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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Gait speed and grip strength: Physical frailty criteria and its association with mortality in peruvian elderly

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Abstract

Objectives: *Determine if grip strength and gait speed could predict 2-year mortality.* **Methods:** *This was a retrospective cohort study. A total of 311 outpatients in a military hospital were included in the study.* **Measurements:** *Grip strength, gait speed, sociodemographic variables, disability, polypharmacy, hospitalizations, falls, body mass index, and 2-year mortality were noted. Bivariate analyses were used to examine the distribution of covariates for subjects by mortality status. Cox regression analysis was used to estimate the hazard ratios as a function of handgrip strength and gait speed.* **Results:** *Adequate grip strength is statistically associated with 13% lower risk of mortality. Similarly, slower gait speed is associated with a 15% increase in the risk of mortality with models including demographic variables and medical conditions.* **Conclusions:** *These findings are helpful to describe and analyze mortality risk in the elderly and contribute knowledge about gait speed and grip strength in veterans, in addition, to increased data about frailty's physical components and mortality, and health-care systems.* (J Lat Am Geriat Med. 2017;3:43-47)

Key words: *Frailty. Mortality. Latin America. Gait speed. Grip strength.*

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INTRODUCTION

Latin America is experiencing a demographic transition, in which the elderly population has been progressively growing, and in turn, the health-care systems are facing more cases of chronic illness and greater functional dependencies[1,2]. Aging-related diseases, such as frailty, are common in this group[3], especially in patients receiving medical care[4]. Peru is going through a similar demographic transition as the rest of Latin America[5], where 8.8% of the national population is the elderly, and chronic diseases are the main cause of death. In developed countries, the prevalence of frailty ranges from 5% to 59%[6]. In Latin America and the Caribbean, the prevalence of frailty has been reported to be between 30% and 48% in women and 21-35% in men[2,7,8]. In Latin America, the association between frailty and various outcomes has been studied in Mexico, Cuba, and other countries[4]. For example, findings suggest that frailty's physical components are closely related to outcomes such as disability, dementia, depression, falls, hip fractures, hospitalization, and mortality[9-11]. In Peru, the prevalence of frailty in the elderly is 7.7%, and this statistic is quadrupled in outpatients[5]. The association between physical frailty criteria, cognitive deterioration, and disability has been studied. However, the relationship between gait speed, grip strength, and mortality has not been explored in this population. Furthermore, previous non-hospital cross-sectional studies in Peru did not measure handgrip strength (HS), one of the components of Fried's frailty phenotype, until now considered to be one of the most important clinical criteria. In addition, there is evidence about low gait speed (GS) and HS and mortality risk,

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but some studies show controversial results, such as gender differences or chronic diseases influence. This study will analyze the relationship between the two most important components of frailty, GS and HS, and mortality in the elderly. Bearing in mind that clinical physical criteria are used to diagnose frailty[8,18-21], this information will allow us to establish mortality risk and use this to make decisions regarding specific preventive interventions, treatment, and rehabilitation. Moreover, it will contribute data on HS in the elderly and the association with mortality as we do not currently have any such studies in Peru.

METHODS

Sample and measures

Participants are from a hospital study cohort, assessed between May and October 2010, and data about death reports until December 2012. Data were obtained by ambulatory assessment of patients from the Geriatrics Service at Centro Médico Naval "CMST" (Peruvian Naval Medical Center). We included Peruvian naval veterans and their families. According to our power calculation (90%), we needed 309 participants to be able to observe at least a 16% difference in mortality incidence, which according to the previous reports in the literature ranges from 14% to 30%. We recruited 351 participants, 21 of these were not included (Parkinson's disease, cerebral stroke sequels, and Alzheimer's disease or other dementia history), eight refused to participate, and 11 were lost during follow-up. Hence, we ended up with 311 participants (follow-up: 8.69 ± 4.84 months).

We obtained mortality data from the epidemiology department at Centro Medico Naval, in month/day/year format. Procedures and other sample or measures information are available in our previous publication[5]. We assessed HS with a hand-held dynamometer (Dynamometer, series 120286) with a trained interviewer, performing two trials and using the best score for analysis. The GS was assessed over a 4-m timed walk test, and participants were asked to walk "as usually they do." Height and gender-adjusted time points were used. We included the higher measure.

Sociodemographic variables: Age, gender, and education were included in the study. Age was used as a continuous variable. The Peruvian Scholar system to receive elementary and high school education takes 11 years and having 12 or more years corresponds to graduate education. Thus, years of formal education were categorized into two groups: <12 years and 12 years or more. Hospitalization assessed by asking participants about the number of times they had been hospitalized in the past year (0 vs. 1 or more). Functional status: The Barthel Index was used to measure functional status. The Barthel index is a 10-item instrument that includes the following activities: Feeding, bathing, grooming, dressing, bowel and bladder continence, toilet use, transferring from bed to chair, mobility on level surfaces, and use of stairs. Information about these activities was obtained by self-report or caregiver's report. The index score ranges from 0 to 100. A score of 60 or less indicates disability in activities of daily living, as described by Mahoney et al. in 1965. Polypharmacy assessed by asking participants the following: "Do you use five or more different prescription medications on a regular basis?" (Yes vs. No). Body mass index (BMI) calculated using weight in kilograms and divided by height in meters squared. Height and weight were measured using a scale (VEGA, model PT-CLX, series 2085). We included this variable only for adjusting values of HS by gender.

Statistical analysis

Chi-square, *t*-test, and Mann-Whitney tests were used to examine the distribution of covariates for subjects by mortality status. Cox regression analysis was used to estimate the hazard ratios (HR) as a function of HS and GS. Four models were created. Model 1 included age, gender, education (demographics), and HS. Model 2 included demographics and GS. Model 3 included demographics, HS, and GS. Finally, Model 4 included demographics, GS, HS, and medical conditions (falls, hospitalizations, disability, and polypharmacy). Analyses were performed using Stata Software for Windows v.13.0 (Statistics laboratory at Universidad Peruana Cayetano Heredia).

Ethics approval

This investigation received approval in 2009 from Peruvian Naval Medical Center's Ethics Committee, and in 2013, the Universidad Peruana Cayetano Heredia´s ethics committee approved the secondary analyses.

RESULTS

The mean walk time was 0.58 (standard deviation [SD]: 0.36), the mean HS was 33.5 kg (SD: 11.2), 11.6% of the sample received <12 education years (school only), and 88.4% received ≥12 education years. A total of 63% (n = 196) had at least one positive dimension of disability on the Barthel index, and 19% (n = 59) had polypharmacy. We have data about 57 death reports in a 2-year follow-up (18.3%) (Table 1).

Table 2 presents the results of bivariate analyses by mortality status. Patients who were confirmed

deceased were significantly more likely older and to have lower GS mean and lower HS mean and <11 years of education. We did not find significant differences with gender, military rank, and number of hospitalizations. Among disability, lower Barthel index score was associated with mortality, as was polypharmacy and falls.

Table 3 presents the results of Cox regression analyses predicting mortality as a function of GS and HS. We constructed four models. Model 1 included demographic variables (age, gender, and education) and HS. Model 2 included demographic variables and GS. Model 3 included demographic variables HS and GS. Finally, Model 4 included disability (Barthel index), polypharmacy, hospitalizations, and falls (medical conditions), and variables included in Model 3. The only significant factor associated with mortality in Model 1 was HS, but in Model 2, we found an association with age and HS. In Model 3, we observed that significance with age was lost, but significance with GS and HS remains. In Model 4, we saw that addition of medical condition variables did not affect substantially the association between physical frailty variables (GS and HS) and mortality, but we found significant results with disability, falls, and polypharmacy. In addition, hospitalizations were closely significant in the complete model.

Table 1. Characteristics of the sample (n=311)

Variables	n (%)	Mean±SD*
Age		76.1±8.3
Retirement years		20.1±10.1
Gender (male)	185 (59.5)	
Marital status		
Single	12 (3.9)	
Married	231 (74.3)	
Widower	52 (16.7)	
Divorced	16 (5.1)	
Military status		
Retired subaltern	159 (51.1)	
Retired officer	24 (7.7)	
Civilian	128 (41.2)	
Education		
≤11 years	36 (11.6)	
>11 years	275 (88.4)	
Disability (Barthel)	196 (63)	
Polypharmacy (>5 drugs)	59 (19)	
Hospitalizations (≥1 in the past year)	199 (64)	
Falls (≥1 in the past year)	171 (55)	
2-year mortality	57 (18.3)	
Grip strength (kg)		33.5±11.2
Gait speed (m/s)		0.82±0.20

* SD: Standard deviation.

DISCUSSION

The primary objective of our study was to determine the ability of HS and GS to predict 2-year mortality in the Peruvian elderly. Understanding the impact

Table 2. Bivariate analysis by mortality status (n=311)

Variables	Deceased during follow-up n=57 (18.3%)	Alive after follow-up n=254 (81.7%)	p value
Gait speed m/s (mean±SD*)	0.58±0.36	0.89±0.51	0.001†
Grip strength in kg (mean±SD*)	20.9±5.1	36.3±10.2	0.001†
Age (mean±SD*)	79.5±6	75.3±8.6	0.001†
Gender n (%)			0.3‡
Male	31 (16.8)	154 (83.2)	
Female	26 (20.6)	100 (79.4)	
Education n (%)			0.04‡
≤11 years	11 (19.3)	25 (9.8)	
>11 years	46 (80.7)	229 (90.2)	
Military status n (%)			0.6‡
Retired naval personnel	32 (56.1)	151 (59.5)	
Civilian	25 (43.9)	103 (40.6)	
Disability n (%)	32 (16.3)	164 (83.7)	0.02‡
Polypharmacy n (%)	13 (22)	46 (78)	0.04‡
Hospitalizations n (%)	32 (18.7)	139 (81.3)	0.08‡
Falls n (%)	39 (19.6)	160 (80.4)	0.04‡

*SD: Standard deviation, †U Mann-Whitney, ‡Chi-square.

Table 3. Cox regression analysis predicting mortality (n=311)

	Model 1 HR* (95% CI)	p value	Model 2 HR* (95% CI)	p value	Model 3 HR* (95% CI)	p value	Model 4 HR* (95% CI)	p value
Gait speed			1.23 (1.15-1.32)	<0.0001	1.10 (1.02-1.18)	0.013	1.15 (1.05-1.25)	0.002
Grip strength	0.86 (0.82-0.90)	<0.0001	-	-	0.87 (0.82-0.92)	<0.0001	0.87 (0.83-0.92)	<0.0001
Age	1.01 (0.97-1.05)	0.5	1.03 (1.01-1.07)	0.04	1.01 (0.96-1.05)	0.9	1.01 (0.96-1.05)	0.7
Gender (female)	1.16 (0.64-2.08)	0.6	1.35 (0.69-2.66)	0.4	1.39 (0.29-1.61)	0.3	1.28 (0.65-2.51)	0.5
Education (>11 years)	0.69 (0.33-1.44)	0.3	0.72 (0.31-1.65)	0.4	0.69 (0.29-1.61)	0.4	0.79 (0.30-2.07)	0.6
Falls							1.16 (1.01-1.32)	0.008
Hospitalizations							1.11 (0.98-1.14)	0.09
Polypharmacy							1.02 (1.01-1.04)	0.009
Disability							1.16 (1.08-1.23)	0.02

*HR: Hazard ratio.

of physical frailty criteria in older adults is an important matter. That is why, the aim of this investigation was to determine the magnitude of the association between two of the main frailty criteria (HS and GS) and mortality of outpatients at a military hospital. Our results demonstrate that HS is statistically associated with lower risk of mortality. Similarly, GS is associated with risk of mortality, with models including demographic variables and medical conditions. Previous studies have shown that frailty and many of its diagnostic criteria, taken independently, can adequately predict mortality and other adverse outcomes[4,8-10,12-14].

