

# Preventive health services and physical activity improve health-related quality of life in Mexican older adults

Katia Gallegos-Carrillo, MSc, DSc,<sup>(1,2)</sup> Yesenia Honorato-Cabañas, MD,<sup>(3)</sup> Nayeli Macías, MSc,<sup>(4)</sup>  
Carmen García-Peña, MD, MSc, PhD,<sup>(5)</sup> Yvonne N Flores, MPH, PhD,<sup>(1,6)</sup> Jorge Salmerón, MD, MSc, DSc.<sup>(1,7,8)</sup>

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## Abstract

**Objective.** To evaluate the combined use of IMSS preventive health services (PHS) and the practice of physical activity (PA) in order to determine their association with the perceived health-related quality of life (HRQoL) of older adults. **Materials and methods.** A survey-based cross-sectional study was conducted at nine primary health care units (PHCUs) in Mexico City. The 36-Item Short-Form Health Survey evaluated the HRQoL, while PA and PHS use were assessed through self-report. Linear regression analyses were performed to determine the relationship between these three variables. **Results.** Of the 1 085 older adults who participated in the study, 36.8% used PHS, and 23.3% reported that they engage in PA. After controlling for possible effects due to sociodemographic and health differences, we found that participants who were physically active and used PHS reported better perceived HRQoL scores. **Conclusions.** The combined use of preventive practices such as the use of PHS and the practice of PA can help improve the perceived HRQoL of older adults.

**Keywords:** health-related quality of life; physical activity; preventive health services; older adults; Mexico

## Resumen

**Objetivo.** Determinar la asociación del uso combinado de servicios de salud preventiva (SSP) y la práctica de la actividad física (AF) sobre la calidad de vida relacionada con la salud (CVRS) de los adultos mayores en México. **Material y métodos.** Estudio transversal en unidades de atención primaria. La percepción de CVRS fue evaluada a través del instrumento SF-36; el nivel de AF, y el uso de SSP, a través de auto-reporte. Se realizaron análisis de regresión lineal para determinar la relación entre estas tres variables. **Resultados.** De los 1 085 adultos mayores que participaron en el estudio, 36.8% usaron SSP y 23.3% informaron practicar AF. Los adultos mayores físicamente activos y que usaban SSP reportaron una mejor puntuación de CVRS percibida, ajustando por variables de salud y sociodemográficas. **Conclusiones.** Prácticas preventivas como la actividad física en conjunto con el uso de servicios preventivos pueden ser útiles para mejorar la percepción de CVRS de los adultos mayores.

**Palabras clave:** calidad de vida relacionada con la salud; actividad física; servicios de salud preventivos; adulto mayor; México

- (1) Unidad de Investigación Epidemiológica y en Servicios de Salud, Instituto Mexicano del Seguro Social. Cuernavaca, México.
- (2) Department of Preventive Medicine, Keck School of Medicine, University of Southern California. Los Angeles, USA.
- (3) Unidad de Medicina Familiar núm. 20, Instituto Mexicano del Seguro Social. Cuernavaca, México.
- (4) Centro de Investigación en Nutrición y Salud, Instituto Nacional de Salud Pública. Cuernavaca, México.
- (5) Departamento de Investigación, Instituto Nacional de Geriátrica. Ciudad de México, México.
- (6) UCLA Department of Health Policy and Management, Fielding School of Public Health and Jonsson Comprehensive Cancer Center. Los Angeles, USA.
- (7) Centro de Investigación en Salud Poblacional, Instituto Nacional de Salud Pública. Cuernavaca, México.
- (8) Centro de Investigación en Política, Población y Salud, Facultad de Medicina, Universidad Nacional Autónoma de México. Ciudad de México, México.

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Corresponding author: Dr. Katia Gallegos-Carrillo. Unidad de Investigación Epidemiológica y en Servicios de Salud, Morelos, Instituto Mexicano del Seguro Social. Boulevard Benito Juárez 31, col. Centro. 62000 Cuernavaca, Morelos. México.  
E-mail: kgallegosc13@gmail.com

The ageing process presents a challenge to both society and health systems, but the impact of this process can differ by country. For example, Japan has had many decades to adapt to the increasing rates of older adults, while others less developed countries like Brazil have been undergoing an ageing process for fewer years.<sup>1</sup> In Mexico, the population aged 60 years and older currently represents 10.4% of the total population,<sup>2,3</sup> but by 2050, an estimated one fourth of all Mexicans will be in this age group.<sup>4</sup> The Mexican health system needs to be prepared for the more than doubling increase of the elderly population in the next 30 years.

