

# Comparison of quality of life among community-dwelling older adults with the frailty phenotype

Sergio Sánchez-García<sup>1,8</sup>  · Katia Gallegos-Carrillo<sup>2</sup> · María Claudia Espinel-Bermudez<sup>3</sup> · Svetlana V. Doubova<sup>4</sup> · Rosalinda Sánchez-Arenas<sup>1</sup> · Carmen García-Peña<sup>5</sup> · Antoni Salvà<sup>6</sup> · Silvia C. Briseño-Fabian<sup>7</sup>

Accepted: 20 June 2017 / Published online: 30 June 2017  
© Springer International Publishing AG 2017

## Abstract

**Purpose** To compare the perception of the quality of life (QOL) of community-dwelling older adults with the phenotype of frailty.

**Methods** Cross-sectional analysis of baseline data of the “Cohort of Obesity, Sarcopenia and Frailty of Mexican Older Adults” (COSFOMA). Operationalization of frailty was carried out using the phenotype as follows: weight loss, self-report of exhaustion, low physical activity, slow gait, and weakness. QOL was measured using two scales: World Health Organization Quality of Life of Older Adults (WHOQOL-OLD), which is a specific instrument for the elderly population, and Short Form-36 Health Survey (SF-36), a generic instrument to evaluate the QOL related to health. One-way analyses of variance were conducted to assess the differences among the three phenotypes of frailty and QOL perception.

**Results** There were 1252 older adult participants who were analyzed; 11.2% ( $n = 140$ ) had frailty, 50.3% ( $n = 630$ )

pre-frailty and 38.5% ( $n = 482$ ) were not frail. The mean ( $\pm$ SD) total score of the WHOQOL-OLD according to the phenotype of frailty was 60.3 (13.9) for those with frailty, 67.4 (12.7) pre-frailty and 72.4 (11.2) not frail (ANOVA,  $p < 0.001$ ). The mean ( $\pm$ SD) of the SF-36 of the physical and mental component measures the sum, 38.9 (9.9) and 41.9 (11.3) with frailty, 45.7 (9.1) and 46.6 (9.8) pre-frailty, and 49.6 (7.3) and 49.4 (7.9) not frail, respectively (ANOVA,  $p < 0.001$ ).

**Conclusions** Frailty is observed in 1/10 community-dwelling older adults. Those with frailty and pre-frailty had a lower perception of QOL compared with those who were not frail.

**Keywords** Frailty · Community-dwelling · Older adults · Quality of life · Mexico

✉ Sergio Sánchez-García  
sergio.sanchezga@imss.gob.mx

<sup>1</sup> Epidemiological Research Unit and Health Services, Aging AreaXXI Century National Medical Center, Mexican Social Security Institute, Mexico City, Mexico

<sup>2</sup> Epidemiological Research Unit and Health Services, Mexican Social Security Institute, Mexico City, Morelos, Mexico

<sup>3</sup> Medical Research Unit in Clinical Epidemiology, Medical Unit of High Specialty, Specialty Hospital, National Medical Center West, Mexican Social Security Institute, Guadalajara, Mexico

<sup>4</sup> Epidemiological Research Unit and Health Services, XXI Century National Medical Center, Mexican Social Security Institute, Mexico City, Mexico

<sup>5</sup> National Institute of Geriatrics, National Institutes of Health of Mexico, Ministry of Health, Mexico City, Mexico

<sup>6</sup> Fundació Salut i Envel·liment, Autonomous University of Barcelona, Barcelona, Spain

<sup>7</sup> Family Medicine Unit No. 14, North Delegation, Mexican Social Security Institute, Mexico City, Mexico

<sup>8</sup> Unidad de Investigación en Epidemiología y Servicios de Salud, Área Envejecimiento, Centro Médico Nacional Siglo XXI. IMSS, Avenida Cuauhtémoc No. 330., Edificio CORCE, Tercer piso. Col. Doctores, Delegación Cuauhtémoc, 06725 México, D.F., Mexico

## Introduction

Frailty is a health problem that may be present in elderly subjects. It has been conceptualized as a biological syndrome characterized by loss of physiologic reserve and resistance to stressors that involves multiple physical, mental, and emotional deficits [1, 2]. The gradual loss of functional capacity related to age gradually changes the type and amount of activities that the elderly do. As frailty advances, vulnerability to dependence increases, which causes the need for long-term medical and social care. Studies in different populations have documented that frailty phenotype, from the stages of pre-frail and frail, is an important risk factor for adverse health outcomes and increased mortality rate of the elderly [2, 3]. Likewise, frailty has been linked to a low perception of quality of life (QOL) and has been considered a priority for public health policies, particularly aimed at strengthening healthy aging [4–7].

QOL is a broad concept, sensitive to changes in physical health, social relationships and the psychological state of the individual and in relation to goals, expectations, standards, and concerns. QOL has been defined by the WHO as “the individual’s perception of his position in life in the cultural context and value system” [8]. QOL is a multidimensional construct where different systems and/or domains interact [3, 9, 10]. This helps explain its close relationship with the health of the elderly, their functional capacity and the state of a set of psychological and social conditions that help maintain self-care and the role of the elderly in family and social life. These components of everyday life can have a negative influence of different magnitudes on different areas of QOL [4, 11]. Mexico is a country with a collectivist culture as other latin america countries, where an high proportion of older living with family members, conserving friends and having a social support system, issues that would change the perception of quality of life and selfperception of phenotype frailty. The Aging Mexican population could be considered as a living example of an environment that promotes the quality of life and decrease the impacts of the frailty.

The findings on the relationship between frailty and QOL of the elderly present major challenges for analysis due to cultural differences that affect how subjects perceive the QOL as well as their relationship to negative health events [12, 13]. There is a particularly strong relationship with changes in physical and mental functions due to the weight of the scales of QOL in these areas and may be an explanation for a low perception of QOL in the presence of frailty. However, socioeconomic and health disparities that limit the autonomy of the elderly could change, to a greater extent, the overall perception of QOL of the elderly. For

this reason, it is advisable to analyze the different domains or components of the scales used [14]. This provides more information on the perception of the elderly in different domains or components of QOL scales in relation to the presence of frailty.

Currently, only the scale WHO Quality of Life of Older Adults (WHOQOL-OLD) includes aspects related to environment and autonomy of the elderly, among others [15]. Use of this scale to assess the impact of frailty on QOL is still scarce. Consequently, it is relevant to determine how frailty changes, according to the QOL, relevant health aspects of community-dwelling older adults; this study was the first approach to analyze of frailty and quality of life comparing SF36 and WHOQOL-OLD on Mexican community-dwelling older adults. Therefore, the objective of the present study was to compare the perception of the quality of life (QOL) of community-dwelling older adults with the phenotype of frailty.