In the literature, we noted many factors associated with high risk of mortality in the elderly, which appeared to be independent of frailty status[15-18]. There is also literature supporting the fact that all-cause and specific mortality in frail patients are more closely related to physical frailty criteria[19-21]. In our study, we noticed that variables such as age, falls, hospitalizations, and BMI lose statistical significance when entering models including HS and GS, indicating that those may be independent of other factors; similar outcomes have been found by other researchers[1,2,22-24].

The high risk of mortality in elderly patients has been the subject of many publications. In Latin America, studies have addressed the issue and explained the role of HS, GS, and mortality risk. For example, a study in Cuba discusses the increased risk of mortality according to physical frailty diagnosis[16] and an Italian national survey that assessed physical measures of sarcopenia, including HS and GS, determined a high risk of death over 80 years[21].

A systematic review showed that HS is an independent risk factor for mortality but weakens in cohort studies with long-term follow-up or patient age near 60 years old on enrollment. The same study proposed GS as a mortality risk factor in the elderly and defined it as extremely widespread and reliable[3]. However, not all studies regarding HS indicate a high risk of all-cause mortality, as does GS[25]; even some studies in hospitalized populations found HS less useful[10]. Regarding that, we tried to explain the individual role of HS and GS in predicting mortality risk.

There is a lack of evidence about HS and GS in outpatients at military hospitals[26] regarding mortality. A Swedish study showed that HS is a predictor of death from cardiovascular disease, and one study from Taiwan described that GS is associated with all-cause mortality, while HS adequately predicted deaths from infectious causes[21,27].

Low GS and HS as physical frailty markers must be considered conditions of public health interest, intimately related to geriatric medicine practice. The issues related to aging must redirect resources to support modification of health services offered to aged people, including in Latin American countries[8].

Every definition and concept of frailty involve physical criteria, and the recent studies have acknowledged that we must assess the frail elderly with a multidimensional approach. In addition, it is well known that the choice of the components to diagnose frailty, including HS and GS, is controversial due to demographic, social, racial, and physical factors[12]. Concluding our analysis, we tried to explain the association between HS and GS and mortality risk, highlighting the independent role of each one and demonstrating that, independently of other conditions, comorbidities, and geriatric syndromes, both physical frailty criteria successfully predict 2-year mortality risk in our population.

The current study has some limitations. The temporal sequence of events and deaths is limited because our study enrolled participants as they came in for clinical evaluation. Therefore, enrollment was linked to visit date, not to a clinically relevant event or diagnosis. In addition, as we describe in our previous publication, our findings may not be generalizable

because part of our sample has military service antecedent. Despite these limitations, our findings are really helpful to describe and analyze frailty's mortality risk in this population and contribute to increasing the literature about frailty in veterans and data about frailty's physical components, about mortality, and can help the health-care decision-making[6,7]; in addition, we detected two possible therapeutic targets in prevention of mortality that may open an opportunity to future intervention studies.

DECLARATION OF INTEREST

The authors disclose no conflict of interest. Other affiliations: (first author) Postgraduate student, School of Public Health and Management, Universidad Peruana Cayetano Heredia.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Painful diabetic neuropathy in older adults

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Abstract

Objective: *Describe risk factors, clinical characteristics, relevant findings of neurological examinations and the medications used in the treatment of older adults patients with painful diabetic neuropathy (PDN).* **Patients and methods:** *Retrospective study, which included 284 patients over 60 years of age who attended the geriatrics and/or neurology service. Two groups were formed: those with PDN and with non-PDN (NPDN).* **Results:** *The prevalence of PDN was 77%. Compared with those with NPDN, patients with PDN reported higher alcohol consumption (50% vs. 14%, p = 0.03) and Achilles higher hyporeflexia/areflexia (73% vs. 18%, p = 0.01). Regarding the treatment of pain in patients with PDN, there were higher consumption in neuromodulators (58%), nonsteroidal anti-inflammatory drugs (42%).* **Conclusions:** *The patients with PDN have a higher frequency in alcohol consumption, decrease or loss of Achilles reflexes. In relation to the treatment, the medicine most used in patients with PDN was the neuromodulator.* (J Lat Am Geriat Med. 2017;3:48-52)

Key words*: Diabetic neuropathy. Geriatric assessment. Older adults. Painful diabetic neuropathy.*

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INTRODUCTION

During the ageing process, anatomical and functional changes occur in the somatosensory system which can produce a number of alterations, for example, reduction in the myelinated and non-myelinated fibers, the number and size of sensory neurons in the dorsal root ganglia, changes in the peripheral afferent nerves, and in the pain-modulating descending pathways[1]. As a result of this process, there may be mechanical similarities between age-related changes in nociception and in neuropathic pain perception, defined as that which results from a lesion or disease that affects the somatosensory nervous system, and which may be caused, for example, by a diabetes mellitus (DM) complication[2].

Painful diabetic neuropathy (PDN) is a frequent complication of DM, affecting between 13% and 26% of sufferers[3]. In Mexico, the prevalence of DM is 9.2%, of which 70% of patients are aged over 70 years[4]. Given this scenario, PDN constitutes a growing health problem among Mexicans, due to the ageing population, as well as the longer life expectancy of patients with DM. It should be noted that the presence of PDN in older adults (OA) is associated with a range of complications which may result in comorbidities, for example, alterations in sensory and motor functions, loss of stability, alteration of gait, and impact on the normal activities of daily life[5], which may seriously affect the quality of life of the patient.

Regarding treatment for PDN, research has been conducted with the aim of evaluating the effectiveness of treatment for PDN in young people[6]; however, at present, adequate studies have not been con-

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ducted to analyze cases of PDN in OAs, meaning that limited information is available on how this disease manifests itself and is treated among patients within this age group.

The aim of our study was to describe risk factors, clinical characteristics, relevant findings of neurological examinations and the medications used in the treatment of OA patients with PDN.

PATIENTS AND METHODS

This retrospective, transversal study involved patients aged 60 years and older who attended a third-level care hospital in Mexico City. Clinical records were reviewed from January 2015 to January 2017. Patients with a diagnosis of DM, use of an oral hypoglycemic agent or insulin, information regarding chronic complications associated with DM (retinopathy, heart disease, nephropathy, and neuropathy) were included in the study. Information regarding the diagnosis of diabetic neuropathy (DN) was obtained using the Michigan Neuropathy Screening Instrument[7], which evaluates distal symmetric polyneuropathy. Subsequently, two groups were formed: Patients with PDN and patients with non-PDN (NPDN); for diagnosis of neuropathic pain the DN4 questionnaire was used[8]. Information from the complete neurological examination was included, which was conducted by a specialist in neurology. Demographic characteristics, physical examination, comorbidities, treatments, geriatric syndromes, and functional status were obtained from the geriatric evaluation. For the description of geriatric syndromes, the number of drugs prescribed, geriatric depression scale score[9], mini mental state examination score[10], presence or absence of urinary incontinence, gait disturbance, falls syndromes (more than two falls in the past 6 months), as well as the Lawton and Brody index (instrumental activities of daily living),[11] and the Katz index (basic activities of daily living) were considered to assess functional status[12].

Laboratory results for glycosylated hemoglobin (HbA1c), fasting blood glucose, triglycerides, total cholesterol, high-density lipoproteins, low-density lipoprotein (LDL), Vitamin B12, and folic acid (performed up to 3 months before review of the clinical file) were collected.

The study excluded those patients who had received a diagnosis of neuropathy associated with a cause not related to DM, amputees, severe dementia (CDR: 3)[13], and decompensated psychiatric disorder (major depressive disorder, anxiety, and schizophrenia), as well as all those patients whose files did not contain all the information required for the study.

Statistical analysis

Descriptive statistics were used for the sociodemographic and clinical characteristics of both groups; the Chi-square test to compare categorical variables and for continuous variables, the Student's t-test and U Mann–Whitney tests were used, according to distribution. A value of $p < 0.05$ was considered statistically significant.

The study used the SPSS (SPSS Inc., Chicago, IL, USA version 20.0 for Windows) software package. The study was submitted to and approved by the Institutional Ethics Committee.

RESULTS

A total of 284 patients were registered from January 2015 to January 2017. 34 patients were excluded from the study because their dossiers were incomplete for the purposes of the analysis. The study included 122 patients diagnosed with DM. Of these patients, 64 met the diagnostic criteria for PDN, of which 44 reported pain as a predominant clinical manifestation (Fig. 1).

Of the patients with PDN, 53% were women. The mean age was 76.6 ± 7.7 years. The mean duration of DM was 24.4 ± 11.4 years. The mean fasting blood glucose was 144.8 ± 53.3 mg/dl, and the mean HbA1c was 7.9 ± 1.8. Total cholesterol was 177.8 ± 49. LDL was 102.8 ± 41.4. Triglycerides were 176.5 ± 103.9 and body mass index was 25 ± 5.8 kg/m^2. The most common comorbidities were arterial hypertension (83%) and dyslipidemia (55%). Among the DN complications, 77% presented PDN.

Compared with those with NPDN, patients with PDN reported higher alcohol consumption (50% vs. 14%, $p = 0.03$) and Achilles hyporeflexia/areflexia (73% vs. 18%, $p = 0.01$). Urinary incontinence was less frequent in PDN patients compared to patients who presented NPDN (19% vs. 50%, $p = 0.04$) (Table 1). After comparing the macro- and micro-vascular complications between the PDN and NPDN groups, no statistical differences were found.

With regard to pain treatment, four groups of drugs were recorded: Neuromodulators (58%), nonsteroidal anti-inflammatory drug (NSAIDs) (42%), and opioids (20%). Compared to those who presented NPDN, the patients with PDN had a greater frequency of consumption of neuromodulators (70.5% vs. 30%,

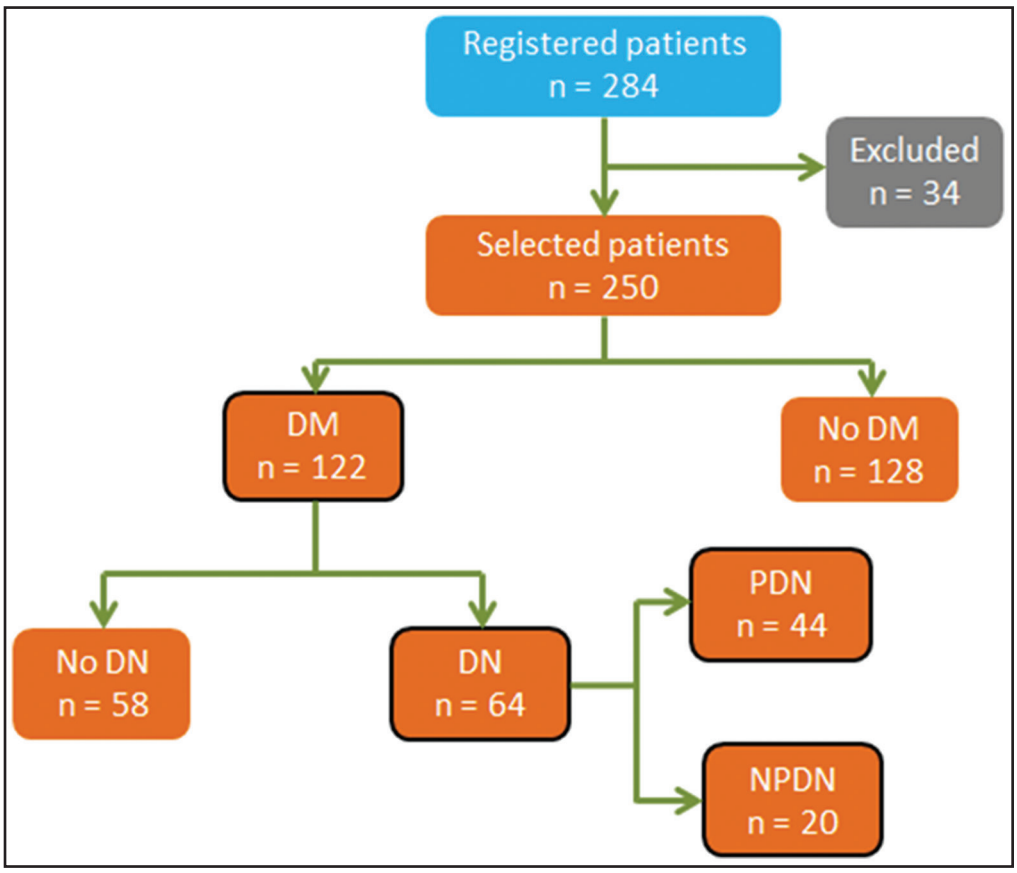

Figure 1. *Selection of patients for the study analysis. DM: Diabetes mellitus, DN: Diabetic neuropathy, PDN: Painful diabetic neuropathy, NPDN: Non-painful diabetic neuropathy.*

p = 0.02 the most used of which was gabapentin (GBP) 20 [45.5%]); NSAIDs (54.6% vs. 15%, p < 0.01 the most used of which was paracetamol 19 [43.2%]); and opioids (29.5% vs. 0%, p < 0.01 the most used of which was tramadol 7 [15.9%]).

