| Weight | 0.951 (0.929-0.974) | <0.001* |
| BMI | 0.903 (0.848-0.961) | 0.002* |
| Urinary incontinence | 2.588 (1.503-4.457) | 0.001* |
| Pressure ulcers | 6.834 (0.855-54.612) | 0.070 |
| Hypercholesterolemia | 0.618 (0.368-1.035) | 0.067 |
| Fractures | 1.764 (1.010-3.081) | 0.046* |
| Other fractures | 2.118 (1.116-4.017) | 0.022* |
| Antihypertensives | 0.521 (0.315-0.859) | 0.011* |
| Beta blockers | 1.765 (0.951-3.276) | 0.072 |
| ARBs | 0.580 (0.330-1.018) | 0.058 |
| CCB | 0.448 (0.222-0.904) | 0.025* |
| Antipsychotics | 1.862 (0.977-3.551) | 0.059 |
| Antidepressants | 1.771 (1.075-2.917) | 0.025* |
| Lipid-lowering agents | 0.575 (0.333-0.994) | 0.048* |
| Anti-dementia | 5.207 (1.939-13.988) | 0.001* |
| Antihistamines | 0.332 (0.128-0.865) | 0.024* |
| Antiprostatic hypertrophy agents | 0.219 (0.069-0.692) | 0.010* |
| Antiparkinson | 3.830 (1.240-11.826) | 0.020* |

BI: Barthel Index; GDS: Geriatric Depression Scale; MNA: Mini Nutritional Assessment; BMI: Body Mass Index; ARBs: Angiotensin II receptor blockers; CCB: Calcium channel blockers.

## Discussion

In Mexico, the population pyramid is currently in the process of inversion compared to the last century.[26] The aging population and increased life expectancy have made CI a key public health matter. Understanding the risk and beneficial factors for the development of CI can lead to targeted interventions and more effective use of limited health resources which is even more critical in developing countries.[27] Miu et al., described factors associated with CI in Mexican older adults in the community. However, to our knowledge, the factors that influence CI in older adults living in LTCFs have not been studied in Mexico, where the prevalence of CI is even higher .[28]

In the present study older age is associated with cognitive decline which can be related to the normal aging process that leads to important decreases in neurological activity and a decline in cognitive functions such as memory, spatial learning, and attention.[29] The aging process can increase collagen deposits in the perivascular space and stimulate structural changes and thickening of the basement membrane; moreover, the aging process can also affect the blood vessels which can lead to cerebral circulation problems that can contribute to CI or dementia.[30]

Higher education level in older adults can be associated with a greater synaptic density considering that the skills and abilities in the education environment such as mathematics, reading, writing, decision making, test-taking, and reasoning skills result in an early and elevated number of synapses that increase brain function.[31] In the current study, a higher level of education was associated with the group of normal cognitive function. It is important to note that older adults with higher education levels may have a greater cognitive reserve and synaptic density, the same cognitive damage in older adults with higher education will lead to lower levels of cognitive decline than in older adults with lower levels of education.[31,32]

Coinciding with previous studies, we found a positive moderate correlation between cognitive function and functional dependence, under the hypothesis that cognitive decline affects functional dependence in the elderly population.[33] Residents with CI were ten times more likely to present functional dependence, similar to other studies.[34-36] Even in a prospective study, cognitive function was found to be the strongest predictor for determining future functional status in older adults.[37]

Older adults with CI had a significantly higher frequency of being at risk of malnutrition or being malnourished than those with normal cognition, particularly among those who are institutionalized.[38-40] In our study, we found that residents of LTCFs with CI were two times more likely to suffer malnutrition. However, the interrelationships between CI and nutritional status are complex and reciprocal; mild CI precedes malnutrition or vice versa. On the one hand, nutritional risk influences risk factors or outcomes of mild CI. An altered nutritional status appears to predict the severity and progression of CI among the elderly.[41] At the same time, mild changes in the ability to perform daily living activities among mild CI patients increase nutritional risk.[42] It is of great importance to monitor early the nutritional status of patients with CI. Therefore, some evidence suggests that the use of oral nutritional supplementation in patients with Alzheimer's disease is effective on body weight, nutritional status, and body composition, cognition, eating behavior, and biochemical markers. Long-term effects of nutritional supplementation could delay institutionalization and decreased morbidity.[43]