In Mexico, population aging also has an impact on healthcare expenditures. Mexican families with at least one older adult have healthcare expenditures that are 50.7% higher than those of families without an elderly member.<sup>5</sup> However, new notions about healthy ageing indicate that old age does not necessarily have a negative impact on health systems.<sup>6,7</sup>

Health promotion in the primary healthcare setting is a key strategy to improve the health status and quality of life of older adults, which may help address certain challenges of population aging worldwide.<sup>8</sup> Studies have suggested that health care needs of the elderly can be better addressed if health care, health promotion and welfare services are integrated.<sup>9-11</sup> However, older adults, and the general population, tend to seek healthcare services to treat diseases, instead of looking for health promotion or preventive care services.<sup>12</sup>

In Mexico, health sector offers health care services as well as preventive health services (PHS) to its insured population, through institutions like the Mexican Institute of Social Security (*Instituto Mexicano del Seguro Social, IMSS*), at its sports facilities and clinical settings.<sup>13</sup> Since 2014, Mexican health sector has implemented initiatives to encourage health promotion practices through availability and utilization of PHS, such as immunizations and health education sessions, including oral health, and activities to increase physical activity (PA) and promote a balanced diet to improve the well-being of population.<sup>14,15</sup> However, little has been reported, within the context of IMSS in Mexico, about the impact of this type of approach, which includes health promotion programs and activities, to improve life quality and well-being of elderly population.

Previous studies that assessed the relationship between health promotion practices, PA and the perceived HRQoL of older adults have evaluated both strategies separately. For example, one study that focused on health promotion practices found that a health education intervention specifically tailored for older adults was associated with positive changes in the HRQoL of the participants.<sup>16</sup> Other studies have shown that

PA is associated with quality of life and is essential for successful ageing. A few studies have examined the impact of health promotion practices jointly,<sup>17</sup> and some of them have found that disease prevention reduces functional dependence and preserves individual autonomy among the elderly.<sup>18,19</sup> Nevertheless, based on our review of literature, there is scarce information regarding how health promotion practices can contribute to the HRQoL of older adults.<sup>20</sup> The purpose of this study was to evaluate the combined use of IMSS preventive health services (PHS) and physical activity (PA) in order to determine their association with the perceived HRQoL of older adults. Our hypothesis was that older adults who engage in both health promotion practices would perceive their HRQoL as better, compared to those who do not.

## Materials and methods

### Study design and population

A survey-based cross-sectional study was conducted among older adults of both sexes assigned to nine PHCUs (Primary Healthcare Units) at IMSS in Mexico City, which have a population of 131 288 individuals aged 60 and older. IMSS is a mandatory social security health system, whose beneficiaries are affiliated with a specific PHCU based on their home address. IMSS offers a comprehensive package that includes health care services as well as economic and social security benefits. Other benefits include preventive programs to encourage health promotion practices such as PA at IMSS sports facilities known as Social Security Centers. These programs are available to IMSS affiliates for a nominal fee, or for free in the case of older adults and patients with diabetes, hypertension or obesity. The study participants were selected through a simple random sampling of IMSS affiliates at nine PHCUs in Mexico City, which was obtained from a list of IMSS affiliates in 2007. This sampling method was used to obtain a representative sample of older adults who are IMSS affiliates that included all the PHCU in the administrative zone. Differences in the size and sociodemographic characteristics of the population affiliated to the nine PHCUs were taken into consideration. The number of participants selected from each PHCU was proportional to the size of its total population; the participants were stratified by age and sex.

Data collection activities took place in Mexico City during 2008 and were performed by previously trained personnel who administered structured questionnaires in person at the participants' homes, using names and address provided by the registry of the PHCUs. The

study staff visited each participant's home in order to collect information about their use or lack of use *IMSS* preventive services. We included *IMSS* affiliates who were neither in the terminal phase of an illness nor cognitively impaired, as determined by a validated Spanish version of the Mini-Mental State Examination (MMSE) adapted for the Mexican population.<sup>21</sup> A threshold of 23 points or less was used to indicate cognitive impairment. A total of 1 150 participants were enrolled from our estimated sample size of 1 380 subjects, with a 20% response rate. There was a non-response rate of 17%, and the main reasons stated for not participating were lack of time (6%) and lack of interest in the study (9%).