DISCUSSION

PDN is a frequent complication in patients with DN. In this study, the prevalence of PDN was 77%, which is higher than that reported in other studies. In a study conducted in the consulting rooms of a hospital, Kim et al. reported a prevalence of PDN of 43%, with an average age of 63 years[14]. Other authors, such as Abbott et al., reported the prevalence of 23% in the DM1 group (the average age of which was 37 years) and of 35% in the DM2 group, with an average age of 64 years[15]. It is possible that the greater prevalence observed in our study was due to the close monitoring and medical attention provided as a matter of course in our institution.

With regard to risk factors, history of alcohol consumption was more common in patients with PDN. Consumption of ethanol has a direct toxic effect on the nerve fibers (Aδ and C fibers), resulting in degeneration and inhibition of axonal transport[2]. It also produces lipid peroxidation and atypical activation of the protein kinase C[16]. In turn, acetaldehyde, the toxic metabolite of ethanol, increases oxidative stress[17], combining to cause oxidative stress damage to the nerve fiber.

The presence of DN should be considered obligatory for a diagnosis of PDN, given that there is a directly proportional association between the severity level of DN and the risk of developing PDN[18]; therefore, the coexistence of neuropathic pain and the clinical characteristics of DN is inevitable. Likewise, our study indicated a higher percentage of Achilles hyporeflexia and areflexia in patients with PDN; it is important to mention that in OAs without PDN or DN there may be loss or decrease of the Achilles reflex as a consequence of a reduction in the elasticity of the Achilles tendon[19]; but, unlike those patients with DN and PDN, the effect may be isolated and/or asymmetric[20].

On the other hand, in our study, there was a higher prevalence of urinary incontinence in patients with NPND, despite the fact that there is no previous evi-

Table 1. Clinical and sociodemographic characteristics of groups

Characteristics	Total (n = 64)	Without PDN (n = 20)	PDN (n = 44)	p value
Sociodemographic				
Age, mean ± SD	76.6 ± 7.7	77.9 ± 7.9	76.0 ± 7.6	0.4
Female gender, n (%)	34 (53)	13 (65)	21 (47.7)	0.3
Alcohol, n (%)	23 (41)	2 (14.3)	21 (50)	0.03
Tobacco, n (%)	26 (48)	5 (41.7)	21 (50)	0.6
Comorbidities				
History of depression, n (%)	13 (23.2)	4 (28.6)	9 (21.4)	0.6
Hypertension, n (%)	53 (86.9)	16 (88.9)	37 (86)	0.8
Dyslipidemia, n (%)	35 (62.5)	8 (57.1)	27 (64.3)	0.8
Cancer, n (%)	8 (14.8)	2 (15.4)	6 (14.6)	0.9
Cerebrovascular event, n (%)	6 (11.3)	3 (25)	3 (7.3)	0.1
Hypothyroidism, n (%)	11 (19.6)	3 (21.4)	8 (19)	0.8
Analytical parameters				
Glucose, mean ± SD	144.8 ± 53.3	146.9 ± 50.6	144.0 ± 54.9	0.7
Glycosylated hemoglobin, mean ± SD	7.9 ± 1.8	7.8 ± 2.3	8.0 ± 1.7	0.8
Triglyceride, mean ± SD	176.5 ± 103.9	185.1 ± 139	173.0 ± 88.1	0.9
Total cholesterol, mean ± SD	177.8 ± 49	178.9 ± 38.5	177.4 ± 52.6	0.9
HDL, mean ± SD	46.2 ± 14.2	47.5 ± 14.1	45.7 ± 14.3	0.7
LDL, mean ± SD	102.8 ± 41.4	99.0 ± 33.9	104.2 ± 43.9	0.7
BMI, mean ± SD	25 ± 5.8	21.3 ± 10.4	26.1 ± 3.2	0.2
Geriatric syndromes				
Urinary incontinence, n (%)	15 (26.8)	7 (50)	8 (19)	0.04
Number of medicines, mean ± SD	6.6 ± 2.6	7.1 ± 2.7	6.5 ± 2.6	0.5
Depressive symptoms GDS*, mean ± SD	5.3 ± 4	4.8 ± 3.6	5.6 ± 4.3	0.5
MMSE, mean ± SD	25.2 ± 4.6	25.8 ± 3.4	24.8 ± 5.2	0.9
IADL disability (Lawton and Brody), n (%)	41 (64.1)	15 (75)	26 (59.1)	0.2
BADL disability (Katz), n (%)	17 (26.6)	7 (35)	10 (22.7)	0.3
Alteration of gait, n (%)	27 (42.2)	8 (40)	19 (43.2)	0.8
Falls, n (%)	11 (20.8)	3 (25)	8 (19.5)	0.7

Level of significance $p < 0.05$. *15 question version. DN: Diabetic neuropathy; BMI: Body mass index; GDS: Geriatric depression scale; MMSE: Mini Mental State Examination; IADL: Instrumental activities of daily living; BADL: Basic activities of daily living; SD: Standard deviation; HDL: High-density lipoproteins; LDL: Low-density lipoprotein; PDN: Painful diabetic neuropathy.

dence to indicate any relationship between these. However, it is important to emphasize that there is a correlation between DN and diabetic cystopathy. In turn, the latter is related to loss of neurotrophin production, which is also implicated in the development of DN sensory neuronal degeneration (acting at the level of Aδ and C fibers)[21].

With regard to treatment, the most frequently used pharmaceuticals in our study were the neuromodulators group (GBP). GBP binds strongly to the alpha 2-delta subunit and reduces the influx of calcium in the nerve endings; it, therefore, decreases the release of neurotransmitters (glutamate, noradrenaline, and substance P). GBP is also considered a first choice drug for the treatment of PDN in drug treatment guidelines; however, very few studies have evaluated the efficacy of this drug in the OA population. In 2000, Dallocchio et al. demonstrated that in a sample group of 25 persons with an average age of 71 years, GBP use was more effective and had fewer adverse effects

than amitriptyline[22]. Subsequently, Backonja et al. demonstrated the efficacy and tolerability of GBP in the treatment of neuropathic pain in adults, in a population aged between 20 and 90 years; in addition, they also demonstrated that in the group of patients with PDN, GBP consumption at a dose in excess of 1800 mg/day was more effective than the placebo and that the OA patients did not experience greater adverse effects than the younger participants in the study[23].

The second most frequent PDN treatment group are the NSAIDs, with the most frequently used drug being acetaminophen; however, according to current guidelines for the pharmacological treatment of PDN, use of this drug as treatment is not recommended. The Cochrane Review concluded that there is insufficient evidence to support or refute the suggestion that acetaminophen functions as a treatment for any type of neuropathic pain[24].

Finally, the least frequently used drug group was opioids; however, a significant percentage of patients with PDN were treated with this group, with tramadol being the most frequently used drug. Harati et al. demonstrated that use of tramadol at 200 mg/day was effective in the treatment of PDN compared to a placebo[25]. The benefit of use of this drug is derived from the action of tramadol and its active metabolite on the central mu opioid receptors and the inhibition of descending pain pathways[26].

The main strength of this study is the fact that there are very few studies describing the frequency and characteristics of PDN in OAs, it was demonstrated that PDN is a frequent condition in OAs with DN. The increase in diabetic patients who manage to live longer with chronic complications is increasing, and the integral geriatric evaluation will help to improve the diagnostic and therapeutic approach of the PDN and how it could influence with the presence of other geriatric syndromes. The limitations are a consequence of the design of the study, given that the information was obtained retrospectively, the sample size was insufficient, and no record was kept of the intensity of the pain associated with this entity. Nevertheless, the study does identify the importance of PDN as a frequent complication in OAs with DN.

In conclusion, our study demonstrates that alcohol consumption is a contributing factor of PDN, as well as the importance of conducting a complete neurological evaluation, given that decrease or loss of Achilles and knee-jerk reflexes are frequent in those OAs with PDN. With regard to treatment, the most frequently used group of drugs among this group of patients is neuromodulators.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Use of NAO robot in training of primary care clinicians for treatment of elderly patients

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Abstract

Background: *In recent years, senior population has experienced a rapid growth. New challenges in health-care and overall improvement of well-being for older adults have arose. Mexico's demand for geriatric care is greater than available formation resources, particularly for primary care clinicians.* **Objective:** *The aim of the present work is to assess the feasibility of using a humanoid robot as an alternative training tool in education for health professionals, focusing on identification of elder abuse. The robot's performance (measured as the physician's satisfaction) is compared to that of a geriatric specialist.* **Results:** *No statistically significant difference was observed for overall satisfaction scores, effective transmission of information, and competency comprehension for both lecturers.* (J Lat Am Geriat Med. 2017;3:53-56)

Key words*: Geriatric training. Elder abuse. Humanoid robot. Medical education.*

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INTRODUCTION

All over the world, the elderly population is the fastest-growing demographic group. While this has been a trend in developed countries for some time now, it has only recently become a matter of concern in countries like Mexico[1]. Despite projections concerning the growth of elderly population in Mexico, the formation of human resources specialized in the treatment of senior population is well below required levels to ensure an adequate coverage[2]. According to the American Geriatrics Society, an acceptable proportion of geriatric specialists is one for every 10 thousand people aged 75 or older. As of May 2017, The Mexican National Council of Geriatrics has a total of 401 registered specialists[3].

Among other conditions that are particularly frequent in this age group, abuse is of great concern for health professionals. Elder abuse is defined by the World Health Organization as "a single or repeated act, or lack of appropriate action, occurring within any relationship where there is an expectation of trust, which causes harm or distress to an older person[4]." In Mexico City, an estimated 10.3% of older adults suffer one or more types of abuse, with psychological mistreatment as the most frequent one (6.20%), followed by physical mistreatment (3.26%), economic mistreatment (2.61%), neglect (0.98%), and sexual abuse (0.82%)[5]. Lack of training in primary care physicians (PCPs) may hinder their ability to perform screenings and effectively detect and manage elder abuse situations. Moreover, there is a lack of professionals with skills to train health professionals on these issues.

Throughout the world, technology is changing education rapidly. Medical education is no exception. Increasing numbers of medical students, decentralization of formation centers, and growth in the knowledge base required for future physicians have brought attention to novel techniques such as online education, simulation tools, and long-distance courses. Among the unprecedented tools explored by the advent of technology are robotics.