## Methods

### Recruitment of participants

The cross-sectional analysis was obtained through baseline assessment “Cohort of Obesity, Sarcopenia and Frailty of Older Mexican Adults” (COSFOMA) conducted between April and September 2014 in Mexico City. For this study, a simple random selection of records of adults 60 years of age and older affiliated with 48 primary health care called Family Medicine Units (FMU) from Mexico City and belonging to the Mexican Institute of Social Security (IMSS in Spanish) was performed. The sample size was calculated under the assumption that 14.1% of community-dwelling elderly subjects would present frailty [16], with an accuracy of the expected proportion of the phenomenon of  $\pm 2\%$  and a confidence level of 95%. The minimum sample size was 1164 older adults.

The participation rate was 80.9% ( $n = 1252$ ) of 1547 older adults contacted and invited to the COSFOMA. Written informed consent was requested prior to data collection. COSFOMA protocol was approved by the National Commission for Scientific Research of the IMSS (Registration No. 2012-785-067).

It is noteworthy that the IMSS is the social security institution in Mexico that confers protection to employed persons and their families with preventive medical and curative services, along with economic benefits of disability pension or retirement. The beneficiaries of this institution are affiliated with a FMU based on their home address. The IMSS covers 36.5% of the population of Mexico City and  $\sim 50.9\%$  of older adults [17, 18].

## Measurements

Data collection was performed by healthcare professionals from April–September 2014 and was obtained via a questionnaire and evaluation scales to determine the sociodemographic characteristics (gender, age, marital status, education, paid employment, living alone), consumption of tobacco or alcohol, nutritional status (BMI) [19], comorbidity (chronic diseases diagnosed by a physician), cognitive impairment (Mini-Mental State Examination, MMSE) [20, 21], major depression (Center for Epidemiologic Studies Depression Scale-Revised (CESD-R) [22, 23], and polypharmacy ( $\geq 3$  drugs).

## Measurement of frailty phenotype

Operationalization of the frailty phenotype was performed using the five criteria proposed by Fried et al. [2]: weight loss, exhaustion, low physical activity [24], slowness and weakness. The criteria for low physical activity, slowness and weakness were adapted for the study population (Table 1). Subjects were classified as non-frail (score 0), pre-frail (score 1–2), and frail (score 3–5).

## Instruments for assessing QOL

With a strategy to evaluate the QOL of the elderly in a more comprehensive way [25, 26], the use of two scales was considered: (1) WHO Quality of Life of Older Adults (WHOQOL-OLD), which is a specific instrument for the elderly population [15] and (2) Short Form-36 Health Survey (SF-36), which is a generic tool for assessing QOL related to health in different populations [25].

The WHOQOL-OLD is a scale that assesses relevant aspects of the QOL of older adults [15, 27]. This scale consists of 24 items with a Likert-type response. The scale comprises six dimensions: (a) sensory abilities, sensory impairment that affects daily life and overall functioning; (b) autonomy, ability to make their own decisions, to feel in control of their own future and to engage in the activities of their choice; (c) activities (past, present, and future), satisfaction scale with past and future achievements and recognition of accomplishments; (d) social participation, satisfaction in the various activities in which they participate; (e) death and dying, degree of concern toward death and dying; (f) intimacy, opportunity to love and be loved [15]. These dimensions are grouped in turn in a summary measure called total score of WHOQOL-OLD. It is noteworthy to mention that the scores of each facet or domain have a positive direction, i.e., the higher the score, the better the QOL. The score for the six dimensions and total score has a range of 0–100.

SF-36 assesses the level of QOL related to health, conceptually based on a two-dimensional model of physical and mental health [25, 28]. It consists of 36 items grouped into eight dimensions: (a) physical functioning, (b) physical role, (c) bodily pain, (d) general health, (e) vitality, (f) social functioning, (g) emotional role, and (h) mental health. The eight dimensions are grouped into two summary measures: Physical Fitness Component (PFC) and Mental Health Component (MHC). The score for the eight dimensions and the two summary measures (PFC and MHC) have a range of 0–100. For both the WHOQOL-OLD and SF-36, a score close to 100 represents the best QOL.

## Statistical analysis

The frequency and distribution of the characteristics of the study population according to the frailty phenotype was determined.  $\chi^2$  test was used to evaluate specific differences in the study population (e.g., male vs. female, etc.), into groups according to the frailty phenotype.

The comparison between each independently criterion of frailty phenotype and the total score and each dimensions of WHOQOL-OLD and SF36 were analyzed with Student *t* test. Likewise, the differences between mean scores (total and subscales) of the WHOQOL-OLD and SF-36 by frailty categories were also identified using One-way analysis of variance (ANOVA) and Post hoc Bonferroni test, with statistically significant differences ( $p \leq 0.050$ ).

## Results

The sample was comprised of 1252 older adults with an average age of  $68.5 \pm 7.2$  years; 59.9% ( $n = 750$ ) were women and 40.1% ( $n = 502$ ) were men with an average age of  $68.7 \pm 7.4$  years and  $68.2 \pm 6.8$  years, respectively. The frequency of each of the operational criteria of the frailty phenotype was determined: 9.9% ( $n = 124$ ) with weight loss, 32.3% ( $n = 405$ ) exhaustion, 25.8% ( $n = 323$ ) low physical activity, 14.7% ( $n = 184$ ) slowness and 22.7% ( $n = 284$ ) weakness.

The prevalence of frailty was 11.2% ( $n = 140$ ) and pre-frail 50.3% ( $n = 630$ ), 38.5% ( $n = 482$ ) were robust (non-frail). In Table 2, the frequency and distribution of the characteristics of the study population according to the frailty phenotype is presented. It is observed that the frequency and distribution of frailty phenotypes are different for the studied variables of gender, age, marital status, education, and alcohol consumption ( $p \leq 0.050$ ), whereas