Regarding urinary incontinence, we found that residents of LTCFs with CI were two times more likely to have CI. A possible reason for the close relationship of urinary incontinence and CI can be explained by neurological degeneration that can cause inhibition of the micturition reflex and in consequence involuntary detrusor contractions.[44] Considering that the action of the micturition reflex involves the cerebral cortex, pons, spinal cord, autonomic and somatic nervous systems and the sensory system of the lower urinary tract, degeneration of white matter and brain lobes due to CI can cause the inhibition of this reflex and results in urinary incontinence.[45] It is important to mention that urinary incontinence and lower urinary tract symptoms are often a predictor of cardiovascular diseases,[46] and cardiovascular disease are well-known risk factors for dementia due to vascular damage. Moreover, cardiovascular disease also intensifies cognitive problems.[47]

This study showed that residents with CI were almost two times more likely to have suffered a fracture, with fractures other than the hip being more prevalent. Low bone mineral density and osteoporosis[48] often result in fractures in older adults. Likewise, CI has been closely related to bone mineral density loss.[49] It is important to note that osteoporosis and CI in older adults have various equal risk factors such as hypoxemia and hormonal changes. Also, osteoporosis has been closely related to high rates of progression from mild CI to Alzheimer's disease,[50] given that Alzheimer's disease risk inflammatory factor marker interleukin-6 levels are elevated in bone mass loss.[51] The relationship of osteoporosis-related fractures with CI can be associated with hormonal changes, most importantly

to a deficiency of estrogen, which plays an important role in bone homeostasis by stimulating the activity of osteoblasts. Furthermore, estradiol has been shown to decrease neuronal apoptosis and increase synaptic plasticity; in addition, estrogen increases cerebral blood flow by elevating levels of high-density lipoprotein cholesterol. Estrogen replacement has shown to be a relevant cognitive improvement factor in menopausal women.[51]

Antihypertensive drugs have been found to provide a protective effect against cognitive decline, and prevention of dementia.[52] However, there have been discrepancies as to whether all classes of antihypertensive drugs help, or whether some, in particular, are the ones that cause benefit.[53] In our study, we found that there is just one class of antihypertensive drugs that showed association with cognitive decline, the CCB. Results similar to a systematic review described that CCB and ARBs could decrease the risk of not only vascular dementia but also Alzheimer's disease.[54] In the case of lipid-lowering agents, the relationship is controversial because statins have a role in mild and reversible CI, and also, offer protection against dementia. Further research is needed to understand the reason that lies behind this situation.[55] At the same time, there have been large phase III clinical trials that found no relationship between statin use and cognitive impairment.[56,57] Our findings support the association between the use of lipid-lowering agents and the group of older adults with normal cognitive function. In the case of antihistamines, studies found no relationship between newer-generation antihistamines and CI[58, 59]; although, there are positive reports with the use of first-generation antihistamines.[60, 61] Our multiple regression analysis showed a significant relationship between normal cognition and antihistamines in an elderly population that are under this treatment. The possible association with antiprostatic hypertrophy agents is also controversial. A study that compared a group of older men users of dutasteride with a control group found no relationship with cognitive performance.[62] On the other hand, tamsulosin was reported as a possible risk factor for dementia.[63] In our case, we found that older men treated with antiprostatic hypertrophy agents had four times less probability of presenting CI.