Humanoid robots have been employed in education at basic levels, to teach science[6], programing[7],

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and languages[8]. In these settings, the presence of a robot has shown improvement in the learning process for students. Specific brands of robots have been used for this matter, such as the NAO. This robot is manufactured by Softbank Robotics. It is a 25-degree of freedom humanoid robot, incorporating proximity, inertia, and infrared sensors, cameras, and wireless communications. It is capable of recognizing faces, emotions, and sounds[9]. This robot presents adequate characteristics for it to be tested as a training tool for medical professionals, mainly its communication skills and empathy generated with human beings.

There is a lack of information about the feasibility of using these robots in training health professionals (in specific PCPs), for geriatric contents. We hypothesize that the characteristics of the NAO robot would allow to train PCPs and nurses in detecting elder abuse and that it would perform training as satisfactory to the PCP as a geriatric specialist would do. Therefore, the aim of the present work is to assess the feasibility of using a humanoid robot as an alternative training tool in education for health professionals, focusing on identification of elder abuse.

MATERIALS AND METHODS

We present the results of a cross-sectional pilot study to test the feasibility of using a NAO robot in training PCP and nurses to detect abuse of older adults. A convenience sample was selected, due to the preliminary nature of the study. The experiment was conducted at a primary care unit from the Instituto Mexicano del Seguro Social *(*IMSS-Mexican Institute of Social Security) in the outskirts of Mexico City (Cuautitlán Izcalli). Participants were invited by the chief physician of the unit, with a final recruitment of 78 participants. The subjects were divided into two groups for two different shifts and trainer. The first group (Group A) received training from a humanoid NAO robot. The second group (Group B) attended lectures by a geriatric specialist. The groups had no contact among each other. The contents of both lectures were homogeneous and generated by the geriatrics specialist. The geriatric mistreatment scale was selected as the core material for content design, which is a validated tool for the detection of abuse in older adults[5].

Technical considerations in programing of the NAO robot included voice volume modulation with systematic shifts in volume in response to environmental noise, orientation correction -ensuring an appropriate direction of the robot toward the audience, body language -incorporating gestures to provide a more natural performance, and control points - interaction gestures to improve audience engagement.

The following four sets of dependent variables were used to define feasibility:

1. General satisfaction with the experience: Opinion on the lecturer's performance, didactic material, contents, and general opinion on the training
2. Effective transmission of information: Evaluation of contents. Questions regarding concepts covered during the training
3. Didactic material: Subjects were instructed to evaluate the quality of the didactic material (the same for both groups)
4. Competency comprehension: Questions regarding expected competencies acquired during the training.

The first part of the evaluation included questions regarding the participants' opinion on the usefulness and pertinence of the lecture and asked them to assign a 1-10 score to the lecturer, the contents of the lecture, and the didactic material employed. The second section asked direct evaluation questions on the topics covered by the lecture, to assess the participants' grasp of the subject after the sessions. A third set of questions was related to the didactic material, and also, the subjects had to score from 1 to 10 these contents. The last part included questions on the clinician's role in detection and management of elder abuse, to evaluate the participant's understanding of the required competencies for appropriate treatment of elder abuse in primary care settings. As previously stated, each of the scores of these dependent variables was expected to be at least the same both for the geriatric specialist and the NAO robot.

The independent variable of interest was belonging to Group A of Group B; in addition, for description purposes, age, sex, type of health professional (nurse or physician), and years of experience were also gathered.

Description of the variables with mean and standard deviation for continuous ones and frequencies for discrete was used. A bivariate analysis was performed for the scores of the four dependent variables, using t-tests to assess significant differences between Group A and Group B. A $p \geq 0.05$ was considered statistically significant. All statistical analyses were performed with Microsoft Excel®.

RESULTS

From a total of 78 subjects with a mean age of 35.38 years, the majority were female and an average of 8.6 years of experience had the sample. Group A (NAO group) had a total of 50 subjects, whereas Group B (specialist group) 28 subjects. According to the health professional category, the majority were PCPs (69.23%) (Table 1).

The overall score for the lecturer had a mean of 8.94 (± 1.18 standard deviation [SD]), without a significant difference between Group A and Group B (p = 0.474). The content of the training session was rated overall with a score of 8.89 (± 1.2 SD) and was rated higher in Group B (9.36, p = 0.009). The same was for the didactic material score and was rated higher in Group B (9.39, p = 0.002) with an overall score mean of 8.88 (± 1.15 SD). Finally, the score of satisfaction with the presentation had no statistical significance between Group A and Group B (p = 0.0626) (Table 2).

DISCUSSION

The use of NAO robots is feasible when training PCPs on detecting abuse and mistreatment in older adults. Our results showed that the ratings of the lecturer (but not the contents or didactic materials) were not different between the groups. Even that, this study was a pilot and shows preliminary results, and the possibility of incorporating this kind of technology merits further research.

An interesting phenomenon can be seen, and in the way, contents and didactic material were graded by participants. These were the only two cases in which statistical difference between scores for both groups was significant. Paradoxically, these were the only two elements that remained constant through training for both groups. Contents were delivered in the same way, using the same order and didactic material. A possible explanation may be that participants considered the robot as a part of the didactic material they were asked to rate, and responded accordingly.

Table 1a. Group composition: Description of sex, age, and years of experience in health care

	Group A	Group B	Total	
Sample size	50	28	78	
Female	26	28	54	
Male	17	7	24	
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Significance**
Age	36.71 ± 9.17	32.73 ± 11.21	35.32 ± 10.03	0.1343
Years of experience	9.17 ± 6.55	7.52 ± 7.25	8.60 ± 6.80	0.3506

SD: Standard deviation

Table 1b. Group composition: Description by Group (A or B) of the type of health professional.

Groups	Position at family medicine unit					Total
	PCP	Resident physician	Graduate physician	Nurse	Undergraduate nurse	
Group A						
Amount	34	2	1	1	4	42
%	80.95	4.76	2.38	2.38	9.52	64.62
Group B						
Amount	11	2	5	1	4	23
%	47.83	8.70	21.74	4.35	17.39	35.38
Total						
Amount	45	4	6	2	8	65
%	69.23	6.15	9.23	3.08	12.31	100.00

SD: Standard deviation; PCP: Primary care physicians

Table 2. Comparisosn of satisfaction scores between Group A (NAO robot) and Group B (geriatrics specialist)

	Total	Group A	Group B	Significance
	Mean ± SD	Mean ± SD	Mean ± SD	
Lecturer score (1-10)	8.94 ± 1.18	8.87 ± 1.20	9.07 ± 1.16	0.474
Content score (1-10)	8.89 ± 1.20	8.62 ± 1.31	9.36 ± 0.83	0.009
Didactic material score (1-10)	8.88 ± 1.15	8.56 ± 1.24	9.39 ± 0.74	0.002
Overall satisfaction score	18.47 ± 3.29	17.94 ± 3.35	19.39 ± 3.02	0.0626

SD: Standard deviation

The robot's programing does not fully exploit its full features. Participants questioned the robot's ability to fully engage in interaction with the audience. While this was not the case during the training, to observe repeatability for the human specialist, the robot is indeed capable of engaging in richer interactions.

While not statistically significant, overall satisfaction scores for the robot were slightly lower for the robot than those obtained by the specialist. This may be attributed to the following:

- Resistance to the introduction of new technologies by experienced professionals, accustomed to traditional education techniques
- Empathy: Clinicians may find it easier to relate to a colleague such as the human specialist and feel the need to show support for a person they identify with, rather than a previously unknown entity such as the humanoid robot
- Audience distraction: Effectiveness in information transmission may be hindered by the robot's "novelty factor." People with no previous experience with similar technologies may be distracted by the robot's appearance and features, rather than paying attention to the message it intends to transmit.

This experiment considers only the short-term effect of the robot's presence during training. A longer exposure to it would be necessary to assess its effectiveness once the novelty factor wears off.

Finally, it is understood that a robot may never be a substitute for a human instructor. While artificial intelligence grows exponentially, human interaction provides the learning process with an enrichment extremely hard to emulate.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE REVIEW ARTICLE

Geriatrician co-pilot: When should seniors stop driving?

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Abstract

One of the challenges of demographic aging is the high prevalence of decreased mobility that occurs in old age and the negative outcomes that occur. Although there are no specific statistics on the causes of death, seniors are known to occupy a moderate percentage of road-related casualties in the Latin American region. While every year millions of older people in the world stop driving, most depend on this activity to maintain their autonomy and mobility. Healthy aging implies active car transfers, and the approach to driving, as an activity representative of functional abilities in old age is a significant advance for the culture of healthy aging. Geriatricians and gerontologists have been the most committed health professionals to collect enough data to develop recommendations and warnings for older drivers who require medical care for common illnesses. The objective of this article is to present a detailed and exhaustive description of this scientific evidence, the global and regional driving situation and this strategy developed for the evaluation of the skills needed to promote the elderly population. (J Lat Am Geriat Med. 2017;3:57-66)

***Key words**: Driving. Elderly. Comprehensive geriatric assessment.*

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INTRODUCTION

One of the challenges that have brought the demographic aging is the increase of the driving of cars by the old people. The problems arising from this phenomenon of mobility come directly to the driving activity, but also from the difficulty in developing strategies to achieve adequate conditions for driving, such as the search for adequate assessments of driving skills, and development of public policies that promote collective road safety.

Healthy aging involves active participation in social activities, so the realization of transfers is necessary. Not surprisingly, social interaction depends on the ease of mobilization. In this way, an indicator of the quality of life among the elderly is the distance and frequency of transfers. The high prevalence of mobility decline that occurs in old age has led to an increase in specific mobilization and transfer needs. These needs have sparked the development of special transportation technology. In comparison to using a regular vehicle the injury rate doubles when traveling

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on an adapted vehicle. Hence, traveling by car is considered the safest way to get around for the majority of older[1-4].

The objective of this article is to present a detailed and exhaustive description of this scientific evidence, the world and the regional situation on driving, and the current strategies developed for the evaluation of the skills needed to drive in the elderly population.

GLOBAL AND REGIONAL SITUATION

Although seniors occupy a moderate percentage in road-related accidental deaths in the Latin American region, there are no specific statistics on the causes of the death. Almost 1.25 million people die every year from automobile accidents in the entire world, and 90% of these deaths occur in low or middle-income countries, despite the fact that these countries only concentrate 54% of the vehicles of the world. It is important to add that all Latin American countries are classified in these categories[5].

In Mexico, the National Vehicle Registry of 2013 registered 35 005 913 vehicles (300 vehicles per 100,000 inhabitants) and reported 17 653 deaths due to car accidents (79% males and 21% females), of which 9 660 were in adults over 60 years old (27%)[5,6] (Table 1). The situation of road safety in the Latin America countries, according to the latest report of the World Health Organization, is not very different from that of Mexico. The Dominican Republic is at the top of the countries with the most cars accidents, with more than 20 deaths per 100,000 habitants, with an average of 29 road deaths. Brazil is second on the list with 23, followed by Bolivia. With rates between 20 and 10, there are Guatemala (19), Honduras, Colombia, Uruguay, Nicaragua, Peru, Costa Rica, and Mexico and Panama (10)[5].

Most countries in Latin America have a lead agency for road safety and traffic, which performs coordination, legislation, and evaluation functions. In the last report of the WHO, only Mexico and Dominican Republican do not have an institution that complies with these characteristics. It is notable that only four countries do not have a national road safety strategy (Dominican Republic, Ecuador, Honduras, and Peru). Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Nicaragua, and Peru are the only countries that promote investment in public transportation. Paraguay it's the only country that separate vulnerable road user from high-speed traffic in a systematized way, unlike the rest of countries of the region Table 2[5].