**Table 1** Criteria and operational definition for the phenotype of frailty

Criterion	Operational definition
Weight loss	Calculated as the difference between weight in the previous year and current weight. Subjects with weight loss >10 lb. (4.5 kg) in that period were classified as positive for the criterion of weight loss
Self-reported exhaustion	Two questions were used from the revised version of the Center for Epidemiologic Studies Depression Scale (CESD-R) adapted to older Mexicans to determine the criterion of exhaustion [22]. Items considered were: “I felt that everything I did was with effort” and “I could not go on.” It was considered as positive for the judgment if the participant answered: “for 5–7 days in the last week” or “almost every day for 2 weeks”
Low physical activity <sup>a</sup>	The level of physical activity in the last week was assessed using the Physical Activity Scale for the Elderly (PASE) including labor, home, and leisure self-reported [24] activities. Low physical activity $\leq 58.6$ points for men and $\leq 56.4$ points for women (lowest quartile PASE score by sex) was considered
Walking distance <sup>a</sup>	The Walking speed was evaluated by the time it takes to travel 15 feet (4.5 m), stratified by sex and height Male Cutoff point Height $\leq 163$ cm $\geq 7.0$ s Height $> 163$ cm $\geq 6.5$ s Female Cutoff point Height $\leq 151$ cm $\geq 8.7$ s Height $> 151$ cm $\geq 7.0$ s
Weakness (low grip strength) <sup>a</sup>	Evaluated using dynamometry in hand grip strength (Takei TKK 5001, Takei Scientific Instruments Co. Ltd., Tokyo, Japan) of the nondominant hand with values stratified by gender and body mass index (BMI) quartiles Male Cutoff point BMI $\leq 24 \leq 22.0$ kg BMI $24.1\text{--}26.7 \leq 23.0$ kg BMI $26.8\text{--}29.4 \leq 24.0$ kg BMI $\geq 29.5 \leq 27.2$ kg Female Cutoff point BMI $\leq 24.6 \leq 11.0$ kg BMI $24.7\text{--}27.7 \leq 13.0$ kg BMI $27.8\text{--}31.3 \leq 14.0$ kg BMI $\geq 31.4 \leq 14.0$ kg

<sup>a</sup> Operational definition adapted for the study population

groups were homogeneous in relation to living alone, tobacco consumption and nutritional status ( $p > 0.050$ ).

It is worth noting that women had a higher proportion of frailty in comparison with men (13.3 vs 8%); however, the men had a higher proportion of not frail (42.4 vs 35.9%). Subjects who were pre-frail were distributed more frequently between 60 and 69 years old, whereas frail subjects were concentrated between 70 and 79 years old. Lack of education was higher in pre-frail and frail groups. The number of subjects who answered “yes” to alcohol consumption was higher in the non-frail group. Finally, comorbidity, cognitive impairment, depression, and polypharmacy had the highest percentage in frail subjects followed by pre-frail subjects.

Table 3 shows the average size scales of QOL in contrast to each operational criterion of the frail phenotypes. For each dimension of the WHOQOL-OLD, we identified a statistically significant difference ( $p \leq 0.050$ ) with scores in regard to presence versus absence of

weight loss related to sensory capacity, activities (past, present, and future), and total score. For the presence versus absence of exhaustion, it was observed that there was a statistically significant difference ( $p \leq 0.050$ ) in the means of the six dimensions and total score. Corresponding to physical activity, it was determined that there was a difference between the presence versus absence in the means of sensory capacity, autonomy, activities (past, present, and future), social participation, privacy, and total score ( $p \leq 0.050$ ). It was determined that there was a statistically significant difference in the presence versus absence of exhaustion in the means of sensory capacity, autonomy, activities (past, present and future), social participation and total score ( $p \leq 0.050$ ). Similarly, a difference was observed between the presence versus absence of weakness in the means of sensory capacity, autonomy, activities (past, present, and future), social participation, privacy, and total score ( $p \leq 0.050$ ).

**Table 2** Characteristics of the study population according to the phenotype of frailty

	Total % (n)	Not frail % (n)	Pre-frail % (n)	Frail % (n)	<i>p</i> *
	100 (1252)	38.5 (482)	50.3 (630)	11.2 (140)	
Gender					
Female	100 (750)	35.9 (269)	50.8 (381)	13.3 (100)	<b>0.004</b>
Male	100 (502)	42.4 (213)	49.6 (249)	8.0 (40)	
Age (years)					
≥80	100 (119)	10.1 (12)	58.8 (70)	31.1 (37)	<b>&lt;0.001</b>
70–79	100 (332)	33.1 (110)	50.0 (166)	16.9 (56)	
60–69	100 (801)	44.9 (360)	49.2 (394)	5.9 (47)	
Marital status					
Single	100 (508)	34.6 (176)	50.4 (256)	15.0 (76)	<b>0.001</b>
Married/free union	100 (744)	41.1 (306)	50.3 (374)	8.6 (64)	
Education					
None	100 (51)	21.6 (11)	49.0 (25)	29.4 (15)	<b>&lt;0.001</b>
1–6 years	100 (409)	26.9 (110)	54.8 (224)	18.3 (75)	
7 and higher	100 (792)	45.6 (361)	48.1 (381)	6.3 (50)	
Paid employment					
Yes	100 (439)	42.4 (186)	49.2 (216)	8.4 (37)	<b>0.025</b>
No	100 (813)	36.4 (296)	50.9 (414)	12.7 (103)	
Living alone					
Yes	100 (126)	38.9 (49)	50.8 (64)	10.3 (13)	0.949
No	100 (1126)	38.5 (433)	50.3 (566)	11.3 (127)	
Tobacco consumption					
Yes	100 (117)	39.3 (46)	50.4 (59)	10.3 (12)	0.941
No	100 (1135)	38.4 (436)	50.3 (571)	11.3 (128)	
Alcohol consumption					
Yes	100 (311)	46.3 (144)	47.6 (148)	6.1 (19)	<b>&lt;0.001</b>
No	100 (941)	35.9 (338)	51.2 (482)	12.9 (121)	
Nutritional status					
Overweight/obesity (BMI ≥ 30)	100 (361)	37.7 (136)	47.9 (173)	14.4 (52)	0.062
Underweight (BMI ≤ 21.9)	100 (123)	31.7 (39)	55.3 (68)	13.0 (16)	
Normal weight (BMI 22.0–29.9)	100 (768)	40.0 (307)	50.7 (389)	9.4 (72)	
Comorbidity					
≥3	100 (58)	24.1 (14)	53.4 (31)	22.4 (13)	<b>&lt;0.001</b>
1–2	100 (420)	34.0 (143)	51.2 (215)	14.8 (62)	
0	100 (774)	42.0 (325)	49.6 (384)	8.4 (65)	
Cognitive impairment					
Yes	100 (304)	24.7 (75)	52.3 (159)	23.0 (70)	<b>&lt;0.001</b>
No	100 (948)	42.9 (407)	49.7 (471)	7.4 (70)	
Major depression					
Yes	100 (53)	1.9 (1)	54.7 (29)	43.4 (23)	<b>&lt;0.001</b>
No	100 (1199)	40.1 (481)	50.1 (601)	9.8 (117)	
Polypharmacy					
Yes	100 (565)	33.1 (187)	51.2 (289)	15.8 (89)	<b>&lt;0.001</b>
No	100 (687)	42.9 (295)	49.6 (341)	7.4 (51)	