Depressive symptoms are common in individuals residing in LTCFs and are a major target of intervention.[64] There is no significant association between antidepressants and the risk of incidence of mild CI in elderly patients.[65] A meta-analysis that evaluated the use of antidepressants in cognition found that antidepressants have a modest positive effect in cognition in depressed individuals.[66] In this particular case, the antidepressant intake association with CI may be related to the pathophysiology of depression rather than a direct cause of CI. In the case of the relationship between CI and anti-dementia and antiparkinson medication, it is due to the reason itself for which these medications are used. It is known that patients with dementia have a lower score in their cognitive performance and about a quarter of patients with Parkinson's disease have CI.[67]

As far as we know, this is the first study in Mexico that defines the factors associated with CI in institutionalized older adults. Nevertheless, there are limitations to out study. The most important was that imaging, biochemical, and genetic studies were not performed on the participants to investigate further the causes of CI. Another important limitation is that the time each drug was taken was not collected, which would be a key factor in determining the association of these and CI. Despite these limitations, with our sample size, the inclusion of a large number of possible influencing factors, and the collection of data and realization of scales to measure geriatric syndromes by a specialist, is valid to make inferences concerning the institutionalized older adults in Northeastern Mexico.

The identification of individual factors associated with CI may provide opportunities for the implementation of prevention strategies in the noninstitutionalized and institutionalized elderly population. Our study showed that older age, functional dependence, malnutrition, urinary incontinence, fractures, and use of antidepressants are factors associated with CI in elderly institutionalized population. Higher education level, higher weight as well as BMI, and taking antihypertensives, antihistamines, antiprostatic hypertrophy agents, and lipid-lowering agents were factors associated with normal cognitive function in institutionalized older adults. Nevertheless, due to the type of study, it is impossible to establish a timeline in the relationships of these variables. Therefore, further studies are needed.

## References

1. CONAPO. Población a Inicio de año. Proyecciones de la Población de México y de las Entidades Federativas, 2016-2050. 2018.https://datos.gob.mx/busca/dataset/proyecciones-de-la-poblacion-de-mexico-y-de-las-entidades-federativas-2016-2050.
2. INMUJERES. Situación de las personas adultas mayores en México. 2015. http://cedoc.inmujeres.gob.mx/documentos_download/101243_1.pdf.