Table 1. Safer mobility by countries in Latin America

Country/area	Vehicles	There are policies that		
	Number of registered vehicles	Promote walking and cycling	Promote investment in public transportation	Separate vulnerable road users from high-speed traffic
Argentina	23 120 241	Subnational	Yes	Subnational
Belize	-	Subnational	No	No
Bolivia	1,206,743	Yes	Yes	Subnational
Brazil	31,600,729	Yes	Yes	Subnational
Chile	4,263,084	Yes	Yes	No
Colombia	9,734,565	No	Yes	Subnational
Costa Rica	1,759,341	Subnational	No	National
Cuba	628,155	No	Yes	No
Dominican Republic	3215,7773	No	No	No
Ecuator	1,721,206	Yes	Subnational	National
El Salvador	817,972	No	Subnational	No
Guatemala	2,562,925	Subnational	Subnational	Subnational
Honduras	1,378,050	No	Subnational	No
Mexico	35,005,913	Subnational	Subnational	No
Nicaragua	566,731	Subnational	Yes	National
Panama	1,004,669	No	No	No
Paraguay	1,227,469	No	Yes	Yes
Peru	4,264,114	Yes	Subnational	No
Uruguay	1,991,836	Subnational	Subnational	Subnational

Table 2. Road safety management, strategies and targets by countries in Latin America

Country/area	Lead agency		Functions of the lead agency			Road safety strategies	
	A lead agency is present	The lead agency is funded	Coordination	Legislation	Monitoring & evaluation	There is a national road safety strategy	The strategy is funded
Argentina	Yes	No	Yes	Yes	Yes	Yes	Fully
Belize	Yes	No	Yes	Yes	Yes	Yes	Partially
Bolivia	Yes	Yes	Yes	Yes	Yes	Yes	Partially
Brazil	Yes	Yes	Yes	Yes	Yes	Yes	Fully
Chile	Yes	No	Yes	Yes	No	Yes	Partially
Colombia	Yes	Yes	Yes	Yes	Yes	Yes	Partially
Costa Rica	Yes	No	Yes	Yes	Yes	Yes	Partially
Cuba	Yes	No	Yes	Yes	Yes	Yes	Partially
Dominican Republic	No	_	_	_	_	No	_
Ecuator	Yes	Yes	Yes	Yes	Yes	No	_
El Salvador	Yes	Yes	Yes	Yes	Yes	Yes	Partially
Guatemala	Yes	Yes	Yes	Yes	Yes	Yes	Partially
Honduras	Yes	Yes	Yes	Yes	Yes	No	Partially
Mexico	No	_	_	_	_	Yes	Partially
Nicaragua	Yes	No	No	No	No	Yes	Not funded
Panama	Yes	Yes	Yes	Yes	Yes	Yes	Not funded
Paraguay	Yes	No	Yes	Yes	Yes	Yes	Partially
Peru	Yes	Yes	Yes	Yes	Yes	No	-
Uruguay	Yes	Yes	Yes	Yes	Yes	Yes	Partially

To foster the emergence and development of a road culture that does not exclude older drivers, political will is absolutely indispensable. We believe that geriatricians and gerontologists should work actively in the development of public policies for road safety and inclusive mobilization in all Latin American countries.

Driving and aging

Mobility in old age is reduced for a diversity of reasons: Walking and biking are demanding ways to physically move while traveling by public transportation or driving a car can be challenging. Travel depends on various personal characteristics: The desire to be elsewhere, health and economic status, access to a car, as well as time availability. The need for an appropriate system that at the same time offers better mobility, while enforcing safety for the aging population and the public at large is critical[2,3,5].

Mobility behavior of the elderly seems to be different from other age groups. It has been reported that driving is the most used alternative to transport of the elderly (69%), followed by traveling as car passenger (14%), walking (9%), and using public transport (7%)[4]. Common reasons for traveling by car among the elderly include reaching home (37%), attending social and recreational activities (20%), shopping (13%), or health -related visits (2%)[4,7]. The older persons tend to travel shorter distances, especially if they have medical problems. Variables that affect the distance per trip include physical health, economic solvency, having a driver's license, and the availability of a car[8,9]. The frequency of traveling is directly related to having a driver's license and the availability of a car, so when older people lack social networks (family or friends), their mobility is reduced[8-11]. Gender is also a factor in the distance traveled. Elderly women travel shorter distances and stop to driving before men. Cultural and social issues associated with gender roles may influence the cessation or noncessation of driving in old age[2,3].

FACTORS AFFECTING ELDERLY DRIVERS

Driving a vehicle is a complex task demanding perception, judgment, physical ability, and adequate response timing; therefore in old age, many disorders can affect the ability to drive[8,11-14] (Fig. 1).

Visual skills are of great importance for driving safely; this explains why visual acuity tests are

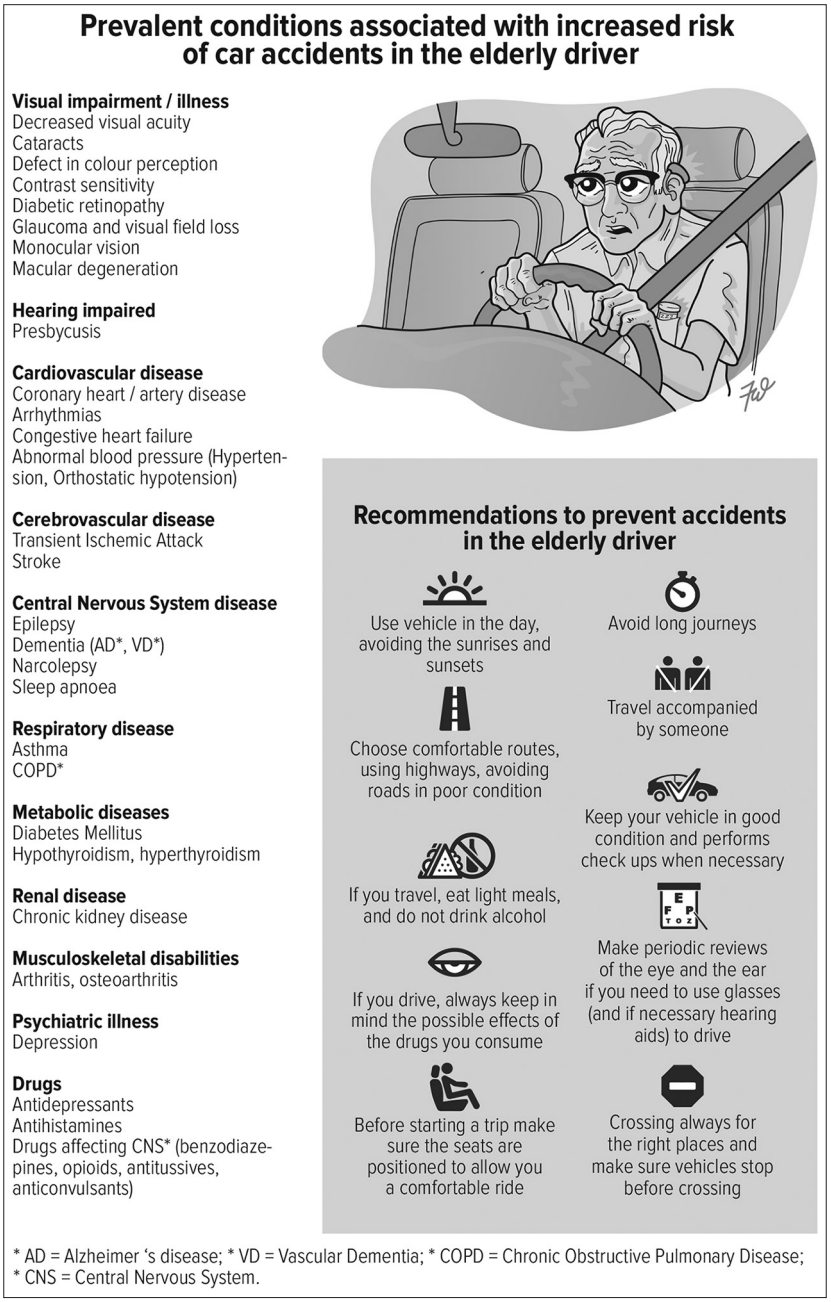


Figure 1. *Prevalent conditions associated with increased risk of car accidents in the elderly driver.*

universally required to grant a drivers license. While visual acuity is critical, its association with accidents is weak, and cannot effectively identify the elderly at increased risk of colliding[8,15,16]. Visual acuity is an important component of driving skills, but there are other factors, such as the simultaneous use of the central and peripheral that is not assessed with conventional screening instruments. Many drivers with reduced visual acuity stop driving either voluntarily or have their driver license cancelled, while others simply reduce their driving. Tests that detect visual processing skills are regarded as having the greatest potential for identifying individuals at risk[17].

Neurological or joint dysfunction, foot pathology, or gait disturbance can further interfere with driving skills. Those sensory and motor deficits interfere with the perception of environmental hazards[8,15,16]. Furthermore, medical conditions common in this age group can reduce driving safety. Dobbs reported the association of such diseases with an increased risk of car accidents and describes these associations as "red flags"[11,18] (Table 3).

Some drugs interfere with driving skills, particularly those central nervous system effects

(e.g. antidepressants, antihistamines, anticholinergic, and benzodiazepines). Other drugs that appear to be independently associated with car accidents in the elderly are nonsteroidal anti-inflammatory drugs and anticoagulants[11,19]. This is relevant given the presence of polypharmacy as a geriatric syndrome.

Additional risks for the elderly driver come from non-user-friendly architectural designs, sudden environmental changes, as well as the lack of familiarity with new or changing routes[20] (Fig. 1).

HOW DO THE ELDERLY DRIVE?

Contrary to the widespread belief that old people are dangerous drivers, most data indicate that is not the case. For instance, Canadian statistics for those older than 65 years show that the elderly come second to the young drivers in road deaths (16%)[21-23].

In comparison to driving while intoxicated, driving recklessly, speeding, or even using mobile phones while driving, the elderly behind the wheel are not generally considered a serious problem[8-11]. With respect to the licensing of older adults, public opinion is often quite clear. In a survey assessing problems related to elderly drivers, 76% of those surveyed agreed that the elderly drivers should be evaluated at a certain age and complete training to maintain driving privileges. The average age suggested for this evaluation was 70 years. 70% agreed that elderly drivers with a deficit or impairment must have some restrictions on their driving privileges, including restrictions to drive at night, or limiting driving to a radius of 25 km from their home. 65% agreed on the need to develop programs to improve the skills of the elderly driver, and 38% agreed that elderly drivers should lose driving privileges if they cause a car accident[24]. In Spain, for example, a medical evaluation for license renewal is required starting at 45 years of age, with subsequent reviews every 5 years until age 70, and then every other year[25]. Nonetheless, although older people come second in mortality, they lead the injury rates. In comparison to healthy elders, it is more likely that those suffering from vulnerability-inducing geriatric syndromes (e.g. fragility syndrome) will suffer an injury in a car accident. This helps understand why elderly people have the second highest mortality rate, but the highest injury rates as consequence of car accidents[21-23]. Another aspect to consider to properly interpreting these data are the fact that the elderly tends to drive less and paradoxically raising the risk of car accidents. Low mileage drivers are at increased risk of accidents. One reason behind that is traffic density. Most accidents occur in congested streets that in high-speed roads[8,21,26]. Another cause of death in automobile accidents in the elderly is getting hit. Older drivers are more prone to having accidents at intersections, with side or angled impact, as well as a spinning component, particularly to the left. Old drivers are also at increased risk due to traffic law violations (e.g. ignoring road signs)[27-29].