### Health-related quality of life (HRQoL)

The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) was used to assess HRQoL.<sup>22</sup> Adapted and validated in Spanish,<sup>23,24</sup> the original questionnaire consists of 36 items that use a Likert scale to assess HRQoL in the four weeks prior to administration. The questions test eight dimensions, namely: physical functioning (PF); role limitations caused by physical problems (Role-Physical or RP); bodily pain (BP); social functioning (SF); overall mental health and psychological stress (MH); role limitations caused by emotional problems (Role-Emotional or RE); vitality, energy and exhaustion (Vitality or VT), and general health perception (General Health or GH). The PF, RF and BP dimensions cover the physical health components, while SF, RE and MH represent the psychological components; lastly, VT and GH measure the respondents' subjective perceptions of health. Each dimension was converted to a scale from 0 to 100, where the highest values indicate better functioning and fewer limitations.<sup>25</sup>

### Use of preventive health services (PHS)

To define use of PHS in the last 12 months, we employed a measure that considered all of the PHS provided to adults aged 60 or more years. This allowed us to take into account the comprehensive nature of different types of PHS provided at *IMSS* facilities. The following variables were considered to determine the use of PHS and its association with HRQoL: 1) Screening for chronic conditions and for the following risk factors: a) high blood pressure (hypertension), b) high glucose levels (diabetes), c) high levels of cholesterol (cholesterolemia); and c) overweight and obesity; 2) health promotion activities such as: a) application of vaccines, b) preventive dental procedures (application of fluoride); and c) health education classes that focus on self-care and healthy lifestyles offered by the staff at the PHCUs. These

variables were selected based on the types of services provided at *IMSS* as part of an institutional prevention program known as *PREVENIMSS*.<sup>14</sup> A summary scale was built to categorize whether or not participants used these preventive services, considering yes/no as the two response options. Self-reported information about screening conditions has previously been used within the Mexican context to measure PHS.<sup>12</sup>

### Physical activity

Physical activity (PA) was assessed as a component of the participants' healthy lifestyle, regardless of their use of the PHS provided at *IMSS*. This was done to determine the independent association between PA and perceived HRQoL. PA was measured and coded using the following criteria: frequency, intensity, and duration. To be considered physically active, participants had to: 1) practice PA at least three times a week for 30 minutes or more; 2) engage in PA with a moderate-to-vigorous intensity, and 3) participate in PA during the six months prior to the interview. Based on these criteria, participants indicated by self-report whether or not they were physically active. The PA variable was categorized as yes/no.

### Sociodemographic data and modifiable health risk factors

Participants provided the following sociodemographic data: age, sex, marital status, education level, and occupation. In addition, we assessed frequency and intensity of alcohol intake and tobacco use. This information was coded as indicators of modifiable risk factors.

### Health status

The participants' health status was determined based on their self-report of the following conditions in the previous month: health problems, discomfort, or bodily injury caused by an accident or aggression. Any report of the aforementioned conditions was considered a health issue.

### Statistical analyses

We determined frequencies and calculated differences between sociodemographic characteristics and the main exposure variables (PA practice and use of PHS) using  $\chi^2$ . Next, we conducted analysis to determine the distribution of the HRQoL, PA and PHS variables. Eight HRQoL scales were included, and their means and standard deviations were calculated according

to the sociodemographic characteristics of the elderly adults. In addition, we assessed the mean differences between the participants for each of the eight scales of HRQoL according to PA practice (physically active/physically inactive) and PHS use (users/non-users), by means of one-way variance analyses (ANOVA) and a Bonferroni comparison.

The following four groups were created to examine the association between use of PHS, PA and the eight HRQoL dimensions among elderly adults: 1) group 1: physically inactive and non-users of PHS (reference), 2) group 2: physically inactive and users of PHS, 3) group 3: physically active and non-users of PHS, and 4) group 4: physically active and users of PHS. Multiple linear regression analyses were performed for the eight HRQoL scales using the four aforementioned groups. Models were adjusted by sociodemographic and health status variables, as well as by alcohol and tobacco consumption. Inferences were drawn at  $<0.05$  level of significance. Statistical analyses were performed using Stata 12.1 software.\*

### Ethical considerations

All study subjects signed an informed consent form prior to enrollment and to commencing study activities. In compliance with the institutional guidelines of IMSS, we offered no incentive or financial compensation for participation in this study. The IMSS Research and Ethics Committees evaluated and approved all study materials and procedures. Data collection activities were performed by previously trained personnel, who administered a structured, in-person survey at the participants' homes.