3. CONAPO. Proyecciones de la población de México y de las entidades federativas, 2016-2050: Nuevo León. 2019. https://www.gob.mx/cms/uploads/attachment/file/487384/19_NLE.pdf.
4. Coindreau-Frias F, Ramos-Bacco M, et al. Características del adulto mayor institucionalizado en el área metropolitana de Monterrey. Salud Pública de México 2018; 60:738.
5. Montes de Oca V, Hebrero M. Family dynamics, aging, and functional impairment in Mexico. Rev Kairos 2008; 11(1):143–66.
6. Giri M, Chen T, Yu W, Lü Y. Prevalence and correlates of cognitive impairment and depression among elderly people in the world's fastest growing city, Chongqing, People's Republic of China. Clin Interven Aging 2016; 11:1091–98. doi: 10.2147/CIA.S113668. eCollection 2016
7. Ren L, Zheng Y, Wu L, Gu Y, He Y, Jiang B, et al. Investigation of the prevalence of Cognitive Impairment and its risk factors within the elderly population in Shanghai, China. Sci Rep 2018; 8(1):3575. doi: 10.1038/s41598-018-21983-w
8. Borrás Blasco C, Viña Ribes J. Neurofisiología y envejecimiento. Concepto y bases fisiopatológicas del deterioro cognitivo. Rev Esp Geriatr Gerontol 2016; 51:3-6. DOI:10.1016/S0211-139X(16)30136-6
9. Jakavonyté-Akstinienė A, Dikčius V, Macijauskienė J. Prognosis of treatment outcomes by cognitive and physical scales. Open Med 2018;13:74–82. doi: 10.1515/med-2018-0011
10. Langa KM, Levine DA. The Diagnosis and Management of Mild Cognitive Impairment. JAMA 2014; 312(23):2551. doi: 10.1001/jama.2014.13806
11. Pérez-Hernández MG, Velasco-Rodríguez R, Maturano-Melgoza JA, Hilerio-López AG, García-Hernández ML, García-Jiménez MA. Cognitive impairment and risk of falling in institutionalized older adults in the state of Colima, Mexico. Rev Enferm Inst Mex Seguro Soc 2018; 26(3):171–178.
12. Li J, Wang YJ, Zhang M, Xu ZQ, Gao CY, Fang CQ, et al. Vascular risk factors promote conversion from mild cognitive impairment to Alzheimer disease. Neurol 2011; 76(17):1485-91. doi: 10.1212/WNL.0b013e318217e7a4
13. Byers AL, Yaffe K. Depression and risk of developing dementia. Nat Rev Neurol 2011;7(6):323-331. doi: 10.1038/nrneurol.2011.60
14. Vetrano DL, Villani ER, Grande G, et al. Association of Polypharmacy With 1-Year Trajectories of Cognitive and Physical Function in Nursing Home Residents: Results From a Multicenter European Study. J Ame Med Direct Assoc. 2018;19(8):710-713. DOI: 10.1016/j.jamda.2018.04.008
15. Sgrò G, Caruso C, Ceravolo F, Curinga G, Renda GF, Rispoli V, et al. Relationship between cognitive impairment and nutritional assessment on functional status in Calabrian long-term-care. Clin Intervent Aging 2014;105. DOI: 10.2147/CIA.S54611
16. Deckers K, Nooyens A, van Boxtel M, Verhey F, Verschuren M, Köhler S. Gender and Educational Differences in the Association between Lifestyle and Cognitive Decline over 10 Years: The Doetinchem Cohort Study. JAD 2019;70(s1):31-41. DOI: 10.3233/JAD-180492
17. Viswanathan A, Rocca WA, Tzourio C. Vascular risk factors and dementia: How to move forward?. Neurol. 2009; 72(4):368-374. DOI: 10.1212/01.wnl.0000341271.90478.8e
18. Koyanagi A, Lara E, Stubbs B, Carvalho AF, Oh H, Stickley A, et al. Chronic Physical Conditions, Multimorbidity, and Mild Cognitive Impairment in Low- and Middle-Income Countries. J Am Geriatr Soc 2018; 66(4):721-727. doi: 10.1111/jgs.15288
19. Shen Z, Ruan Q, Yu Z, Sun Z. Chronic kidney disease-related physical frailty and cognitive impairment: a systematic review. Geriatr Gerontol Int 2017; 17(4):529-544. DOI: 10.1111/ggi.12758
20. Dubé CE, Mack DS, Hunnicutt JN, Lapane KL. Cognitive Impairment and Pain Among Nursing Home Residents With Cancer. J Pain Symptom Management 2018;55(6):1509–1518. DOI: 10.1016/j.jpainsymman.2018.02.012
21. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State" A practical state method for grading the cognitive state of patients for the clinician. J Psychiat Res 1975;12:189–198. DOI: 10.1016/0022-3956(75)90026-6
22. Sainsbury A, Gudrun S, Bansal A, Young JB. Reliability of the Barthel Index when used with older people. Age and Ageing 2005;34:228–232. DOI: 10.1093/ageing/afi063
23. Wancata J, Alexandrowicz R, Marquart B, Weiss M, Friedrich F. The criterion validity of the Geriatric Depression Scale: a systematic review. Acta Psychiatr Scand. 2006; 114(6):398-410. DOI: 10.1111/j.1600-0447.2006.00888.x
24. Guigoz Y, Lauque S, Vellas BJ. Identifying the elderly at risk for malnutrition. Clin Geriat Med 2002; 18(4):737-757. DOI: 10.1016/s0749-0690(02)00059-9
25. Jakavonytè-Akstinienè A, Dikčius V, Macijauskienè J. Prognosis of treatment outcomes by cognitive and physical scales. Open Med 2018;74–82. DOI: 10.1515/med-2018-0011
26. Gallardo-Prieto L, Nellen-Hummel H, Hamui-Sutton A, et al. Valoración perioperatoria en el anciano. Cir Ciruj. 2005; 73:59–68.
27. Prince M, Albanese E, Guerchet M, Prina M. World Alzheimer Report 2014. Dementia and Risk Reduction 2014;1–99. https://www.alzint.org/u/WorldAlzheimerReport2014.pdf
28. Miu J, Negin J, Salinas-Rodriguez A, Manrique-Espinoza B, Sosa-Ortiz AL, Cumming R, et al. Factors associated with cognitive function in older adults in Mexico Factors associated with cognitive function in older adults in Mexico. Global Health Action 2016;9:1–6. doi: 10.3402/gha.v9.30747
29. Gard T, Hölzel BK, Lazar SW. The potential effects of meditation on age-related cognitive decline: a systematic review. Ann NY Acad Sci 2014;1307(1):89-103. DOI: 10.1111/nyas.12348
30. Fulop GA, Tarantini S, Yabluchanskiy A, et al. Role of age-related alterations of the cerebral venous circulation in the pathogenesis of vascular cognitive impairment. Am J Physiol Heart Circulat Physiol 2019; 316(5):H1124-H1140. https://doi.org/10.1152/ajpheart.00776.2018