Row percentage, \* Chi square test

**Table 3** Comparison of operational criteria for the phenotype of frailty in older adults with the average quality of life (SF36 and WHOQOL-OLD) values

Quality of life (WHOQOL-OLD) Mean (SD)	Weight loss		Self-reported exhaustion		Low physical activity		Slow motion		Low grip strength		<i>p</i> *					
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No						
	<i>p</i> *	<i>p</i> *	<i>p</i> *	<i>p</i> *	<i>p</i> *	<i>p</i> *	<i>p</i> *	<i>p</i> *	<i>p</i> *	<i>p</i> *						
Sensorial capacity	66.3 (20.7)	70.5 (19.2)	<b>0.021</b>	65.4 (20.3)	72.3 (18.6)	<b>&lt;0.001</b>	64.5 (20.7)	72.0 (18.6)	<b>&lt;0.001</b>	63.4 (21.5)	71.2 (18.8)	<b>&lt;0.001</b>	62.7 (19.6)	72.2 (18.8)	<b>&lt;0.001</b>	
Autonomy	63.7 (18.2)	65.5 (18.2)	0.278	61.1 (19.1)	67.4 (17.4)	<b>&lt;0.001</b>	62.4 (18.9)	66.4 (17.8)	<b>0.001</b>	61.9 (20.9)	65.9 (17.6)	<b>0.006</b>	60.6 (17.2)	66.7 (18.2)	<b>&lt;0.001</b>	
Past/present/future activities	67.5 (18.9)	71.2 (16.6)	0.022	66.0 (18.9)	73.1 (15.3)	<b>&lt;0.001</b>	66.8 (18.3)	72.2 (16.1)	<b>&lt;0.001</b>	66.6 (20.0)	71.6 (16.2)	<b>&lt;0.001</b>	67.1 (16.9)	71.9 (16.7)	<b>&lt;0.001</b>	
Social participation	67.3 (18.7)	69.9 (16.7)	0.114	64.8 (18.3)	71.9 (15.7)	<b>&lt;0.001</b>	66.0 (18.7)	70.9 (16.1)	<b>&lt;0.001</b>	67.1 (19.1)	70.1 (16.5)	<b>0.028</b>	65.5 (16.8)	70.8 (16.8)	<b>&lt;0.001</b>	
Death and dying	71.4 (26.8)	72.6 (24.8)	0.613	69.1 (26.0)	74.1 (24.3)	<b>0.001</b>	71.7 (25.5)	72.8 (24.8)	0.532	71.6 (25.4)	72.7 (24.9)	0.599	71.3 (26.1)	72.8 (24.7)	0.368	
Privacy	59.2 (24.2)	63.0 (23.8)	<b>0.088</b>	57.3 (24.8)	65.2 (22.9)	<b>&lt;0.001</b>	52.9 (29.9)	66.0 (20.2)	<b>&lt;0.001</b>	61.1 (22.9)	62.9 (24.0)	0.345	56.0 (24.6)	64.6 (23.2)	<b>&lt;0.001</b>	
Total score	65.9 (14.3)	68.8 (12.6)	<b>0.018</b>	64.0 (13.8)	70.7 (11.8)	<b>&lt;0.001</b>	64.1 (13.8)	70.0 (12.1)	<b>&lt;0.001</b>	65.3 (14.5)	69.1 (12.5)	<b>&lt;0.001</b>	63.9 (12.2)	69.9 (12.7)	<b>&lt;0.001</b>	
<b>QOL related to health (SF-36)</b>																
Mean (SD)	Yes	No	<i>p</i> *	Yes	No	<i>p</i> *	Yes	No	<i>p</i> *	Yes	No	<i>p</i> *	Yes	No	<i>p</i> *	
	Physical functioning	67.6 (31.3)	75.2 (26.8)	<b>0.004</b>	62.9 (31.5)	79.9 (23.3)	<b>&lt;0.001</b>	59.9 (33.2)	79.5 (23.0)	<b>&lt;0.001</b>	58.6 (32.4)	77.1 (25.5)	<b>&lt;0.001</b>	62.4 (30.2)	77.9 (25.5)	<b>&lt;0.001</b>
	Physical role	59.3 (42.1)	65.8 (40.7)	0.093	50.1 (42.9)	72.3 (37.9)	<b>&lt;0.001</b>	51.8 (43.2)	69.8 (39.0)	<b>&lt;0.001</b>	51.1 (43.5)	67.6 (40.0)	<b>&lt;0.001</b>	51.6 (43.6)	69.1 (39.2)	<b>&lt;0.001</b>
Body ache	69.3 (24.7)	75.4 (22.0)	<b>0.004</b>	67.3 (25.1)	78.4 (20.0)	<b>&lt;0.001</b>	68.6 (24.3)	76.9 (21.3)	<b>&lt;0.001</b>	67.5 (25.1)	76.0 (21.7)	<b>&lt;0.001</b>	68.2 (24.2)	76.7 (21.5)	<b>&lt;0.001</b>	
General health	57.2 (20.2)	60.9 (19.7)	<b>0.050</b>	54.7 (20.8)	63.3 (18.7)	<b>&lt;0.001</b>	56.7 (19.8)	61.8 (19.7)	<b>&lt;0.001</b>	56.8 (20.7)	61.1 (19.6)	<b>0.006</b>	55.1 (20.2)	62.1 (19.4)	<b>&lt;0.001</b>	
Vitality	60.3 (21.8)	64.2 (20.1)	<b>0.043</b>	55.0 (21.1)	68.0 (18.5)	<b>&lt;0.001</b>	59.1 (20.5)	65.5 (20.0)	<b>&lt;0.001</b>	57.7 (20.8)	64.9 (20.0)	<b>&lt;0.001</b>	58.1 (20.6)	65.5 (19.9)	<b>&lt;0.001</b>	
Social functioning	77.4 (25.9)	82.0 (22.2)	<b>0.033</b>	72.9 (26.3)	85.6 (19.3)	<b>&lt;0.001</b>	75.8 (25.4)	83.5 (21.2)	<b>&lt;0.001</b>	73.9 (25.6)	82.8 (21.8)	<b>&lt;0.001</b>	75.7 (25.1)	83.3 (21.5)	<b>&lt;0.001</b>	
Emotional role	71.5 (39.3)	75.9 (37.7)	0.225	60.7 (44.0)	82.4 (32.4)	<b>&lt;0.001</b>	68.6 (41.8)	77.8 (36.2)	<b>&lt;0.001</b>	63.6 (43.5)	77.5 (36.5)	<b>&lt;0.001</b>	65.1 (43.2)	78.4 (35.7)	<b>&lt;0.001</b>	
Mental role	64.9 (17.5)	68.1 (16.6)	<b>0.045</b>	61.1 (18.1)	71.0 (15.0)	<b>&lt;0.001</b>	64.2 (16.4)	69.0 (16.7)	<b>&lt;0.001</b>	63.9 (17.9)	68.4 (16.4)	<b>0.001</b>	64.8 (17.5)	68.6 (16.4)	<b>0.001</b>	
Physical health	44.1 (10.1)	46.7 (9.0)	<b>0.003</b>	43.0 (9.9)	48.1 (8.3)	<b>&lt;0.001</b>	42.2 (10.1)	47.9 (8.3)	<b>&lt;0.001</b>	42.1 (9.8)	47.2 (8.8)	<b>&lt;0.001</b>	42.5 (9.6)	47.6 (8.7)	<b>&lt;0.001</b>	
Mental health	46.1 (10.6)	47.3 (9.5)	0.205	43.2 (10.9)	49.0 (8.2)	<b>&lt;0.001</b>	46.2 (9.8)	47.5 (9.5)	<b>0.042</b>	45.1 (10.2)	47.5 (9.4)	<b>0.002</b>	45.5 (10.4)	47.6 (9.3)	<b>0.001</b>	