## Results

Table I reports the sociodemographic characteristics and health status of the study population. A total of 65 subjects with incomplete information were eliminated, and 1 085 elderly adults with complete data were included as participants in this study. A total of 397 participants reported that they used PHS, and 253 indicated that they engaged in PA. The mean age of the participants was 71.5 years (ranging from 60 to 98 years). Most of the study population had little or no formal education (20% had no schooling), and nearly 30% of the participants were widowed. Over 60% of study subjects indicated that they did not have health issues during the month prior to the interview.

\* Stata, College Station, TX, USA.

More than 35% of the study participants reported that they used preventive health services at IMSS PHCUs over the last 12 months. Use of PHS was slightly higher among females (38%) than among males (35%), while males were more likely to engage in PA (25%) than females (22%). Use of PHS and PA practice declined with age, but both were found to increase with number of years of schooling. Widowed respondents were more likely to use PHS than those who were married or single, while married respondents were more likely to engage in PA than single or widowed respondents. Participants who reported having health issues were less likely to use PHS (42%), and less than a fourth of them practiced physical activity (table I).

Table II presents the sociodemographic and health status results by each of the eight HRQoL scales. Female participants reported higher physical functioning (PF), social functioning (SF), mental health (MH) and vitality (VT) scores than males, but had lower scores for physical role (RP), emotional problems (RE), bodily pain (BP) and their general health perception (GH). The largest gaps between males and females were observed in emotional problems (RE) and general health perception (GH), with a difference of 22 and 20 points, respectively. However, when the independent variables PA practice and PHS utilization were included, the HRQoL results shifted across all dimensions according to sex, with male participants obtaining the highest scores (data not shown). Scores for all eight scales were found to decrease with increasing age, and the highest scores were reported by respondents who were more educated, married, and did not have health issues.

We also examined the eight HRQoL scales in relation to PA and PHS. The results shown on table III indicate that elderly adults who practiced PA scored higher across all HRQoL scales than those who did not ( $p<0.001$ ). Mean differences—of 29 and 28 points—were greatest for the RP and RE dimensions, respectively, between those who engage in PA and those who do not. For MH the difference was only of 9 points, but it was still statistically significant ( $p<0.001$ ). Similar results were observed when we compared elderly adults who use PHS to those who do not. Significant differences were found in all dimensions except for MH, and the greatest differences were observed in the RP and RE dimensions (14 and 18 points, respectively).

Table IV presents our analysis of the combined effect of using PHS and engaging in PA on HRQoL. Those who practice PA and use PHS (group 4) scored higher across all eight HRQoL scales than those who do not practice PA or use PHS (group 1) and those who practice only one preventive behavior (groups 2 and 3). Significant differences were found between group

**Table I**  
**SOCIODEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION BY USE OF PREVENTIVE HEALTH SERVICES AND PRACTICE OF PHYSICAL ACTIVITY (N=1 085). MEXICO, IMSS, 2008**

Sociodemographic characteristics	Study population	Use of preventive health services		Physically active*	
	n (%)	n (%)	p-value	n (%)	p-value
<b>Sex</b>					
Male	455 (41.9)	158 (34.7)	0.279	116 (25.5)	0.150
Female	630 (58.1)	239 (37.9)		137 (21.7)	
<b>Age (years)</b>					
60-64	230 (21.3)	97 (42.2)	0.050	81 (35)	0.000
65-69	244 (22.6)	106 (43.4)	0.012	87 (36)	0.000
70-74	239 (22.2)	92 (38.5)	0.501	48 (20)	0.162
75-79	174 (16.1)	56 (32.2)	0.183	26 (15)	0.004
80-84	139 (12.1)	31 (23.8)	0.001	9 (6)	0.000
≥85	59 (5.7)	13 (21.3)	0.011	2 (3)	0.000
<b>Education level</b>					
None	221 (20.4)	56 (25.3)	0.000	13 (5.9)	0.000
Elementary	562 (51.8)	199 (35.4)	0.403	114 (20.3)	0.014
Middle school or more	215 (27.8)	142 (35.8)	0.000	87 (41.7)	0.000
<b>Marital status</b>					
Married	718 (66.2)	250 (34.8)	0.090	205 (28.5)	0.000
Single	53 (4.9)	19 (35.8)	0.909	9 (16.9)	0.263
Widowed	314 (28.9)	128 (40.8)	0.608	39 (12.4)	0.000
<b>Health problems</b>					
Yes	401 (37.0)	169 (42.1)	0.004	60 (14.9)	0.000
No	684 (63.0)	228 (33.3)		193 (28.2)	

