

# Prevalence of multimorbidity in subjects aged $\geq 60$ years in a developing country

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**Background:** Aging is one of the most prominent features in recent population dynamics around the world. As populations age, the prevalence of simultaneous chronic diseases increases, which is known as multimorbidity.

**Objective:** The aim of the present study was to determine the prevalence of multimorbidity and associated factors in a sample of elderly Mexican subjects.

**Materials and methods:** A cross-sectional descriptive study was performed on a convenience sample of 139 subjects aged  $\geq 60$  years. The dependent variable was the multimorbidity diagnosis performed by a physician, which was categorized as 0 for subjects with no chronic disease or only 1 disease and 1 for subjects with 2 or more chronic diseases. Questionnaires were used to collect the information on the different variables. A statistical analysis was performed in Stata 11.0.

**Results:** The mean age was  $79.06 \pm 9.78$  years, and 69.1% of the subjects were women. A total of 69.1% (95% confidence interval = 61.3–76.8) reported at least 1 morbidity. The mean morbidity by subject was  $1.04 \pm 1.90$ . Cardiovascular diseases (25.9%), hypertension (20.1%), musculoskeletal disorders (19.4%), and diabetes (13.7%) were the most frequently reported conditions. The prevalence of multimorbidity (2 or more diseases) was 27.3% (95% confidence interval = 19.8–34.8). No significant differences were observed in the independent variables.

**Conclusion:** In conclusion, the prevalence of multimorbidity in this sample of elderly Mexican subjects was relatively low. The distribution across the included variables was not significantly different. Interventions focused on the health care of older adults with multimorbidity should pay special attention to cardiovascular diseases, hypertension, and musculoskeletal disorders.

**Keywords:** older adults, multimorbidity, cardiovascular disease, hypertension

## Introduction

Aging is one of the most prominent features in recent population dynamics around the world. It is partly a result of a sustained decline in fertility levels, a decline in overall mortality and immigration, and an increase in population life expectancy.<sup>1</sup> The aging of the population in Mexico is one of the most important challenges facing the country. In a short time, the elderly population will increase relative to other age groups. People aged  $\geq 65$  years accounted for 3.7% of the total population in 1970, 6.3% in 2010, and 10.4% in 2015. However, by 2050, they are expected to account for 22.5%. This implies changes in work and production capacities, as well as in the demand for goods and facilities, health services, social security, and family relations. Thus, one of the main challenges of aging is health and determining the origin of the associated dependencies and vulnerabilities. Chronic, degenerative, and incapacitating diseases that occur at advanced ages require specialized medical attention and are extremely costly, incurring out-of-pocket expenses when health insurance is not available, and even catastrophic expenses leading to impoverishment in some cases.<sup>2,20</sup> Additionally, the prevalence of

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simultaneous chronic diseases increases,<sup>2</sup> which is known as multimorbidity. Based on a systematic review of the scientific literature, the European General Practice Research Network identified 132 definitions in 416 papers and established the following definition: “Multimorbidity is defined as any combination of a chronic disease with at least one other disease (acute or chronic) or with a psychosocial factor (associated or not) or with a somatic factor.”<sup>3</sup> Increased multimorbidity leads to polypharmacy, which is the greater use of medical and social services as well as restrictions on activity, making it a public health problem.<sup>4</sup>

From an epidemiological point of view, between 60% and 80% of the elderly now present at least 1 chronic illness as a result of the aging population. The negative consequences include increased risk of disability, frailty, hospitalization, institutionalization, and reduction of quality of life, as well as associations with mortality.<sup>5–7</sup> Therefore, aging and chronic diseases represent some of the greatest challenges for health systems because they are also highly expensive. Thus, the planning of health care services at the primary care level should take this phenomenon into account among the elderly.<sup>7,8</sup>

In several countries, the prevalence of multimorbidity in the elderly population and its impact on health care spending have led health agencies to begin addressing the problem and to explore the ways to improve health and function.<sup>9</sup> The percentages of multimorbidity observed in other studies around the world are higher than 60%.<sup>4,6,9,12</sup>

Studies on the prevalence of multimorbidity in the elderly are scarce in developing countries. In Mexico, there is little epidemiological research on health in the elderly. According to the National Health and Nutrition Survey 2012, in Mexico, 27.8% (95% confidence interval =26.2–29.5) of people aged  $\geq 60$  years present multimorbidity.<sup>14</sup> The objective of the present study was therefore to determine the prevalence of multimorbidity and associated factors in an elderly Mexican sample.