IMPACT OF DRIVING CESSATION

While every year millions of elderly people in the world stop driving, most depend on this activity to maintain their autonomy and mobility. The immediate outcomes associated with the cessation of car driving include loss of independence, reduced access to essential services, reduced ability to leave home and reach

Table 3. Changes in normal aging related to drive difficulties and risk of car accidents

Disabilities related to aging	Driving problem
Increased reaction time Difficulty dividing attention between different tasks	Difficulty driving unfamiliar areas or intense traffic flow
Impaired vision, particularly at night	Difficulty seeing pedestrians and objects at night, difficulty in reading signals
Difficulty in calculating speed and distance	Failure to perceive other vehicles Accidents at crossings
Difficulty to perceive and analyse situations	Failure to follow traffic signs Slow to identify risks
Difficulty turning his head, reduced peripheral vision	Failure to detect obstacles while maneuvering the steering wheel Difficulty performing lane changes
Propensity to fatigue	Fatigue on long trips
General effects of aging	Concern about not being able to solve a mechanical failure Handle unfamiliar places at night or in heavy traffic
Fluctuation in severity faults during the day and night	Concern about driving skill

distant sites, and reduced social activities, and integration. All these outcomes negatively interfere with personal identity, satisfaction, and quality of life[15,30-32]. Several studies indicate that the act of driving shapes the perception of both internal and external roles (individual and community, respectively) and is likely that the loss of identity and motivation achieved through life experience as a driver, is also a consequence of the cessation of this activity[33-35]. Even more, some studies indicate that seniors who still drive have higher levels of satisfaction with their lives than those who do not drive[32,34]. In a cohort of 1316 older persons evaluated for 6 years in the United States, it was found that those who stop driving develop more symptoms of depression than those who still drive, even after adjusting for medical, social, and demographic variables[36]. In another larger cohort, there was an increased risk of depressive symptoms 2 years after stopping driving, compared with the elderly who continued to drive[37]. Driving a car is an activity so built to independence and mobility that is not surprising to find negative psychoaffective reactions when ceasing occurs.

APPROACH THROUGH GERIATRICS

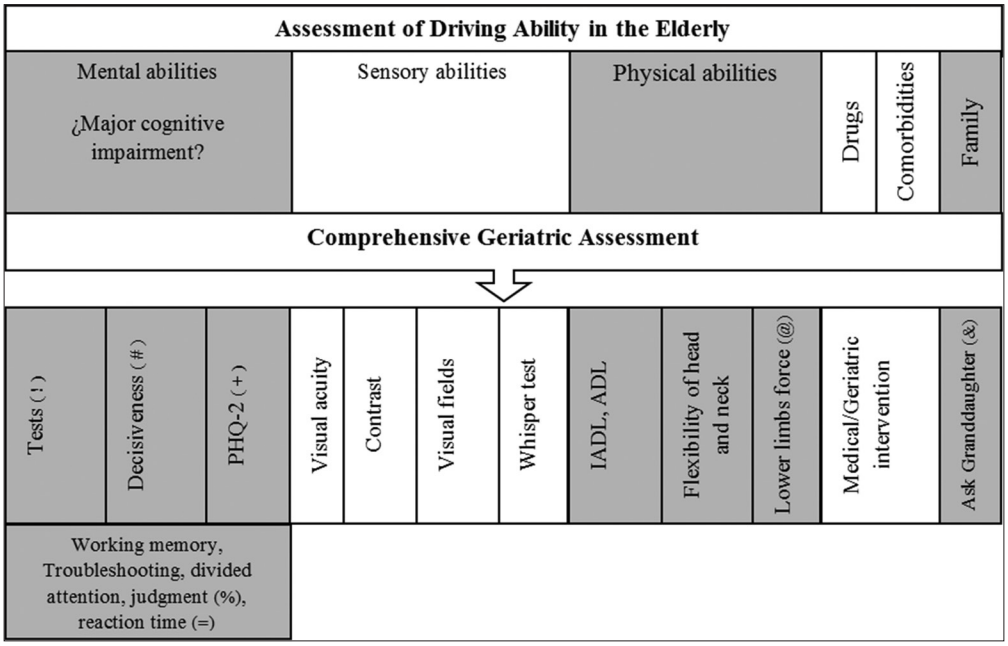
Even with increased disease and disability burden in old age, older drivers can adapt and keep their driving privileges. As we have stated above, they are a safe group on the road. This coupled with better understanding and awareness of the negative effects of driving cessation have caused a change in attitude in the general population about mobility and aging, as well as the implications of a car driving for this age group, who are seen by many sectors of society as a concern of public interest priority. Overall, geriatricians and gerontologists have been among the few health professionals committed to gathering sufficient data to develop recommendations and warnings for older drivers who come to clinical care, with common diseases. For the most part, only geriatricians have the skills to carry out this complex and highly individualized approach[38-40]. Perhaps one of the most important and sensitive questions in outpatient clinics is if the patient is driving or not[41,42]. The Comprehensive Geriatric Assessment (CGA) does not determine - in almost none of its parts - medical fitness to drive. However, it provides with fairly accurate information about the patient's overall capabilities. Nonetheless, a systematic inclusion of questions about transportation and driving are required in the CGA in patients with cognitive impairment[43] (Fig. 2).

On the other hand, the low clinical utility of cognitive assessment scales to assess driving skills is related to their lack of consistency with current models of behavior and driving skills[44,45]. This does not mean that cognition should not be assessed in older drivers, but rather that measurements should be integrated with other factors found by the CGA, including the evaluation of strategic thinking skills judgment, and intuition levels. For example, an argentine study found that the brief neuropsychological battery - which includes: The mini–mental state examination (MMSE); the test clock; and semantic verbal fluency - was a useful screening tool for cognitive impairment in older people who applied for a driving license (sensitivity 87%, specificity 82%. The cut-off is adjusted to identify subjects with cognitive impairment from those with normal performance, and thus provide a quick orientation to assess the risks of the elderly patient driver[46]. In another study, it was concluded that the Montreal cognitive assessment (MoCA) discerns patients with cognitive impairment better than the MMSE. A cut-off 18 or less in the MoCA has a better sensitivity (75%) and lower false positive rate (12%) than MMSE does. Thus, MMSE is not recommended to make decisions in relation to driving safety in patients with cognitive impairment[47]. There is an increasingly widespread interest in the study of cognitive electronic tests to assess driving ability. However, some results are not too promising, for instance, data from a recent systematic review shows that there is no evidence to indicate whether neuropsychological, on-road or other assessments of driving ability can help to reduce crashes in drivers with dementia[48-50].

The approach of driving as an activity representative of functional abilities in old age constitutes a significant advance for the culture of healthy aging. It is also a reflection of the increasing recognition of the negative impact of both traffic accidents and driving cessation in the context of old age.

When to stop driving?

The geriatrician must take an immediate decision on whether the patient can continue driving while assessments (on and off the road) are improved. All decisions and actions should be clearly documented in the medical record, and as is the case for all progressive disorders, periodic evaluations are mandatory, particularly in the cognitively impaired. Experienced centers recommend a biannual review, or earlier if the family or caregiver notice a significant decline in clinical status or driving skills[51]. It is important to warn patients and their families from the decreased driving ability. A reasonable average time it is usually 3 years from the moment neurodegenerative symptoms becomes clinically apparent. Some patients with mild cognitive impairment and slow progression may retain driving skills for longer[38,52]. This precaution will allow patients to plan earlier about quitting driving and exploring alternative transport options. This has been called modified Ulysses contract: Just as Ulysses



(!)	MoCA* ≤18 MMSE* <20/30 Trailmaking A • Unsafe = >2 minutes or more than 2 errors Trail Making B • Safe = <2 minutes and<2 errors (0 or 1 error) • Unsafe=2-3 minutes or 2 errors (Consider qualitative dynamic information on how the test is performed: slow, hesitation, anxiety or panic attack, or perserverante impulsive behaviour, loss of concentration, multiple corrections, forget instructions, disability to understand the test, etc.) • Unsafe = >3 minutes or more than 3 errors Visuo-spatial: Clock and pentagons
(#)	Ability to externalize decision Understand information Understand their disease, treatment options and outcomes Ability to discuss their alternatives
(+)	¿In the last 12 months ever you felt down, depressed for at least two weeks? ¿In the past 12 months and for at least two weeks did not feel like doing things you once enjoyed or interested you?
(@)	¿Repeated chair stands, walking speed, SPPB*?
(&)	Have you felt safe/unsafe in the car when the patient is driving? (Ask separately) Granddaughter question: Do you think your granddaughter of 5 years is sure to be alone with the patient driving? (Usually, if they answer that the person is not sure, he or she is not sure. On the other hand, if they answer that the person is safe, the person can not be sure because the family can not know the current status or may be trying to protect patients)
(%)	¿What would you do if you are driving a car and sees a ball rolling down the street from you? With the diagnosis of dementia, ¿you think at some point you stop driving?
(=)	Tell the patient to keep their dominant hand keep their thumb and forefinger to 2.5 cm away. Hold a ruler of 30 cm from the end between the thumb and forefinger of the patient. Tell the patient will drop the rule and he or she has to catch it. The usual catch is at the mark of 15-23 cm. It is taken as a failure if the rule falls down 2 times.

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Figure 2. *Comprehensive evaluation of the different areas that influence driving skills cars in elders (author´s original). Patient health questionnaire, instrumental activities of daily living, activities daily living, Montreal cognitive assessment, mini-mental state examination, and short physical performance battery.*

ordered his crew is tying him up the mast to help him not to succumb to the songs of the sirens; this strategy leads to a planned surrendering of their driving privileges regardless. In the case of major cognitive impairment (MCI), the patient and their caregivers should be encouraged to inform their car insurance company about their diagnosis[53-55]. In addition, a strategy to extend the driving time in old age is the recommendation for the driver to never drive by his or herself[56].

Cessation of driving should be a consensus decision and preferably based on the results of the road test. Although we must add that if it is true that this approach seems to work for several diseases, has not proven to be effective specifically in the presence of MCI[57].

The promotion of the use of quality alternative transportation and adequate strategies for bereavement management, although lacking in evidence, are other interventions with potential beneficial effects. In the relatively few cases where elderly area at high risk of endangering themselves and the public, it is a professional duty to overcome ethical codes of confidentiality and disclose the information to caregivers and law enforcement agencies[53-57].

Geriatricians should be familiar with local rules and legislation for driving in the presence of illness and advise the patient and their family members based on this information. Although driving and getting a driver's license are not evaluated in the CGA, asking about it is necessary for an adequate clinical practice, because there will come a time when driving cessation occurs.

Proposed intervention

Of note, driving assessment should not be considered solely directed toward safety in the act of driving; the CGA also has a therapeutic element: The establishment of occupational strategy through counseling, technical equipment, and adequate physical rehabilitation. Some studies suggest that occupational therapy is useful in certain patients. For assessing driving skills, however, there is no consensus. Simulators may be helpful to assess the driving abilities of patients with dementia, and eventually achieve an even more important role in the rehabilitation of elderly drivers with neurological disorders[58-61].

Evidence indicates that in mild cognitive impairment driving skills are not compromised[62]. That is why the road test is not usually indicated in the absence of relevant alterations. In elderly patients with a confirmed or suspected diagnosis of Alzheimer's disease, the threshold to perform a road test should be low. The road test is generally regarded as the gold standard in the evaluation of a cognitively impaired old driver[63]. The test consists of evaluating a predetermined test route in a vehicle of dual control. In it, the driving position sense, the answer to traffic signals, awareness of other road users, etc., are evaluated. It is classified the elderly per their performance. Most drivers with dementia tend to perform at a significantly lower level in this type of test; however, a significant minority achieved a safe acceptable level and to continue driving under supervision. The main drawback of road tests is availability of necessary resources (rehabilitation or skilled therapist, with the required automobile technology) and obviously, the presence of test centers[64]. A challenge is that most health services and health insurance plans do not cover the cost of assessments of the road. Losing the mobility by the lack of affordability to these tests is a factor of concern added[65].

Charlton and colleagues investigated the ways by which treating various medical conditions reduces the risk of accidents and promotes mobility. Although the observations are made for any driver, the findings are particularly relevant to the elderly. They found that some treatments increase the risk of accidents (benzodiazepines), and some reduce the risk of accidents at the same level as those who had no pathological condition (e.g. the treatment of depression). Some preliminary data suggest that the cholinesterase inhibitors may improve performance in driving in the presence of mild cognitive impairment. Other treatment measures included specific restrictions, such as those who have lost a limb and could only drive using their prostheses[65,66].