\* Physically active: practice of 150 minutes of moderate to vigorous PA per week, this variable was operationalized based on information regarding frequency, intensity and duration of physical activity practice during six months prior to the interview; p-value obtained by Pearson's chi-square test

Percentages by row

Differences calculated by chi-square of each sociodemographic variable based on comparisons of users vs non-users of PHS and physically active vs. physically inactive

1 and group 2 (those who use PHS but do not engage in PA) in the PF, MH and VT dimensions. Significant differences in the PF, RP, RE and GH dimensions were observed between group 1 and group 3 (those who engage in PA but do not use PHS). The differences in HRQoL that were reported between group 1 and group 4 were substantially greater than those reported by participants in groups 2 and 3, and they were all statistically significant at the  $p < 0.001$  level.

The results of adjusted regression analyses that examined the association between PA practice and use of PHS on HRQoL are reported in table V. Regression analyses indicate that elderly adults who practice PA and use PHS (group 4) have higher scores across all the HRQoL dimensions than group 2 (those who do not engage in PA, but use PHS) and group 3 (those who engage in PA, but do not use PHS). After adjusting for sex, age, education, marital status, health problems in

**Table II**  
**PERCEIVED HEALTH-RELATED QUALITY OF LIFE (HRQoL) ACCORDING TO SOCIODEMOGRAPHIC CHARACTERISTICS (N=1 085). MEXICO, IMSS, 2008**

	HRQoL scales							
	PF Mean DE	SF Mean DE	RP Mean DE	RE Mean DE	MH Mean DE	VT Mean DE	BP Mean DE	GH Mean DE
Sex								
Male	66.3 (31.6)	74.0 (21.8)	40.9 (43.1)	48.4 (42.3)	64.7 (16.4)*	61.1 (16.5)	70.3 (24.5)	48.4 (20.5)
Female	63.9 (31.4)	74.7 (20.4)	42.5 (44.4)	49.2 (42.8)	61.6 (16.7)	59.4 (15.5)	68.9 (26.1)	48.7 (20.6)
Age (years)								
60-64	81.0 (26.4)	82.3 (18.2)	61.4 (43.4)	63.9 (41.8)	67.2 (16.9)	64.6 (17.1)	77.9 (25.3)	56.8 (20.2)
65-69	78.7 (26.3)	79.5 (20.3)	60.1 (42.7)	64.6 (43.3)	67.1 (15.9)	65.1 (14.5)	78.9 (25.1)	55.5 (19.3)
70-74	60.2 (29.9)‡	73.4 (19.9)‡	36.8 (41.8)‡	45.3 (41.2)‡	62.5 (15.7)*	59.3 (14.6)*	66.8 (22.6)‡	45.5 (19.4)‡
75-79	55.2 (29.3)‡	71.4 (20.2)‡	24.6 (36.6)‡	32.6 (38.1)‡	60.4 (15.8)‡	58.6 (14.3)‡	63.4 (24.6)‡	43.8 (18.3)‡
80-84	48.0 (28.9)‡	63.8 (19.6)‡	17.5 (32.9)‡	28.9 (33.3)‡	56.2 (15.8)‡	52.0 (13.6)‡	57.7 (21.7)‡	40.0 (18.9)‡
≥85	33.3 (29.7)‡	58.4 (22.6)‡	16.0 (34.2)‡	33.9 (36.2)‡	53.3 (17.3)‡	49.0 (17.7)‡	52.3 (22.8)‡	35.0 (19.8)‡
Educational level								
None	46.6 (30.7)	66.2 (20.5)	17.9 (32.6)	27.4 (34.4)	55.2 (15.6)	52.8 (14.1)	58.4 (23.7)	35.8 (18.6)
Elementary	65.5 (29.7)‡	75.2 (20.1)‡	39.7 (42.8)‡	46.9 (41.6)‡	63.2 (16)‡	59.9 (14.9)‡	69.7 (24.2)‡	48.3 (19.8)‡
Middle school and more	77.3 (29.1)‡	79.1 (21.3)‡	63.2 (42.9)‡	68.2 (41.5)‡	67.8 (16.7)‡	65.8 (16.8)‡	77.4 (26.1)‡	58.5 (17.8)‡
Marital status								
Married	70 (23.7)	76 (18.7)	47 (25.3)	57 (26.7)	66 (17.5)	63 (30.6)	73 (20.6)	51 (26.6)
Single	60 (41.2)	71 (19.9)	37 (20.9)	44 (23.3)	59 (20.3)*	57 (28.5)*	63 (30.6)*	49 (27.2)
Widowed	53 (16.1)‡	71 (20.2)‡	30 (32.7)‡	32 (27.9)‡	57 (23.9)‡	54 (28.3)‡	62 (29.4)‡	44 (23.7)‡
Health problems								
Yes	51 (13.5)‡	69 (23.7)‡	31 (33.4)‡	32 (29.3)‡	56 (22.1)‡	52 (27.1)‡	56 (17.2)‡	44.0 (24.6)‡
No	73 (18.3)	77 (24.4)	48 (19.2)	58 (17.6)	67 (18.1)	65 (40.2)	77 (25.1)	51.0 (22.2)