31. Alley D, Suthers K, Crimmins E. Education and Cognitive Decline in Older Americans. Res Aging 2007; 29(1):73-94. DOI: 10.1177/0164027506294245

32. Stern Y. Cognitive reserve in ageing and Alzheimer's disease. Lancet Neurol. 2012; 11(11):1006-1012. DOI: 10.1016/S1474-4422(12)70191-6

33. Black SA, Rush RD. Cognitive and Functional Decline in Adults Aged 75 and Older. Journal of the American Geriatrics Society 2002; 50(12):1978–1986. DOI: 10.1046/j.1532-5415.2002.50609.x

34. Samus QM, Mayer L, Onyike CU, Brandt J, Baker A, Mcnabney M, et al. Correlates of Functional Dependence Among Recently Admitted Assisted Living Residents With and Without Dementia. J Ame Med Dir Assoc 2020;10(5):323–329. doi: 10.1016/j.jamda.2009.01.004

35. Agüero-Torres H, Fratiglioni L, Guo Z, Viitanen M, Von Strauss E, Winblad B. Dementia Is the Major Cause of Functional Dependence in the Elderly: 3-Year Follow-up Data From a Population-Based Study. Am J Pub Health 1998; 88(10):1452–1456. DOI: 10.2105/ajph.88.10.1452

36. Millán-Calenti JC, Tubío J, Pita-Fernández S, Rochette S, Lorenzo T, Maseda A. Cognitive impairment as predictor of functional dependence in an elderly sample. Archiv Gerontol Geriatr 2012; 54(1):197-201. DOI: 10.1016/j.archger.2011.02.010

37. Ishizaki T, Yoshida H, Suzuki T, Watanabe S, Niino N, Ihara K, et al. Effects of cognitive function on functional decline among community-dwelling non-disabled older Japanese. Archiv Gerontol Geriatr 2006; 42(1):47–58. DOI: 10.1016/j.archger.2005.06.001

38. Zekry D, Herrmann FR, Grandjean R, Meynet M, Michel J, Gold G, et al. Demented versus non-demented very old inpatients: the same comorbidities but poorer functional and nutritional status. Age and Ageing 2008; 37(1):83-89. DOI: 10.1093/ageing/afm132

39. Guigoz Y, Lauque S, Vellas BJ. Identifying the elderly at risk for malnutrition. Clinics in Geriatric Medicine 2002;18(4):737-757. DOI: 10.1016/s0749-0690(02)00059-9