## Materials and methods

### Design, population, and study sample

A descriptive cross-sectional study was conducted on subjects aged  $\geq 60$  years who were either living in long-term care facilities or living independently and attending an adult day care group in the city of Pachuca, Hidalgo, Mexico. Part of the methodology has been published previously.<sup>15–17</sup> After obtaining the corresponding permissions, the candidates were invited to participate in the study and were informed of the objectives of the investigation and the confidentiality about

the data management. The inclusion criteria were as follows: 1) subjects of either sex, 2)  $\geq 60$  years of age, 3) authorized to participate in the research, and 4) enrollment in the aforementioned groups. No sampling was performed, and the participants were volunteers who agreed to participate in the study. The total initial population consisted of 151 subjects, of whom 139 accepted to participate and met the inclusion criteria.

### Variables and data collection

We used questionnaires aimed at the elderly and applied by trained personnel to collect the information on sociodemographic, socioeconomic, and general health variables. The response variable was the self-report of morbidities previously diagnosed by physicians and measured according to the health problems presented in Table 1. Multimorbidity was operationalized by counting the diseases/conditions and the combination of the diseases according to a cutoff point suggested in the literature, with 0 indicating subjects with no chronic disease or only 1 disease and 1 indicating subjects with 2 or more chronic diseases. The independent variables were age, sex, type of location, marital status, health insurance, pension/retirement, education, and smoking.

**Table 1** Prevalence of morbidity (of chronic diseases) in elderly people aged  $\geq 60$  years in Pachuca, Mexico

Morbidity	Frequency	Percentage
Cardiovascular diseases		
Yes	36	25.9
Hypertension		
Yes	28	20.1
Musculoskeletal disorders		
Yes	27	19.4
Diabetes		
Yes	19	13.7
Neurodegenerative disorders		
Yes	16	11.5
Kidney diseases		
Yes	5	3.6
Mental disorders		
Yes	5	3.6
COPD/asthma		
Yes	3	2.2
Visual impairment		
Yes	2	1.4
Hearing disorders		
Yes	2	1.4
Hypothyroidism		
Yes	1	0.7
Multimorbidity		
No (0–1 disease)	101	72.7
Yes (2 or more diseases)	38	27.3

**Abbreviation:** COPD, chronic obstructive pulmonary disease.

## Analysis of data

The information collected were analyzed in Stata 11.0® (StataCorp, College Station, TX, USA). A descriptive analysis of the sample was carried out, reporting measures of central tendency and dispersion for quantitative variables, as well as frequency and percentages for qualitative variables. Because all the variables were categorical, we used a  $\chi^2$  test in the bivariate analysis.

We also used latent class analysis to identify unobserved groups of individuals based on multimorbidity indicators. Latent class analysis empirically locates subgroups of individuals who are likely to provide similar responses.

## Ethical considerations

This study complied with the specifications of the general health law in research and with the scientific principles of declaration of Helsinki. All individuals signed informed consent forms. The protocol was approved at the Autonomous University of the State of Hidalgo.

## Results

The mean age was  $79.06 \pm 9.78$  years (median =80; Q1 =72 Q3 =87), and 69.1% of the subjects were women. Table 1 presents the prevalences of chronic diseases that were included to perform the calculation of multimorbidity. A total of 69.1% (95% confidence interval =61.3–76.8) reported at least 1 morbidity. The most frequent were cardiovascular diseases (25.9%), followed by hypertension (20.1%) and musculoskeletal disorders (19.4%). The overall prevalence of multimorbidity was 27.3% (95% confidence interval =19.8–34.8). The mean multimorbidity was  $1.03 \pm 0.90$  (median =1; Q1 =0 Q3 =2).