\* Student *t* test

Likewise, we identified a statistically significant difference ( $p \leq 0.050$ ) in the scores of the eight dimensions and summations of PFC and MFC measures of QOL related to health with the SF-36 between presence versus absence of each one of the criteria for determining the frailty phenotype, except for weight loss in the dimensions of physical role, emotional role, and CSM SF-36, where the difference between the means was not statistically significant ( $p > 0.050$ ).

The scores obtained in each of the dimensions of quality of life were compared with presence or absence of each criterion of frailty, for this, we considered the dimensions with significant differences and greater loss related to the mean value of each criterion of frailty. For WHOQOL-OLD, four of five operational criteria of frailty are related to intimacy, sensory abilities, and activities (present, past, and future).

While for the SF36 all components of frailty were related to physical performance. The three components of physical activity, low handgrip strength, and low gait speed had relation with the same parameters: physical functioning, physical role, and emotional role.

Finally, in Table 4, the total score and average of the six dimensions of WHOQOL-OLD are presented as well as the eight dimensions and measure summations of PFC and MFC SF-36 for each of the frailty phenotypes in older adults. We can see that the means are higher in non-frail older adults followed by pre-frail adults and lower in frail adults in the total score and the six dimensions of WHOQOL-OLD as well as the dimensions and measures of PFC and MFC SF-36.

We observe that the lowest scores belong to the frail group, both the total score and six dimensions of WHOQOL-OLD and in dimensions and measures of PFC and MFC SF-36 ( $p \leq 0.001$ ). Meanwhile, the facet of death and dying was similar among the three phenotypes ( $p > 0.050$ ).

## Discussion

According to the results of this study, for older adults whose phenotype indicates frailty, the perception of QOL is significantly lower compared with older adults identified as pre-frail and non-frail. These differences in QOL are consistent using both generic and specific instruments for measuring the QOL.

Our results confirm the same pattern as previous evidence. Systematic reviews and meta-analyses [14, 29] on studies carried out predominantly in European or Asian countries [30] with high incomes such as Italy, Netherlands, and the

UK [31–33] pointed out that the inverse association occurs between the frailty condition of the elderly and their QOL, particularly with the physical phenotype [34]. Research in other cultural contexts indicates that older Mexican–American adults report lower scores on the QOL in the presence of both frailty and pre-frailty [4]. In Latin America, the study of the perception of the quality of life among frail older community-dwelling adults is limited. We have made an effort to expand the information about specific methods of frailty assessment with Mexican older adults and comparison of scales of quality of life, in order to incentive the study of the quality of life as a topic of high relevance that could be applied in interventions focused on reducing frailty.

In the present study, the behavior of the operational components of the frailty phenotype in relation to the score obtained on scales of QOL in community-dwelling elderly subjects in a cultural and social context as dominant in a country like Mexico was determined. This could represent a means to identify the gradual erosion in the QOL affected according to the frailty phenotype present in each individual [26, 35].

In this study, a prevalence of 11.2% of frail older community-dwelling adults was observed in accordance with the criteria adapted for the study population of Mexico City. The prevalence reported in the international literature fluctuates between 4.0 and 59.1% [29]. In Latin America, prevalences of frailty between 26.7 and 42.6% [36, 37] have been reported. Moreover, studies in the adult Mexican population reported prevalences of frailty between 14.1 and 39.5% [16, 36–38]. This wide fluctuation of the prevalence reported in the literature may be due more to the different diagnostic criteria used to determine the frailty, than the sociocultural context among countries itself, where the influence could be the resources available to minimize the effects of frailty. There is also a significant difference when trying to determine their impact on functional aspects and QOL of the elderly; therefore, it was of special interest to compare frailty with a specific instrument such as the WHOQOL-OLD [39].

In relation to this scale, it was found that the frail elderly have a decrease in all their dimensions and their overall score compared to those without frailty. With the exception of the facet that refers to the degree of concern toward death and dying where no statistically significant difference was observed, the trend continues being lower among frail subjects. It has been reported that frailty and even the pre-frail condition have negative consequences on the QOL of the elderly [4, 35, 40]. Its differential impact on different components of the frailty phenotype is still little studied, especially with specific scales for older adults that capture the peculiarities that characterize this age group in relation to the rest of the population [41].