\*  $p < 0.05$ ‡  $p < 0.001$ ;  $p$ -value obtained by Anova. Categories of reference in Bonferroni comparison were: male, group 60-64, none educational level, married, have a health problem

PF: physical functioning, SF: social functioning, RP: physical role, RE: emotional role, MH: mental health, VT: Vitality, BP: bodily pain, GH: general health

**Table III**  
**MEAN DIFFERENCES IN THE PERCEIVED HEALTH-RELATED QUALITY OF LIFE (HRQoL) SCALES OF OLDER ADULTS, BY USE OF PREVENTIVE HEALTH SERVICES (PHS) AND PRACTICE OF PHYSICAL ACTIVITY. MEXICO, IMSS, 2008**

HRQoL dimensions	PHS		Physical activity	
	Users n=688	Non-users n=397	Active n=253	Inactive n=832
Physical functioning	67.2	63.2‡	84.3	59.7*
Social functioning	78.4	72.6*	84.6	71.1*
Physical role	53.1	35.7*	64	35.4*
Emotional role	58.3	44.1*	70.1	42.3*
Mental health	64.7	62.4	69.9	61.5*
Vitality	62.3	59.2‡	68.7	58.4*
Bodily pain	73.7	67.5*	81.2	66.7*
General health	53.5	46.6*	59.3	45.9*

\* With statistical significance ( $p < 0.001$ )‡ With statistical significance ( $p < 0.05$ )

P values obtained with T test

**Table IV**  
**MEAN DIFFERENCES IN THE PERCEIVED HEALTH-RELATED QUALITY OF LIFE (HRQoL) SCALES OF OLDER ADULTS, BY USE OF PREVENTIVE HEALTH SERVICES (PHS) AND PHYSICAL ACTIVITY PRACTICE CATEGORIES (N=1 085). MEXICO, IMSS, 2008**

HRQoL scales	Group 1	Group 2	Group 3	Group 4	Mean	Mean	Mean
	n=623 Mean (SD)	n=209 Mean (SD)	n=65 Mean (SD)	n=188 Mean (SD)	Differences Group 1 vs. group 2	Differences Group 1 vs. group 3	Differences Group 1 vs. group 4
Physical functioning	62.3 (30)	51.7 (36)	78.3 (26)	86.8 (20)	-10.99 <sup>§</sup>	16.42 <sup>§</sup>	23.94 <sup>§</sup>
Social functioning	72.2 (21)	71.2 (23)	78.1 (19)	85.1 (15)	-0.57	6.77	13.88 <sup>§</sup>
Physical role	34.9 (41)	39.4 (45)	51.4 (41)	68.2 (41)	5.72	17.40*	34.24 <sup>§</sup>
Emotional role	42.9 (40)	43.1 (46)	58.2 (43)	74.7 (36)	0.58	15.62*	31.96 <sup>§</sup>
Mental health	62.1 (15)	56.3 (21)	63.5 (26)	71.3 (13)	-4.18*	1.50	9.02 <sup>§</sup>
Vitality	51.3 (14)	54.9 (17)	62.1 (14)	70 (12)	-4.28 <sup>‡</sup>	3.31	11.84 <sup>§</sup>
Bodily pain	67.6 (25)	63.1 (26)	72.3 (27)	84.9 (21)	-3.40	5.67	17.49 <sup>§</sup>
General health	45.2 (18)	45.8 (25)	53.7 (17)	61.5 (17)	-0.86	7.73*	15.90 <sup>§</sup>

Group 1: physically inactive and non-users of PHS (reference group)