Tables 2 and 3 show the results of the descriptive analysis of the different independent variables and bivariate analysis. The  $\chi^2$  analysis showed no statistically significant

**Table 2** Differences of characteristics of patients living in long-term care facilities and patients living independently and attending an adult day care group

Variables	Type of location			p-values
	Publicly funded	Private	Adult day care center	
Age (years), n (%)				$\chi^2=15.86$
60–74	26 (55.3)	7 (14.9)	14 (29.8)	$p=0.003$
75–84	30 (63.8)	8 (17.0)	9 (19.2)	
85–100	28 (62.2)	16 (35.6)	1 (2.2)	
Sex, n (%)				Fisher's exact
Male	30 (69.8)	13 (30.2)	0 (0.0)	$p<0.001$
Female	54 (56.2)	18 (18.8)	24 (25.0)	

**Table 3** Distribution of multimorbidity in elderly people aged  $\geq 60$  in Pachuca, Mexico

Variables	Frequency (%)	Multimorbidity		p-value <sup>a</sup>
		No	Yes	
Age (years)				0.935
60–74	47 (33.8)	34 (72.3)	13 (27.7)	
75–84	47 (33.8)	35 (74.5)	12 (25.5)	
85–100	45 (32.4)	32 (71.1)	13 (28.9)	
Sex				0.257
Male	43 (30.9)	34 (79.1)	9 (20.9)	
Female	96 (69.1)	67 (69.8)	29 (30.2)	
Type of location				0.716
Publicly funded	84 (60.4)	59 (70.2)	25 (29.8)	
Private	31 (22.3)	24 (77.4)	7 (22.6)	
Adult day center	24 (17.3)	18 (75.0)	6 (25.0)	
Marital status				0.839
Single	52 (37.4)	38 (73.1)	14 (26.9)	
With a spouse	25 (18.0)	17 (68.0)	8 (32.0)	
Divorced/widowed	62 (44.6)	46 (74.2)	16 (25.8)	
Health insurance				0.566
Yes	64 (46.0)	45 (70.3)	19 (29.7)	
No	75 (53.0)	56 (74.7)	19 (25.3)	
Pension/retirement				0.450
No benefit	105 (75.5)	78 (74.3)	27 (25.7)	
With benefit	34 (24.5)	23 (67.6)	11 (32.4)	
Schooling				0.810
Elementary and more	49 (35.2)	35 (71.4)	14 (28.6)	
Less than elementary	90 (64.8)	66 (73.3)	24 (26.7)	
Current tobacco use				0.607
No	117 (84.2)	86 (73.5)	31 (26.5)	
Yes	22 (15.8)	15 (68.2)	7 (31.8)	

Note: <sup>a</sup> $\chi^2$  test.

differences in any of the sociodemographic, socioeconomic, or risk variables.

Descriptive statistics for latent class analysis variables are shown in Table 4. None of the models provides an adequate fit ( $p$ -values were  $<0.05$ ).

## Discussion

In this study, it was not possible to identify the variables associated with the prevalence of multimorbidity, which was 27.3%. This percentage is lower than those observed in other studies around the world, where prevalences of multimorbidity higher than 60% are observed<sup>4,6,9,12</sup> but are similar to a previous analysis in Mexico.<sup>14</sup> For example, in Brazil, the observed prevalence is 81.3% among people aged  $\geq 60$  years.<sup>10</sup> In Spain, the prevalence of reported multimorbidity is between 64.1%<sup>4</sup> and 67.5% in subjects aged  $\geq 65$  years.<sup>11</sup> In Burkina Faso, the prevalence was 65% in adults aged  $\geq 60$  years.<sup>12</sup> In another study, the prevalence of multimorbidity ranged from 24.7% in Switzerland to 51.0% in Hungary among 16 European countries (National