The assessment and rehabilitation of the problems that occur in old age require a deep understanding of the underlying mechanisms. Driving is obviously a complex task; although progress has been made through the development of comprehensive models of driving behavior, its approach remains as intricate and somewhat cryptic. Often the information is published in journals not read by geriatricians, or unknown to the general practitioner. The most useful tool for the health care model is a scheme with an emphasis on a hierarchy of strategic, tactical, and operational factors[67,68]. The strategic planning factor includes choice of route, time of day (avoid peak hours), or identification of cases in which it is not appropriate to drive and the decision to use public transport instead. The tactical factor is related to driving style. This includes driver characteristics, adapted by a variety of reasons, whether consciously or unconsciously: Decisions on whether to change lanes, stop at yellow lights, or deciding when to turn lights on the car on, speed control, braking and signaling, to name a few[67,68]. Driving requires organization among those factors.

The clinical evaluation has tended to emphasize the deficiencies at the operational level, i.e. if a disease affects the appreciation of distracting stimuli or response times in certain situations. This approach is wrong because it is biased: For example, in comparison to the elderly, reaction time (a measure integrated operational tasks) is faster that in the young the group with the highest rate of accidents was 15-25 years old[21-23].

It is very likely that decisions at strategic and tactical level are much more important in causing accidents. Elderly drivers widely used strategic and tactical measures to avoid delay, stress, and risks; driving less at night or during bad weather, or avoiding peak hours and unfamiliar routes, etc.[69,70] (Fig. 1).

The application of a diagnostic-therapeutic strategy for these three levels can be of practical help in making

medical decisions. On a strategic level, we must look for evidence of inadequate planning in travel. Poor planning, lack of judgment in the actions, decreased visual acuity and impulsivity without effective filters affect both the strategic level and the tactical. Impulsivity can be attributed to the lack of inhibition (a common symptom in cognitive impairment). Factors that interfere with the operational level include a visual exploration of the inadequate environment with a poor visual tracking, slowness in action and confusion when they must perform complex acts.

However, not enough attention has been paid to the needs of aging drivers. Improving driving conditions in old age will not be possible if the needs of these users are not taken into account from a perspective that transcends the simple medical approach. We think that other concrete actions are also necessary: (a) Legislation on major risk factors in old age (disabling diseases, for example) can be very useful in reducing the number of injuries and deaths caused by traffic accidents in this age group. It can also be a strategy that benefits social inclusion through improved mobility in the elderly. On the other hand, it is undeniable that failure to comply with legislation undermines the potential of road safety laws. Greater effort is required to optimize compliance with traffic laws, (b) countries should improve the quality of data available for the use of cars by elderly people, the driving licenses granted to them, and the data on traffic accidents in that elderly drivers are involved.

We believe that this should ensure the improvement of the quality of care provided to aging drivers.

CONCLUSION

Because of research in recent decades, geriatricians have a much clearer vision of driving assessment and transportation in older people. An approach based on Global Geriatric Assessment can be easily performed and used by the multidisciplinary team; therefore, we think it should be part of the initial assessment of driving in the elderly, and according to the results, should decide whether there is a need for more advanced assessments. However, adequate availability of road test sites is essential for proper driving assessment in elderly patients with cognitive impairment. Current and future planning for driving and transportation in old age should be part of an active and dynamic partnership between health-care providers, patients and their caregivers.

Dr. D. O'Neill - an expert on the subject - highlights a fact difficult to deny: "A point will come where driving cessation occurs, and in general this process occurs with varying inputs from the patient, the family and physician. In my experience, it is uncommon for this to be a very significant problem for the clinician, with much of the discomfort often falling on family members"[54]. We believe that the elderly should drive until they can keep doing it safely. It is desirable that geriatricians include driving skills to the general evaluation.

As we have seen, a great amount of data is available that allow us to know which are the most effective interventions to improve the conditions of old age driving. That is why road-building legislation contributes to improving the performance of aging drivers, and at the same time promotes healthy aging. We believe that the most positive changes in the behavior of road users will occur when legislation on road safety is accompanied by the firm and constant application of the law and public awareness campaigns.

As population ages, the number of older drivers with greater needs will increase, creating a need to include them in socially active models. It is the duty of the geriatrician, gerontologist, urban planners and mobilization experts to conduct further research on elderly drivers, and find better models for assessing driving ability in older citizens. Based on this, it is necessary a trans-disciplinary work to develop public policies to planning models of care to prevent marginalization of elderly who still can participate actively in society and to promote their inclusion and protection.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE REVIEW ARTICLE

Nutritional issues in palliative care based on evidence: Worldwide and regional situation. Second part: Ethical aspects and legal framework

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Abstract

Soon, the number of elderly people worldwide will be about 2,000 million. In old age, disability and the presence of symptoms likely to receive palliative treatment occur due to chronic non-communicable diseases such as cancer. Academic education and training from health professionals allow palliative care to be applied at all institutional levels. The main objective of artificial nutrition and hydration is to provide food and water to seniors whose life and death quality can improve with these treatments. In this way, suspending or starting them at the end of life may be acceptable measures if they are consistent with the patient's wishes and if it results from consensual decisions based on ethical principles. Ethical dilemmas at the end of life can be avoided through good communication with the patient and family and obtaining informed consent and advanced directives. The aim of this article is to present a detailed and exhaustive description of this scientific evidence of the worldwide and regional situations about nutrition and palliative care in the elderly. (J Lat Am Geriat Med. 2017;3:67-72)

Key words: *Aging. Nutrition. Palliative Care.*

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INTRODUCTION

In the first part of this paper (J Lat Am Geriat Med. 2016;2:20-33), we described the fundamental concepts of hydration and feeding in the context of palliative care in old age: Advantages, disadvantages, and complications of artificial nutrition in the elderly with chronic degenerative diseases, in terminal illness and agony. In this second part, we give a current description of the main ethical aspects and legal framework in which medical and nutritional palliative care are practiced in the world and in our region. Ethical dilemmas at the end of life can be avoided through good communication with the patient and family and obtaining informed consent and advanced directives. The aim of this article is to present a detailed and exhaustive description of this scientific evidence of ethical aspects and legal framework about nutrition and palliative care in the elderly.

A systematic review of three databases including PubMed, the Cochrane Library, and IMBIOMED was conducted to identify relevant articles published between 2000 and 2016. Databases were searched for English language articles using the keywords "palliative care", "terminally ill", "artificial nutrition/hydration", "informed consent", "patient autonomy", "advance directives", "living wills", "ethics", "agony", "bioethics"

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"futile", "therapeutic obstinacy", and "general law". Additional relevant publications were identified from article reference lists.

LEGAL ASPECTS OF PALLIATIVE CARE IN MEXICO

The Federal Law on Palliative Care was published in the Official Gazette of Mexico on January 5, 2009. In addition, Article 184 of the General Health Law was amended, adding Article 166 Bis, which contains the law on compulsory palliative care for terminally ill patients[1]. It is designed to safeguard the dignity of terminally ill patients, ensuring quality of life, a natural death with dignity, accepting the boundary between curative and palliative pain treatment, avoiding therapeutic obstinacy, respecting the right of patients to accept or refuse any treatment considered extraordinary, and giving written informed consent[2]. A year later as part of the National Development Plan 2007-2012, the federal government created the National Palliative Care Program (OFFSET) to provide the necessary care to achieve maximum physical, mental, social, spiritual, and greater relief from the suffering of the patient and family; its mission is to provide the best possible palliative care from a professional point of view, based on scientific evidence, integrating patient care throughout their illness until their death, while supporting their families during this period and in grieving. In addition, it promotes educational programs for health professionals and bringing about change in the policies and practice of palliative medicine[3]. There is also the Official Mexican Standard Hospice (NOM-011-SSA3-2014) Agreement and the General Health Council (published in December 2014), representing the legal part of palliative care in Mexico, where the elderly patient in terminal illness, and in full possession of his mental faculties, is entitled to request voluntary suspension of curative and palliative treatment initiation, in terms of the provisions of the General Health Law[1,4].

Although there is a legal framework in Mexico to implement palliative care, there is no specific regulation on the use of artificial nutrition and hydration in terminally ill patients. Still, it is legally established that palliative care should be provided from the moment the terminal stage of the disease is diagnosed, seeking to preserve the quality of life in terminally ill patients, and with the obligation to respect the decision of each patient on treatments. In the presence of an inability of the patient to consent, combined with the absence of any family or legal representatives, the decision to apply any medical treatment or surgery considered necessary will be made by the specialist and/or the institution's ethics committee[2]. For the legal system in the USA, there are no differences between artificial nutrition/hydration and life support therapy (e.g. mechanical ventilation). Thus, the provision should not be considered different from any other medical treatment or therapy that the patient's body is unable to provide for itself.

The definition of artificial nutrition, according to international consensus, refers to the use of nutritional supplements and specific nutrient administration routes, such as enteral nutrition and parenteral nutrition[5].

However, to provide artificial nutritional support is definitely not essential, and health-care suppliers are not required in the case where artificial nutritional support is not more basic than dialysis or supplemental oxygen[6].

INFORMED CONSENT

In palliative care, the patient and their family should be informed with accuracy, clarity, adequacy, and objectivity (it is recommended not to use technical language that is difficult to understand) and this should take into account their beliefs and values[7]. For the administration of artificial nutrition and hydration, informed consent is necessary. The procedures must be explained, and it is necessary to discuss both the risks or benefits of therapy and the prognosis of the disease. It is desirable to make it clear whether the administration of artificial nutrition and hydration will improve survival and the quality of life, and provide any comfort. Or if its is possible that the treatmente could repair any metabolic abnormalities and what will be the true effect on the patient's evolution. In this way, the patient's autonomy will be recognized. Terminally ill patients have the right to receive relevant information about the risks, costs, and benefits relating to the measures recommended by the palliative care team[8]. According to the American Medical Association, informed consent is "a process of communication between the patient and the doctor, resulting in the authorization or consent of the patient to participate in a specific medical intervention"[9]. In Mexico, informed consent is an ethical obligation and a legal requirement. The signing of this document is absolutely necessary before implementing different types of treatment, including palliative care. Competent adults have the right to decide for themselves about the act of eating and drinking, and that includes their desire to start or end artificial nutrition and hydration. In the case of patients who are unable to make decisions for themselves, these must be made in accordance with advance directives or, in the case of missing such document, the caregivers should take an ethical decision[10]. Relative delegates should base their

decisions on the values and wishes expressed previously by the patient. However, patients often do not talk about their desires and have no definition in this regard. In these circumstances, the caretaker must make appropriate decisions for the patient's condition, taking into account the quality of life and death of the patient. If it does not act according to the interests of the patient, it is the duty of the multidisciplinary team or ethics committee to make decisions based on the principle of beneficence.

ADVANCE DIRECTIVES AND LIVING WILLS

In 2008, the Patient Self-Determination Act was approved, and in accordance with international law, it recognizes the autonomy of the patient to decide which treatments they want. The absence of advance directives or living wills could result in the occurrence of ethical conflicts[9-11]. These situations can be avoided if multidisciplinary teams discuss the end of life care and the patient's desires during the disease's progression[9]. This means that proper communication is necessary to have sufficient elements for making correct decisions for the patient and to avoid futile medical procedures. Although these may change at the end of life, it is recommendable to establish them in writing and to sign them in advance[12]. Hence, it is essential to act in support of the medical professional liability, always seeking the greater benefit for the patient to achieve a balance between respect for their autonomy and dignity and good medical practice. Then, every document where the patient expresses health care wishes becomes very valuable[13]. These documents are not part of Mexican law, but they do offer a unique form of a living will, in which individual health, spiritual, and emotional aspects are addressed, and the family and the multidisciplinary team are allowed to know who has been designated to make decisions about care in the final stage of life[9].