**Table 4** Perceived quality of life according to the phenotypes of frailty in older adults (WHOQOL-OLD and SF36)

	Total Mean (SD)	Not frail <sup>a</sup> Mean (SD)	Pre-frail <sup>b</sup> Mean (SD)	Frail <sup>c</sup> Mean (SD)	<i>p</i> *
Quality of life (WHOQOL-OLD)					
Sensorial capacity	70.1 (19.4)	74.4 (18.0) <sup>b,c</sup>	69.6 (18.8) <sup>a,c</sup>	57.3 (21.0) <sup>a,b</sup>	<0.001
Autonomy	65.3 (18.2)	68.6 (17.2) <sup>b,c</sup>	64.4 (18.0) <sup>a,c</sup>	58.3 (19.8) <sup>a,b</sup>	<0.001
Past/present/future activities	70.8 (16.9)	75.0 (14.4) <sup>b,c</sup>	69.2 (17.3) <sup>a,c</sup>	63.8 (19.3) <sup>a,b</sup>	<0.001
Social participation	69.6 (16.9)	73.4 (14.6) <sup>b,c</sup>	68.5 (17.3) <sup>a,c</sup>	61.9 (19.0) <sup>a,b</sup>	<0.001
Death and dying	72.5 (25.0)	74.0 (24.0)	72.1 (25.2)	69.2 (27.1)	0.117
Privacy	62.6 (23.8)	68.7 (19.6) <sup>b,c</sup>	60.4 (24.9) <sup>a,c</sup>	51.7 (26.7) <sup>a,b</sup>	<0.001
Total score	68.5 (12.8)	72.4 (11.2) <sup>b,c</sup>	67.4 (12.7) <sup>a,c</sup>	60.3 (13.9) <sup>a,b</sup>	<0.001
Quality of life related to health (SF-36)					
Physical functioning	74.4 (27.4)	84.9 (18.4) <sup>b,c</sup>	72.3 (27.5) <sup>a,c</sup>	48.0 (32.7) <sup>a,b</sup>	<0.001
Physical role	65.1 (40.9)	76.3 (35.4) <sup>b,c</sup>	62.7 (41.5) <sup>a,c</sup>	37.3 (41.3) <sup>a,b</sup>	<0.001
Body ache	74.8 (22.4)	80.6 (19.3) <sup>b,c</sup>	73.6 (22.1) <sup>a,c</sup>	59.8 (25.5) <sup>a,b</sup>	<0.001
General health	60.5 (19.8)	65.4 (18.7) <sup>b,c</sup>	58.7 (19.4) <sup>a,c</sup>	51.9 (21.4) <sup>a,b</sup>	<0.001
Vitality	63.8 (20.3)	70.3 (17.6) <sup>b,c</sup>	61.2 (20.3) <sup>a,c</sup>	53.0 (21.4) <sup>a,b</sup>	<0.001
Social functioning	81.5 (22.6)	86.9 (18.9) <sup>b,c</sup>	81.1 (21.7) <sup>a,c</sup>	65.0 (29.0) <sup>a,b</sup>	<0.001
Emotional role	75.4 (37.9)	85.1 (29.5) <sup>b,c</sup>	73.6 (39.0) <sup>a,c</sup>	50.2 (45.5) <sup>a,b</sup>	<0.001
Mental health	67.8 (16.7)	72.0 (14.6) <sup>b,c</sup>	66.6 (16.9) <sup>a,c</sup>	58.5 (18.1) <sup>a,b</sup>	<0.001
Physical health component	46.4 (9.2)	49.6 (7.3) <sup>b,c</sup>	45.7 (9.1) <sup>a,c</sup>	38.9 (9.9) <sup>a,b</sup>	<0.001
Mental health component	47.1 (9.6)	49.4 (7.9) <sup>b,c</sup>	46.6 (9.8) <sup>a,c</sup>	41.9 (11.3) <sup>a,b</sup>	<0.001

\* One-way analysis of variance (ANOVA)

<sup>a,b,c</sup> Bonferroni post hoc tests  $p \leq 0.001$ 

Results of studies to measure QOL using the WHOQOL-OLD in an elderly population outside the Mexican context as in the case study of Varela et al. [42] in frail elderly in São Paulo, Brazil, a mean total score of WHOQOL-OLD of 57.6 was reported. In our study, we observed a total score of WHOQOL-OLD of 60.3 in community-dwelling older adults, results that are similar probably due to the context that it is closer to the Mexican elderly than their counterparts in countries with a higher level of development [29, 33, 43]. Previous studies reported that frailty has negative consequences on the QOL of the elderly [4, 35, 40] regardless of cultural differences that may exist in the conception of QOL. This may be reflected in a different relationship between frailty and QOL of the elderly in different populations, which must be considered in the development of public policies and intervention actions in health promotion and prevention of disability [12, 13, 42].

It should be noted that the measurement of QOL related to health is useful not only to measure the results of interventions but also can be used as evidence of the QOL in different populations, which identifies those populations with low QOL and proposes strategies focused on improvement. This is important because previous studies have found that QOL can be an important predictor of life expectancy based on individual estimators and the

perception of physical, psychological or social limitations as well as aimed at decreasing opportunities due to the disease, its consequences or treatment [44]. Special relevance is a fundamental variable to the study of adverse modifying conditions as well as assessing the impact of different strategies of medical and social care aimed at this population. Understanding and knowledge of the QOL of the population drives precisely the development of policies for healthy aging. Due to the extent that factors related to the deterioration of the elderly can influence perception of QOL, specific programs can be designed to address the burden of disease and the higher dependence of older adults [18].

The findings of our study allowed us to observe that the presence of frailty is reflected in lower scores of QOL according to specific components measured by the WHOQOL-OLD and the eight dimensions and measures summations of CSF and CSM SF-36. This is related to a previous study in older Mexican–American adults [4] and also observed in other populations [30, 31, 33, 45–47]. Likewise, the relationship between frailty and components of quality of life emphasized the dimensions of the WHOQOL OLD questionnaire related with frailty criteria were intimacy, sensory ability, and past and future activities, a sensitive landscape for older adults and little advertised, focused on giving and receiving love, being

able to perform daily activities and their capacity to perform activities, elements that we consider fundamental to maximize a self-perception of the quality of life of the elderly through the interventions that generate a double effect on the frailty and quality of life. For the SF36, the relationship between quality of life and frailty focused on physical functioning, expected effect of the questionnaire. We consider that when it is required to evaluate the quality of life on frail elderly, WHOQOL OLD could provide more information about dimensions of high impact in the life of the elderly than other questionnaires of its kind.

It may be concluded that our research is important to document the perception of the QOL of older Mexican adults with and without frailty. We understand that this study also has limitations. One limitation is that the selected epidemiological design does not establish a causal relationship between frailty and QOL in the elderly. However, the results support the need to continue the research into longitudinal studies evaluating both the presence of frailty and its effect on the QOL throughout the aging process in addition to establish the exposure-effect relationship between frailty and QOL in older adults in order to attempt to clarify to what extent the poor QOL that frail or pre-frail older adults perceive is influenced by adverse events that change health [32].

Finally, we can conclude from our results that one in ten community-dwelling older adults suffers from frailty. QOL in frail older adults is lower compared to those without frailty. Therefore, it is essential to detect frailty in the context of primary health care in order to ensure the dignity and QOL of community-dwelling older adults, although the frequency mild cognitive impairment was of 24.3% among older adults, the study did not have information bias, especially for having staff for field work extensively trained that facilitates the understanding of the all questions in a cordial and respectful environment for all elderly participants.