Group 2: physically inactive and users of PHS

Group 3: physically active and non-users of PHS

Group 4: physically active and users of PHS

P value obtained by analysis of variance: \* $p < 0.05$ ; <sup>‡</sup> $p < 0.01$ ; <sup>§</sup> $p < 0.001$

SD: standard deviation

**Table V**  
**ASSOCIATION BETWEEN USE OF PREVENTIVE HEALTH SERVICES, PRACTICE OF PHYSICAL ACTIVITY AND THE HEALTH-RELATED QUALITY OF LIFE (HRQoL) OF OLDER ADULTS. MEXICO, IMSS, 2008**

HRQoL scales	Group 2	Group 3	Group 4
	Physically inactive, users of PHS n=209 Adjusted $\beta$	Physically active, non-users of PHS n=65 Adjusted $\beta$	Physically active & users of PHS n=188 Adjusted $\beta$
Physical functioning	-0.085*	0.063 <sup>‡</sup>	0.138 <sup>§</sup>
Social functioning	0.012	0.044	0.158 <sup>§</sup>
Physical role	0.80 <sup>‡</sup>	0.029	0.149 <sup>§</sup>
Emotional role	0.078 <sup>‡</sup>	0.040	0.148 <sup>§</sup>
Mental health	-0.030	-0.024	0.091 <sup>‡</sup>
Vitality	-0.036	0.006	0.159 <sup>§</sup>
Bodily pain	0.028	0.014	0.131 <sup>§</sup>
General health	-0.008	0.023	0.159 <sup>§</sup>

Significance level: \*  $p < 0.01$ ; <sup>‡</sup>  $p < 0.05$ ; <sup>§</sup>  $p < 0.001$

Group 1: physically inactive and non-users of PHS, (n= 623)

Group 2: physically inactive and users of PHS

Group 3: physically active and non-users of PHS

Group 4: physically active and users of PHS

$\beta$ = Standardized regression coefficients indicating the change in standard units of the dependent variables due to the increase in the standard unit of the independent variable, controlled by the variables indicated in the model

Multivariate multiple linear regression adjusted by sex, age, educational level, marital status, health problems during the last month and alcohol and tobacco consumption

the last month, and use of alcohol and/or tobacco, we observed  $\beta$  coefficients ranging from 0.09 for mental health to 0.15 for vitality and general health ( $p < 0.001$ ).

## Discussion

Our results suggest that perceived HRQoL among older adults who engage in both PA practice and use PHS is better than when each preventive approach is used on its own. This is a particularly relevant finding, especially since older adults are more likely to seek treatment for existing health problems rather than preventing them in the first place.<sup>26</sup> The results of our study provide evidence to support the development and implementation of preventive behavior approaches that promote PA and the use of PHS in order to improve perceived HRQoL among the elderly population.

The association between PA and HRQoL is supported by numerous studies with older adults and has been examined across different types of study designs, populations, and PA measurement methods.<sup>27-29</sup> Anokye *et al.* used both direct (accelerometer) and indirect (questionnaire) PA measurements to document correlation between PA and HRQoL in a sample of 5 537 adults (40-60 years) from a representative national survey in England. Their results revealed that higher levels of PA are associated with better HRQoL.<sup>30</sup>

Although previous studies have examined the relationship between use of health care services such as monthly medical and hospitalization visits, and perceived HRQoL,<sup>31,32</sup> to the best of our knowledge, no studies have examined the association between use of certain PHS and PA practice on the perceived HRQoL of older adults in Mexico.<sup>8</sup> Exposing the elderly to preventive health information when they seek treatment services could help increase the use of PHS among this population, which could lead to improvements in their life quality. These services should inform older adults about the importance of integrating a positive self-care attitude, promoting healthy behaviors and preventive medical strategies.

Other types of preventive approaches, such as household visits, have also been shown to have a positive impact on the functional status of the elderly, as well as reducing hospital and institutional admissions, improving nursing home stays, and even mortality.<sup>32,33</sup> The evidence obtained from these studies supports the importance of measuring the impact of preventive practices on the perceived HRQoL of older adults.

Our results indicate that there is a positive association between the combination of PA and use of PHS, and an improved perception of various HRQoL aspects. The benefits of using PHS have been documented by Kim

and colleagues,<sup>34</sup> who found that older adults who use senior center services have a better HRQoL perception than non-users. However, this evidence was obtained from cross-sectional studies. Longitudinal studies are required to explore if the services provided at senior centers, such as language and computer classes, exercise sessions, entertainment, well-being programs, human development groups, and rehabilitation activities are having an effect on perceived HRQoL.