40. Orsitto G, Fulvio F, Tria D, Turi V, Venezia A, Manca C. Nutritional status in hospitalized elderly patients with mild cognitive impairment. Clinical Nutrition 2006; 28(1):100–2. DOI: 10.1016/j.clnu.2008.12.001

41. Perneczky R, Pohl C, Sorg C, Hartmann J, Tosic N, Grimmer T, et al. Impairment of activities of daily living requiring memory or complex reasoning as part of the MCI syndrome. Int J Geriat Psychiatry 2006; 21(2):158-162. DOI: 10.1002/gps.1444

42. Shawky Khater M, Fawzy Abouelezz N. Nutritional status in older adults with mild cognitive impairment living in elderly homes in Cairo, Egypt. J Nutr Health Aging 2011;15(2):104–8. DOI: 10.1007/s12603-011-0021-9

43. Donini LM, De Felice MR, Cannella C. Nutritional status determinants and cognition in the elderly. Arch Gerontol Geriatr. 2007;44(S1);143–153. DOI: 10.1016/j.archger.2007.01.022

44. de Groat WC, Griffiths D, Yoshimura N. Neural control of the lower urinary tract. Compr Physiol 2015; 5(1):327-396. doi: 10.1002/cphy.c130056

45. Chiang C, Wu M, Ho C, Weng S, Huang C, Hsieh W, et al. Lower Urinary Tract Symptoms Are Associated with Increased Risk of Dementia among the Elderly: A Nationwide Study. BioMed Research International 2015:1-7. doi: 10.1155/2015/187819

46. Parthasarathy S, Fitzgerald M, Goodwin JL, et al. Nocturia, sleep-disordered breathing, and cardiovascular morbidity in a community-based cohort. PloS One. 2012; 7(2)e30969. DOI: 10.1371/journal.pone.0030969

47. Justin BN, Turek M, Hakim AM. Heart disease as a risk factor for dementia. Clin Epidemiol. 2013; 5:135-145. doi: 10.2147/CLEP.S30621

48. Uusi-Rasi K, Karinkanta S, Tokola K, Kannus P, Sievänen H. Bone Mass and Strength and Fall-Related Fractures in Older Age. Journal Osteoporosis 2019:1-6. https://doi.org/10.1155/2019/5134690

49. Seitz DP, Adunuri N, Gill SS, Rochon PA. Prevalence of Dementia and Cognitive Impairment Among Older Adults With Hip Fractures. J Ame Med Director Assoc 2011; 12(8):556-564. DOI: 10.1016/j.jamda.2010.12.001

50. Laudisio A, Fontana DO, Rivera C, Ruggiero C, Bandinelli S, Gemma A, et al. Bone Mineral Density and Cognitive Decline in Elderly Women: Results from the InCHIANTI Study. Calcif Tissue Int 2016;98(5):479-488. doi: 10.1007/s00223-015-0102-6

51. Kang HG, Park HY, Ryu HU, Suk S. Bone mineral loss and cognitive impairment. Medicine 2018; 97(41):e12755. DOI: 10.1097/MD.0000000000012755

52. Xu G, Bai F, Lin X, Wang Q, Wu Q, Sun S, et al. Association between Antihypertensive Drug Use and the Incidence of Cognitive Decline and Dementia: A Meta-Analysis of Prospective Cohort Studies. BioMed Research International 2017:1–11. doi: 10.1155/2017/4368474

53. Zhuang S, Li J, Wang X, Wang H-F, Zhang W-J, Wang H-Y, et al. Renin–angiotensin system-targeting antihypertensive drugs and risk of vascular cognitive impairment: A meta-analysis. Neuroscience Letters 2016;615:1–8. DOI: 10.1016/j.neulet.2016.01.011

54. Rouch L, Cestac P, Hanon O, Cool C, Helmer C, Bouhanick B, et al. Antihypertensive Drugs, Prevention of Cognitive Decline and Dementia: A Systematic Review of Observational Studies, Randomized Controlled Trials and Meta-Analyses, with Discussion of Potential Mechanisms. CNS Drugs 2015;29(2):113–130. DOI: 10.1007/s40263-015-0230-6