**Table 4** Summary statistics for each model estimated

Number of clusters	LL	BIC (LL)	AIC (LL)	AIC3 (LL)	Entropy	Number of parameters	L <sup>2</sup>	DF	p-value	Class errors
1	-413.980	933.178	873.960	896.960	1.000	23	252.102	74	<0.0001	0.000
2	-357.671	930.354	809.342	856.342	1.000	47	139.485	50	<0.0001	0.000
3	-342.834	1,010.472	827.668	898.668	0.822	71	109.810	26	<0.0001	0.038
4	-331.981	1,098.560	853.962	948.962	0.884	95	88.104	2	<0.0001	0.040

**Notes:** L<sup>2</sup> = The model L<sup>2</sup> statistic, which indicates the amount of the association among the variables that remains unexplained after estimating the model. None of the models provides an adequate fit (p-values were <0.05).

**Abbreviations:** L, maximum value of the likelihood function; AIC, the Akaike information criterion; BIC, Bayesian information criterion.

representative samples of individuals aged  $\geq 50$  years in Austria, Belgium, Switzerland, Germany, Denmark, Spain, France, Italy, the Netherlands, and Slovenia).<sup>13</sup> In these studies, the most frequent condition was hypertension. However, there is a lack of consensus on the number and type of health conditions that should be included in the measurement of multimorbidity, which makes it difficult to estimate its prevalence accurately.<sup>4</sup> The most prevalent diseases in this Mexican study were cardiovascular problems and hypertension, as in Spain,<sup>4</sup> Brazil,<sup>6</sup> Burkina Faso,<sup>12</sup> and several European countries.<sup>16</sup> The comparability of multimorbidity studies is hampered by methodological differences, which are mainly related to the type and number of conditions included in the multimorbidity case definition, the instruments used to measure morbidity, how they were measured, and the population of origin,<sup>9-11,18</sup> even within the same country.<sup>14</sup> Existing instruments are characterized by their large heterogeneity, ranging from considering only a few (4 diagnoses) to 185 different diseases.<sup>19</sup> These discrepancies have been widely discussed in various studies, which suggests a need to standardize the instruments in studies on multimorbidity. In a systematic review, Salive<sup>9</sup> mentions that the differences in the prevalences between the studies are probably due to methodological differences rather than actual differences, and it is difficult to find 2 studies that use the same methods. The reported prevalence of multimorbidity is lower in studies with fewer than 10 chronic conditions. However, in studies with 15 conditions, more than 90% may present multimorbidity. Thus, the validity and reliability of the method used to determine a chronic condition affect the prevalence of multimorbidity. In addition, few studies use clinical examination at the time of measurement, and most rely on self-report of clinical diagnosis.<sup>9</sup>

One of the limitations of the present investigation is that it was a cross-sectional study with self-reported data, so there may be subjects with undiagnosed chronic conditions. This could be the reason for the relatively low prevalence of multimorbidity in this study. Another limitation is the small size of the sample. In addition, the fact that the participants

were institutionalized subjects and not community dwelling could introduce some selection bias. Besides, the study used questionnaire to collect data, and this will introduce a recall bias, which is another limitation.

## Conclusion

In conclusion, the prevalence of multimorbidity in this sample of elderly Mexican subjects was relatively low. No variables related to the prevalence of the event were detected. Due to the limited information available in Mexico, more studies on the prevalence of multimorbidity are needed to visualize the scenario. It is also necessary to measure the impact that multimorbidity has on the quality of life among the elderly.

## Author contributions

Horacio Islas-Granillo and Carlo Eduardo Medina-Solis were involved in the design and development of the study. Carlo Eduardo Medina-Solis designed the study, analyzed the data, and wrote the first draft of the manuscript. María de Lourdes Márquez-Corona, Rubén de la Rosa-Santillana, Miguel Ángel Fernández-Barrera, Juan José Villalobos-Rodelo, César Tadeo Hernández-Martínez, José de Jesús Navarrete-Hernández, and Martha Mendoza-Rodríguez were involved in the conception of the paper, analysis, and interpretation of the results. All authors contributed toward data analysis, drafting and revising the paper and agree to be accountable for all aspects of the work. All the authors were involved in the critical review and made intellectual contributions, and they also accepted the final version.

## Disclosure

The authors report no conflicts of interest in this work.

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