As a large medical institution, IMSS is equipped with the necessary human resources and facilities that could be used to implement prevention and health promotion programs, including educational activities geared toward promoting well-being and healthy lifestyles among older adults. The results of this study indicate that the use of these types of preventive services at IMSS is associated with a better perceived HRQoL among older adults in Mexico. These findings support the recommendation to develop strategies to enhance these types of services, with the added benefit of optimizing institutional resources.

According to the Centers for Disease Control and Prevention (CDC) and the Guidelines from The American College of Sports Medicine,<sup>35</sup> it is essential that older adults engage in at least 30 minutes of moderate-to-vigorous exercise on a daily basis. This is particularly relevant if we consider that compliance with international PA recommendations is very low among Mexican adults who are 55 years and older: an estimated 60% of males and 70% of females are physically inactive.<sup>36</sup> In our study, only 23% of the participants achieved the international PA recommendations. While our aim was not to describe the rates of PA or use of preventive services in our study population, this finding is relevant because our sample is representative of IMSS affiliates, since the participants who engaged in PA or used PHS had the same likelihood of being selected as those who did not. This was possible due to the sampling method we used, which involved the random selection of participants from a list of older adults affiliated with IMSS. We can assume that our results are at least representative of the population from which the participants were selected. Moreover, since IMSS provides services to 40% of the elderly population in Mexico,<sup>15</sup> the positive association observed between PA and use of PHS on perceived HRQoL is relevant to a large number of individuals.

Physical inactivity is the 4<sup>th</sup> preventable cause of non-communicable diseases (NCDs) that kill 40 million people each year, equivalent to 70% of all deaths globally.<sup>37-39</sup> Therefore, health delivery organizations such as IMSS need to develop effective strategies to confront the growing burden of NCDs by promoting preven-

tive services. Furthermore, our findings indicate that efforts to increase PA among older adults, especially in conjunction with the use of PHS, could help to improve the perceived HRQoL and general well-being of this population.

Since PHS are used less frequently than treatment services,<sup>26,39</sup> our study measured the use of PHS as occurring at least once during the previous twelve months. Consequently, a better HRQoL perception among respondents may have been attributable to a better health status (even after adjusting for this variable) rather than to the use of PHS. Additionally, the types of PHS assessed in this study represent an institutional approach toward health promotion and prevention that is specific to IMSS and is not necessarily representative of the PHSs that are available in other institutions and countries.

Our study has a number of limitations, which include applying a cross-sectional design to assess the relationship of persistent behaviors with a multidimensional construct like HRQoL. The cross-sectional nature of the study did not allow us to assess trends in the use of PHS, which ideally would have been measured over several years, since the beneficial effects of using PHS on HRQoL may take longer to become evident. Information on use of PHS and PA levels was measured through self-report and assessed for a period of 12 months prior to the interviews, which might result in the possibility of recall bias, especially in the case of older adults. Additionally, the classification of PA levels relied on the self-report of respondents, who may have overestimated their PA level based on existing guidelines and recommendations.<sup>40</sup>

As for the PA measurements, it is understandable that PA should be lower among older adults due to the physical limitations and health issues inherent in this age group. However, our results regarding the association with HRQoL did not change after adjusting by level of PA. Additionally, we only assessed those health issues that were experienced in the previous month. Also, a number of older adults may have suffered from chronic illnesses that were not measured by our study questionnaire. This could result in reverse causality bias, if subjects who were in better health, and therefore were able to fulfill the aforementioned PA recommendations or engage in sufficient PA to obtain substantial health benefits, reported a better HRQoL. Longitudinal studies are needed to confirm these associations.

Despite these limitations, we were able to detect a strong and significant association between the combination of PA and use of PHS, and a better perceived HRQoL, which supports the findings of other studies that were also based on direct measurements.<sup>30,41</sup> To the

best of our knowledge, this is the first study to examine the combined benefit of practicing PA and using PHS on the perceived HRQoL of non-institutionalized older adults in Mexico.

In conclusion, our results indicate that PA and use of PHS are associated with a better perception of HRQoL among older adults in Mexico. This study provides additional evidence that supports extending and strengthening existing programs aimed at older adults within or beyond the framework of a health institution such as IMSS. These results could be useful for policy and decision makers in middle income countries such as Mexico, who are trying to meet the challenges of the aging population by finding ways to improve the HRQoL of the elderly.

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