55. Schultz BG, Patten DK, Berlau DJ. The role of statins in both cognitive impairment and protection against dementia: a tale of two mechanisms. Translational Neurodegeneration 2018;7(5). DOI: 10.1186/s40035-018-0110-3

56. Gupta A, Thompson D, Whitehouse A, Collier T, Dahlof B, Poulter N, et al. Adverse events associated with unblinded, but not with blinded, statin therapy in the Anglo-Scandinavian Cardiac Outcomes Trial—Lipid-Lowering Arm (ASCOT-LLA): a randomised double-blind placebo-controlled trial and its non-randomised

non-blind extension phase. The Lancet 2017;389(10088):2473–2481. DOI: 10.1016/S0140-6736(17)31075-9

57. Giugliano RP, Mach F, Zavitz K, Kurtz C, Im K, Kanevsky E, et al. Cognitive Function in a Randomized Trial of Evolocumab. New England Journal of Medicine 2017;377(7):633–643. DOI: 10.1056/NEJMoa1701131

58. Ziad A, Olekhnovitch R, Ruiz F. Anticholinergic drug use and cognitive performances in middle age: findings from the CONSTANCES cohort. Journal of Neurology, Neurosurgery & Psychiatry 2018;89:1107-1115. DOI: 10.1136/jnnp-2018-318190

59. Kay GG, Harris AG. Loratadine: a non-sedating antihistamine. Review of its effects on cognition, psychomotor performance, mood and sedation. Clinical & Experimental Allergy 1999;29:147–150. DOI: 10.1046/j.1365-2222.1999.0290s3147.x

60. Cenzer I, Nkansah-Mahaney N, Wehner M, Chren M, Berger T, Covinsky K, et al. A multiyear cross-sectional study of U.S. national prescribing patterns of first-generation sedating antihistamines in older adults with skin disease. British Journal of Dermatology 2019;182(3):763–769. DOI: 10.1111/bjd.18042

61. Kay GG. The effects of antihistamines on cognition and performance. Journal of Allergy and Clinical Immunology 2000;105(6). DOI: 10.1067/mai.2000.106153

62. Catalano A, Martino G, Bellone F, Papalia M, Lasco C, Basile G, et al. Neuropsychological Assessment in Elderly Men with Benign Prostatic Hyperplasia Treated with Dutasteride. Clin Drug Investig 2019;39(1):97-102. DOI: 10.1007/s40261-018-0720-7

63. Ulrich S. Relationship found between tamsulosin and dementia Differential prescription behavior in benign prostatic syndrome may explain relationship found between tamsulosin and dementia. Pharmacoepidemiology and Drug Safety 2018;1–2. DOI: 10.1002/pds.4666

64. Hoben M, Heninger A, Holroyd-Leduc J, Knopp-Sihota J, Estabrooks C, Goodarzi Z. Depressive symptoms in long term care facilities in Western Canada: a cross sectional study. BMC Geriatrics 2019;19(1).

65. Han F, Bonnett T, Brenowitz WD, Teylan MA, Besser LM, Chen Y-C, et al. Estimating associations between antidepressant use and incident mild cognitive impairment in older adults with depression. Plos One 2020;15(1). DOI: 10.1371/journal.pone.0227924

66. Prado CE, Watt S, Crowe SF. A meta-analysis of the effects of antidepressants on cognitive functioning in depressed and non-depressed samples. Neuropsychology Review 2018;28(1):32–72. DOI: 10.1007/s11065-018-9369-5

67. Aarsland D, Bronnick K, Williams-Gray C, Weintraub D, Marder K, Kulisevsky J, et al. Mild cognitive impairment in Parkinson disease: A multicenter pooled analysis. Neurology 2010;75(12):1062–1069. DOI: 10.1212/WNL.0b013e3181f39d0e

Artículo sin conflicto de interés