**Acknowledgements** We thank the authorities and staff of the South and North Delegation of the Mexican Institute of Social Security (IMSS) of Mexico City for the support for this study.

**Funding** This study was funded by grants from the Health Sector Research Fund and Social Security SS/IMSS/ISSSTE/CONACYT (Mexico) SALUD-2013-01-201112 and the Fund for the Promotion of Health Research, Mexican Institute of Social Security, FIS/IMSS/PROT/PRI0/13/024.

**Author contributions** The present work have contributed in the idea (SS-G, KG-C, MCE-B, SVD), planning analysis (SS-G, KG-C, MCE-B, SVD) and interpretation of the results (SS-G, RS-A, CG-P, AS-C, SCB-F), as well as in the reading and criticism of the writing (SS-G, KG-C, MCE-B, SVD, RS-A, CG-P, AS-C, SCB-F). We expressed that we have read and approved the manuscript and we are agreed with its final version and the author's order (SS-G, KG-C, MCE-B, SVD, RS-A, CG-P, AS-C, SCB-F).

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. COSFOMA protocol (Registration No. 2012-785-067) was approved by the National Commission for Scientific Research (Registration numbers COFEPRIS 13 CI 09 015 213 for the Research Committee and COMBIOETICA 09 CEI 00920160601 for the Research Ethics Committee) of the IMSS.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

## References

- Buckinx, F., Rolland, Y., Reginster, J. Y., Ricour, C., Petermans, J., & Bruyère, O. (2015). Burden of frailty in the elderly population: Perspectives for a public health challenge. *Archives of Public Health*, 73(1), 19.
- Fried, L. P., Tangen, C. M., Waltson, J., Newmann, A. B., Hirsch, C., Gottdiener, J., et al. (2001). Frailty in older adults: evidence for a phenotype. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 56(3), M146–M156.
- Bortz, W. M. (2002). A conceptual framework of frailty: A review. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 57(5), M283–M288.
- Masel, M. C., Ostir, G. V., & Ottenbacher, K. J. (2010). Frailty, mortality, and health-related quality of life in older Mexican Americans. *Journal of the American Geriatrics Society*, 58(11), 2149–2153.
- Li, C. I., Lin, C. H., Lin, W. Y., Liu, C. S., Chang, C. K., Meng, N. H., et al. (2014). Successful aging defined by health-related quality of life and its determinants in community-dwelling elders. *BMC Public Health*, 14, 1013.
- Cesari, M., Prince, M., Thiagarajan, J. A., De Carvalho, I. A., Bernabei, R., Chan, P., et al. (2016). Frailty: An emerging public health priority. *Journal of the American Medical Directors Association*, 17(3), 188–192.
- Cosco, T. D., Armstrong, J. J., Stephan, B. C. M., & Brayne, C. (2015). Successful aging and frailty: Mutually exclusive paradigms or two ends of a continuum shared? *Canadian Geriatrics Journal*, 18(1), 35–36.
- World Health Organization. (1995). The World Health Organization Quality of Life assessment (WHOQOL): Position paper from the World Health Organization. *Social Science and Medicine*, 41(10), 1403–1409.
- Carr, A., Gibson, B., & Robinson, P. G. (2001). Measuring quality of life: Is quality of life determined by expectations or experience? *British Medical Journal*, 322(7296), 1240–1243.
- Markle-Reid, M., & Browne, G. (2003). Conceptualizations of frailty in relation to older adults. *Journal of Advanced Nursing*, 44(1), 58–68.
- González-Celis Rangel, A. L. (2010). Calidad de vida en el adulto mayor. In L. M. Gutiérrez-Robledo & J. H. Gutiérrez-Ávila (Eds.), *Envejecimiento humano: Una visión transdisciplinaria* (pp. 365–378). México: Secretaría de Salud, Instituto de Geriátria.
- Buck, D., Jacoby, A., Baker, G. A., Ley, H., & Steen, N. (1998). Cross-cultural differences in health-related quality of life of