ETHICAL ISSUES OF ARTIFICIAL NUTRITION AND HYDRATION

Basic principles of medical ethics (beneficence, no maleficence, autonomy, and justice) have to be incorporating into taking decisions at the final stage of life of the patient. Only in this way will decisions be guided to good clinical practice and the measures will focus on the basics of palliative care: Maintaining the quality of life without lengthening or shortening life[9]. Suspending or not initiating treatment at this point is morally equivalent actions and both are acceptable, but they have to be consistent with the patient's wishes. It is assumed that we cannot deny food or drink and conclude that these actions are characteristic of basic care and, therefore, required in any case. However, this assumption is not quite defined since withdrawing liquids and foods does not always contribute to increasing suffering, but can, however, prevent or improve it[14,15].

The inability to eat by mouth may have effects on the quality of life by restricting social interaction, causing troublesome symptoms such as dry mouth and loss of self-esteem to interfere in one of the basic activities of life[16]. In virtually all cultures, food has not only the function of nourishing but also contains social (community building) and emotional nuances (affective value). Moreover, nutrition is indeed a basic human right and is a concern for the patient and their family. In this way, we can maintain the nutritional intervention, motivated by the emotional charge, even if it is futile and we know in advance that this administration will not nourish effectively[17]. However, in certain scenarios, artificial nutrition may come to be regarded as disproportionate, involving undue hardship or significant physical discomfort. Nutrition and hydration of the patient are never disproportionate or useless, except in the moments of agony; what may be disproportionate are the means used for this. The instruments of restraint to keep the feeding tube in place are ethically justified for sustaining life during acute illness, in reversible and some irreversible cases of chronic disease in which the patient has lost the ability to reason about the advantages of artificial nutrition[14]. If the patient refuses nutritional treatment, he has the right to decide and receive a second opinion or be referred to palliative care[13]. The European Association of Palliative Care advised that while the patient is not in agony, they must be assured of hydration, even if by artificial means[16]. The sensations of thirst and dry mouth can be relieved by offering ice, gauze soaked in water, or Vaseline to wet the mouth. Furthermore, it is important to maintain good oral hygiene to prevent infections and sore mouth. The findings of multiple studies suggested that administration of artificial hydration is unnecessary in the dying patient; the majority of palliative care units accept that oral hydration is a measure of basic care that provides comfort to the patient in a terminal situation[12-18]. There is general agreement among experts in bioethics for not maintaining treatment if this is considered futile. However, there is no unanimity on whether artificial hydration and nutrition or therapeutic measures are part of the concept of palliative care[12]. It is clear that it is unethical to interrupt hydration and nutrition or to withhold them if the patient's death will be a consequence of that decision. However, giving water and food are not medical acts and cannot be considered cases of therapeutic cruelty, at least not until the evidence that

they are totally useless is strong, i.e. evidence that the body is unable to assimilate them. Regarding ethical considerations, three important questions must be answered: What is the goal of treatment? And, in whom and when should it be used? Hence, we need to ask whether death will be caused by lack of food or by the underlying disease. If the lack of nutrition and hydration is bad for the patient (causes death or acceleration or causes other conditions) it is unethical to suppress them, unless it is thought to be futile[16]. It is a medical obligation to inform if there are better choices excluding the ones in the public health system. A patient may reject some measures because they deem them harmful, but others can be considered acceptable, and therefore it would be easier to handle. The family should only interfere in the absence of the patient's will[17]. Autonomy and self-determination indicate that patients have the right to decide for themselves whether or not they desire medical therapy. Providing unwanted care contradicts this ethical principle and could infringe on the patient's dignity. We cannot stop seeing the patient as a human being, endowed with feelings and expectations, and entitled to make their own decisions in their lives, but also in the process of their death[5-9].

TO START OR TO FINISH ARTIFICIAL NUTRITION AND HYDRATION

To suspend or not to implement a treatment to sustain life are common questions in terminal illness. Suspending or not implementing treatment are morally equivalent, at least from an ethical perspective[9]. The goal of providing artificial nutrition and hydration is both the perceived benefit and the patient's tolerance to treatment, but also an improvement in nutritional and hydration status, life quality, and prognosis, or patient survival. The decision to start artificial nutrition and hydration is rather complex and is intertwined with social, religious, and psychological conflicts and misperceptions of indications, both among physicians, nutritionists, patients, and caregivers. That is why knowledge of a patient's life expectancy is essential for decision-making[6,19]. When assessing the removal of nutritional support, several issues could be found that can cause difficulties at the agony stage. Some of the most common are fear of dehydration and hunger. The multidisciplinary team should explain clearly that the cause of a patient's death is the underlying disease and not the cessation of nutrition or hydration therapy. In an ideal practice, only therapies with an adequate relationship between the procedures and the predictable result should be applied, which means that we must refrain from actions that will not meet the patient's expectations. These interventions are known as "therapeutic obstinacy". An ethical strategy must include evaluating the costs involved, not only the financial but also physical, psychological, moral, and/or spiritual burdens that the implementation of therapies can imply for the patient, health team, and caregivers. Note that the patient's opinion is a priority. In a terminal patient, some of the therapies should not be considered any further; by contrast, to maintain therapies can promote dysthanasia (a bad death)[12-17]. If it has been decided to administer artificial nutrition and hydration, the multidisciplinary team should prioritize autonomy over beneficence. The risks and benefits of the procedures should be fully explained, and if they are accepted, the only ones that can decide whether the artificial nutrition and hydration provide any benefit are the patient or the primary caregiver, and they should be aware that this outweighs the risks of the procedure itself and must always be with informed consent[6].

EFFECTIVE COMMUNICATION WITH TERMINALLY ILL PATIENTS' CAREGIVERS

The multidisciplinary team should have sufficient knowledge and sensitivity to avoid seeing death as a theoretically preventable phenomenon or, even worse, as a medical failure[17]. It is preferable that all nutritional issues are discussed when patients are still able to make decisions, and the medical team should encourage them to express these decisions to their families and caregivers. Physicians should avoid complex language and ensure that patients and their families have understood all information because ineffective communication can provoke ethical problems later. It is essential that it be understood that palliative care will help by controlling pain and address issues of hygiene and, in spite of the incurable and progressive characters of the disease, the practice of palliative care should not be considered as a negative stigma.

The behavior of the physician or nutritionist can be influenced by trying to avoid conflict with caregivers or fear of legal issues. Not surprisingly, the use of artificial nutrition is the easy way out in many circumstances. However, although it requires more time and effort to advise patients and their caregivers about the complications and benefits of artificial nutrition and hydration, it is important to do so to avoid any ethical issues. The conflict may arise from the definition of "useless therapy". Multidisciplinary teams can perceive therapy as useless, while the families can see it as a way to prolong and improve life. If the goal of artificial nutrition and hydration is to restore the health of a patient with the terminal disease, then this type of therapy is useless, and the medical team is required

to discuss the risks and benefits with the patient and family. However, if the objective is to respect the beliefs and values of the patient or provide a means to alleviate symptoms, then it cannot be considered a useless treatment. If conflicting views persist, an enquiry must be made to an ethics committee. While it is possible to give a rough idea of how long the patient might live, it is more than anything a strategy that allows driving management procedures related to death, and also supports the farewell between the patients and caregivers. An estimate of survival is not intended as a judgment to bring suffering and fear to the family[18-20].

There is evidence that patients with terminal illness are afraid of the unknown and suffer less physically and psychologically if the information that they want is provided. For example, loss of appetite is often distressing and can cause stress in the family because "the patient does not eat enough", and the patient may also be concerned. Fears, myths, and misconceptions can be addressed by providing information, explaining to the patient and family that liquids are not the same as the food, dehydration does not mean suffering, force-feeding a dying patient can tire the patient, eating cannot reverse the underlying process, and that the loss of interest in food is a natural and common phenomenon when close to death[14]. The multidisciplinary team should explain in simple terms that the scientific evidence suggests that the use of artificial hydration or nutrition at agony is reserved for special cases, and it is essential to make it as clear possible that the presence of thirst at the end of life is not only because of dehydration[21,22]. The family must be helped to understand that artificial nutrition and hydration are strategies that, when reaching the patient's last days of life, are not always needed because they would not lead to benefits[23]. It is necessary to train to caregivers to recognize the signs and symptoms of death, so they will be informed and prepared to face the patient's death and, in this way, increase the chances to provide comfort and peace effectively[18].

CONCLUSIONS

Given the demographic transition, it is very important to promote health policies that establish a strong academic background and rethink education in schools and faculties to achieve adequate palliative medicine knowledge about the challenge that this represents for the aging population to treat respectfully and ethically the terminally ill elderly patients. Training from a professional model shows that palliative care can be applied at all levels of health, understanding that health and disease along with life death binomial are biopsychosocial processes that interact together under all circumstances. Although lacking well-designed studies to evaluate the benefit of artificial nutrition at the end of life in the elderly, it is suggested not to provide artificial nutrition or hydration to patients who are at the end of life only to calm the concerns of the families about the lack of hunger or thirst. The evidence suggests that it is common to have no appetite and or thirst in agony and

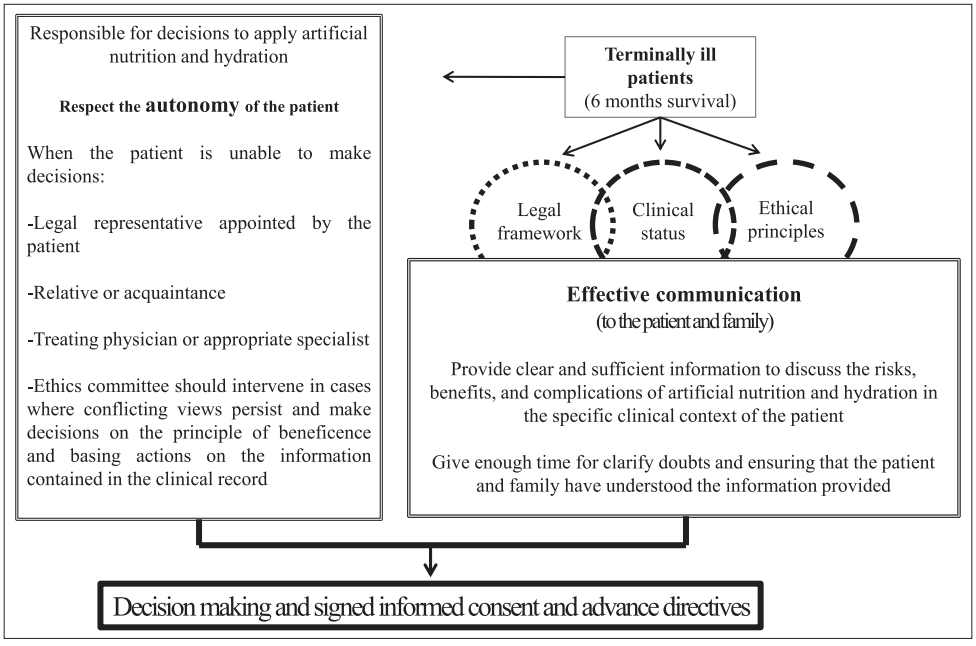

Figure 1. *Model of integration of legal framework and ethical principles in decision-making in artificial nutrition and hydration.*

that artificial nutrition or hydration will not prolong life, improve the overall function, nor prevent bronchial aspiration, neither will it reduce pressure ulcers or improve or prevent delirium. The main objective of artificial nutrition should be providing food for patients whose both life expectancy and quality can be improved with this treatment, as in the specific cases of persistent vegetative state and in patients in cancer treatment that will not allow feeding by mouth. The action of providing artificial hydration palliation depends on patient preference, which is more ethical than medical grounds. The different ethical dilemmas that arise at the end of life can be avoided through good communication with the patient, the family, and the presence of informed consent and advance directives (Fig. 1 Author´s original).

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