- people with epilepsy: Findings from a European study. *Quality of Life Research*, 8(8), 675–685.
13. Kang, Y. (2009). Culture gender differences in the quality of life among Americans and Koreans with atrial fibrillation. *Nursing and Health Sciences*, 11(3), 301–305.
  14. Kojima, G., Iliffe, S., Jivraj, S., & Walters, K. (2016). Association between frailty and quality of life among community-dwelling older people: A systematic review and meta-analysis. *Journal of Epidemiology and Community Health*, 70(7), 716–721.
  15. Power, M., Quinn, K., Schmidt, S., & WHOQOL-OLD Group. (2005). Development of the WHOQOL-Old module. *Quality of Life Research*, 14(10), 2197–2214.
  16. Ruiz-Arregui, L., Avila-Funes, J. A., Amieva, H., Borges-Yanez, S. A., Villa-Romero, A., Aguilar-Navarro, S., et al. (2013). The Coyoacan cohort study: Design, methodology, and participatory characteristics of a Mexican study on nutritional and psychosocial markers of frailty. *Journal of Frailty and Aging*, 2(2), 68–76.
  17. Instituto Nacional de Salud Pública. Encuesta Nacional de Salud y Nutrición 2012. (2013). Resultados por entidad federativa, Distrito Federal. Cuernavaca, México: Instituto Nacional de Salud Pública.
  18. Consejo Nacional de Población. (2016). Indicadores demográficos básicos 1990-2030. [http://www.conapo.gob.mx/es/CONAPO/Proyecciones\\_Datos](http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos).
  19. Douketis, J. D., Paradis, G., Keller, H., & Martineau, C. (2005). Overweight and obesity: Canadian guidelines for body weight classification in adults: application in clinical practice to screen for overweight and obesity and to ASSESS disease risk. *Canadian Medical Association Journal*, 172(8), 995–998.
  20. Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-Mental State". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12(3), 189–198.
  21. Reyes-Beaman, S., Beaman, P. E., García-Peña, C., Villa, M. A., Heres, J., Córdova, A., et al. (2004). Validation of a modified version of the Mini-Mental State Examination (MMSE) in Spanish. *Aging Neuropsychology and Cognition*, 11(1), 1–11.
  22. Eaton, W., Muntaner, C., Smith, C., & Tien, A. (1998). *Revision of the center for epidemiologic studies depression (CES-D) scale*. Baltimore: Johns Hopkins University, Prevention Center.
  23. Sanchez-Garcia, S., Juarez-Cedillo, T., Gallegos-Carrillo, K., Gallo, J. J., Wagner, F. A., & García-Peña, C. (2012). Frecuencia de los síntomas depresivos entre adultos mayores de la Ciudad de México. *Salud Mental*, 35(1), 71–77.
  24. Washburn, R. A., McAuley, E., Katula, J., Mihalko, S. L., & Boileau, R. A. (1999). The physical activity scale for the elderly (PASE): Evidence for validity. *Journal of Clinical Epidemiology*, 52(7), 643–651.
  25. Ware, J. E., Jr., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care*, 30(6), 473–483.
  26. Clegg, A., Young, J., Iliffe, S., Rikkert, M. O., & Rockwood, K. (2013). Frailty in elderly people. *Lancet*, 381(9868), 752–762.
  27. Quiroz, C. O. A., Garcia, J. J. V., Castro, S. B. E., Encinas, D. M. S., & Flores, R. G. (2013). Confiabilidad y validez del Cuestionario de Calidad de Vida (WHOQOL-OLD) en adultos mayores mexicanos. *Psicología y Salud*, 23(2), 241–250.
  28. Zuñiga, M. A., Carrillo-Jimenez, G. T., Fos, P. J., Gandek, B., & Medina-Moreno, M. R. (1999). Evaluación del estado de salud con la encuesta SF-36: Resultados preliminares en México. *Salud Pública de México*, 41(2), 110–118.
  29. Collard, R. M., Boter, H., Schoevers, R. A., & Oude Voshaar, R. C. (2012). Prevalence of frailty in community-dwelling older persons: A systematic review. *Journal of the American Geriatrics Society*, 60(8), 1487–1492.
  30. Lin, C. C., Li, C. I., Chang, C. K., Liu, C. S., Lin, C. H., Meng, N. H., et al. (2011). Reduced health-related quality of life in elders with frailty: A cross-sectional study of community-dwelling elders in Taiwan. *PLoS ONE*, 6(7), e21841.
  31. Mulasso, A., Roppolo, M., & Rabaglietti, E. (2014). The role of individual characteristics and physical frailty on health related quality of life (HRQOL): A cross sectional study of Italian community-dwelling older adults. *Archives of Gerontology and Geriatrics*, 59(3), 542–548.
  32. Bilotta, C., Bowling, A., Nicolini, P., Casè, A., Pina, G., Rossi, S. V., et al. (2011). Older People's Quality of Life (OPQOL) scores and adverse health outcomes at a one-year follow-up. A prospective cohort study on older outpatients living in the community in Italy. *Health and Quality of Life Outcomes*, 9, 72.
  33. Gobbens, R. J., & van Assen, M. A. (2014). The prediction of quality of life by physical, psychological and social components of frailty in community-dwelling older people. *Quality of Life Research*, 23(8), 2289–2300.
  34. Rizzoli, R., Reginster, J. Y., Arnal, J. F., Bautmans, I., Beaudart, C., Bischoff-Ferrari, H., et al. (2013). Quality of life in sarcopenia and frailty. *Calcified Tissue International*, 93(2), 101–120.
  35. Morley, J. E., Vellas, B., Van Kan, G. A., Anker, S. D., Bauer, J. M., Bernabei, R., et al. (2013). Frailty consensus: A call to action. *Journal of the American Medical Directors Association*, 14(6), 392–397.
  36. Alvarado, B. E., Zunzunegui, M. V., Béland, F., & Bamvita, J. M. (2008). Life course social and health conditions linked to frailty in older men and Latin American women. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 63(12), 1399–1406.
  37. de Diaz, D. L. G. E., Tamez, P. H., Gutiérrez, H. H., Cedillo, R. J., & Torres, G. (2012). Frailty and its association with mortality, hospitalization and functional dependence in Mexicans aged 60-years or older. *Medicina Clínica*, 138(11), 468–474.
  38. Sanchez-Garcia, S., Sanchez-Arenas, R., García-Peña, C., Rosas-Carrasco, O., Avila-Funes, J. A., Ruiz-Arregui, L., et al. (2014). Frailty among community-dwelling elderly Mexican people: Prevalence and association with sociodemographic characteristics, health state and the use of health services. *Geriatrics and Gerontology International*, 14(2), 395–402.
  39. Golubeva, E. Iu. (2011). Conceptual basis of evaluation of life quality of elderly people in the institutional care system. *Advances in Gerontology*, 24(4), 587–590.
  40. Lutomski, J. E., Baars, M. A., Boter, H., Buurman, B. M., den Elzen, W. P., Jansen, A. P., et al. (2014). Frailty, multi-morbidity and disability: The relationship with quality of life and healthcare costs in elderly people. *Nederlands Tijdschrift voor Geneeskunde*, 158, A7297.
  41. Moreno-Aguilar, M., Garcia-Lara, J. M., Aguilar-Navarro, S., Navarrete-Reyes, A. P., Amieva, H., & Ávila-Funes, J. A. (2013). The phenotype of frailty and health-related quality of life. *Journal of Frailty and Aging*, 2(1), 2–7.
  42. Varela, F. R., Ciconelli, R. M., Campolina, A. G., & Soarez, P. C. (2015). Quality of life evaluation of frail elderly in Campinas, São Paulo. *Revista da Associação Médica Brasileira*, 61(5), 423–430.
  43. Santos-Eggimann, B., Cuénoud, P., Spagnoli, J., & Junod, J. (2009). Prevalence of frailty in middle-aged and older community-dwelling Europeans living in 10 countries. *The Journals of Gerontology Series A: Biological sciences and Medical Sciences*, 64(6), 675–681.
  44. Patrick, D., & Erickson, P. (1993). *Health policy, quality of life: Health care evaluation and resource allocation*. New York: Oxford University Press.
  45. Chang, Y. W., Chen, W. L., Lin, F. G., Fang, W. H., Yen, M. Y., Hsieh, C. C., et al. (2012). Frailty and Its impact on health-related

- quality of life: A cross-sectional study on community-dwelling elder preventive health service users. *PLoS ONE*, 7(5), e38079.
46. Puts, M. T., Shekary, N., Widdershoven, G., Heldens, J., Lips, P., & Deeg, D. J. (2007). What does quality of life mean to older frail and non-frail community-dwelling adults in the Netherlands? *Quality of Life Research*, 16(2), 263–277.
47. Kanwar, A., Singh, M., Lennon, R., Ghanta, K., McNallan, S. M., & Roger, V. L. (2013). Frailty and health-related quality of life among residents of long-term care facilities. *Journal of Aging and Health*, 25(5), 792–802.