ORIGINAL INVESTIGATION

Validity and reliability of the SF-36 in Chilean older adults: the ALEXANDROS study

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Abstract To validate short-form-36 health survey (SF-36) with specific scoring algorithm obtained in a large sample of Chilean older people and to associate quality of life in this sample with social and health related factors. A cross-sectional study on 2,143 community-living subjects aged 60–92 years (33 % men and 67 % women) conducted in Santiago, Chile. Scores in 8 scales of SF-36-physical function (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE) and mental health (MH)-, were calculated. Factor analysis was used to extract two principal factors and logistic regression model was applied to estimate its association with socio-demographic and health variables. The internal consistency of scales was high (Cronbach's alpha 0.86–0.87). Factor analysis retained two factors: mental (MCS) and physical (PCS) components accounting for 65.3 % of total variance (55.3 and 10.0 % respectively). High correlations (0.61–0.94) between MCS and MH, V, RE and SF were obtained. PCS correlated highest (0.72–0.86) with RP, PF and BP. Self-perceived symptoms of depression (GDS-15 ≥ 5) was the main variable explaining low scores in both MCS and PCS (adjusted OR = 26.9; 95 % CI: 15.3–47.2; OR = 3.4; 95 % CI: 2.1–5.5, respectively). We have demonstrated the reliability and validity of SF-36 questionnaire to evaluate health related quality of life, reporting Chilean-Specific factor score coefficients for MCS and PCS based in national Chilean means and standard deviations for older people. After adjusting by age and gender, the main predictors of low health related QoL in Chilean older people were self-perceived symptoms of depression, the presence of two or more chronic diseases and illiteracy. Important gender inequalities were observed in all of these results, being consistently less favorable in women than in men.

Keywords Older people · SF-36 health survey · Health-related quality of life · Factor analysis

Introduction

During the last decade there has been a growing increase of older population in Chile, from 8 % in 1980 to 13 % in 2010 (INE 2008). The ageing process in countries like Chile has been faster and more recent than in developed countries. Chile now has levels of fertility and mortality similar to those of North and Western European countries and the USA, with a total fertility rate (TFR) in 2005–2010 of 1.9 and life expectancy at birth is 76 years for men and 81 years for women (WHO 2012). However in Chile, these relatively low rates of fertility and mortality were achieved much more rapidly than in the now developed world. The TFR fell from 5.5 to 1.9 in the space of 50 years (1955–1960 to 2005–2010) and in the same period life expectancy at birth increased, from 56 to 79 years (INE 2012) thus resulting in a rapid ageing of the population. As a consequence there has not been enough preparation of public and social policy to afford this process. Furthermore, in Chile, this ageing process has taken place in a context of great social inequalities as several studies have evidenced (Albala et al. 2005; SENAMA 2010).

The quality of life (QoL) is not only linked to health but also to autonomy, social relations and socio-economic factors. Then, QoL gives a global and broader vision of

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health status, not just of the physical or mental health of the older people but a more comprehensive concept. In consequence, QoL is one of measurements which might be relevant to guide the design and implementation of public policies; since there are many factors that should be considered while building healthy ageing strategy.

Several authors have studied determinants of QoL in older adults (Sloane et al. 2005; Hoi et al. 2010; Brett et al. 2012). A national survey on dependency done in Chile in 2010 showed that QoL in the older individuals is influenced by socio-economic and health-related factors, such as education, number of chronic diseases, self-perceived symptoms of depression and difficulties in activities of daily living (ADL), (SENAMA 2010). Moreover, life satisfaction in older people was also related with chronic diseases in a cohort of Chilean older persons (Castillo et al. 2012).

In spite of the importance of Qol in older people, the majority of QoL instruments have not been developed in these populations (Netuveli and Blane 2008), raising the need to develop or validate instruments oriented to this specific age group.

The short-form-36 health survey (SF-36) is a well-known instrument to assess health-related QoL in adults (Ware and Sherbourne 1992). Initially developed in the United States, it has proven to be adequate for health research, allowing measuring of both patient and general population health status profiles (Ware and Gandek 1998). The international quality of life assessment project (IQOLA) translated, validated and adapted SF-36 in 7 European countries including Spain, Canada, Australia and Japan for its use internationally (Ware and Gandek 1998). SF-36 has been used in more than 40 countries, including countries from Asia, Africa and Latin America. Among the Latin American countries, five Spanish speaking are considered: Argentina, Chile, Colombia, Honduras and Mexico (Ware and Gandek 1998). In Chile, SF-36 was adapted and used to establish a multidimensional health profile in a sample of general population aged 15–86 years (Olivares 2006) using the US algorithm.

However only in the USA, UK, Australia and China, SF-36 was validated for older people (Syddall et al. 2009; Bohannon and DePasquale 2010; Walters et al. 2001; Bartsch et al. 2011; Hu et al. 2010).

Even though many studies (Orfila et al. 2006; Hsu 2007; Netuveli and Blane 2008; Molzahn et al. 2010; Webb et al. 2011) have demonstrated the importance of QoL in older adults, in Chile there are few publications devoted to it. A study done in older people in Antofagasta, Chile, found that people perceiving themselves as sick had significantly lower quality of life (Urzua et al. 2011). On the other hand, Fuentes-García et al. (2012) studied the oral health-related QoL in Santiago and two other Latin American cities showing a strong association with educational level.

In Chile there is not a validated instrument with Chilean-specific scores to be used in older population. The goals of this paper are both to validate the SF-36 with a specific scoring algorithm obtained in a large sample of Chilean older people and to associate quality of life with social and health-related factors.

Methods

Sample

The data used in this research comes from the baseline of the 'Active Life Expectancy, Ageing, and Disability Related to Obesity Study' (ALEXANDROS). This is a longitudinal study conducted in Santiago, the capital of Chile, aimed to explore the trajectories of disability associated with obesity in Chilean older individuals from different socio-economic and demographic backgrounds (Albala et al. 2011). In brief, ALEXANDROS is a longitudinal study of 3 cohorts of community dwelling older adults aged 60–92: (a) the SABE cohort (Albala et al. 2005) formed by 1,173 people born before 1,940 living in Santiago. The subjects were selected in a probabilistic sampling process with three-step procedure (districts, blocks and households); (b) the ALEXANDROS cohort comprising 950 people born between 1940 and 1948, randomly selected from primary health care centers (PHCC) registries in a two-step procedure, health care centers and registered older adults from the selected PHCC and (c) the ISAPRES cohort of 266 people of high socio-economic level (SEL) born before 1948 randomly selected from private health insurance system registries (ISAPRES) (Albala et al. 2011). No exclusion criteria were considered. The baseline of this study obtained in 2004/2007 consisted of 927 people from SABE (43.3 %), 950 from ALEXANDROS (44.3 %) and 266 from ISAPRES (12.4 %). The proportion of people from the ISAPRES group corresponds nearly to the proportion of older persons from high SEL (13.6 %) in Chile (PAMUC 2007).

After signing an informed consent approved by the Ethics committee of Institute of Nutrition and Food Technology (INTA), all the subjects underwent face to face interviews including SF-36 Spanish version (Alonso et al. 1995), socio-demographic characteristics, self-reported chronic diseases, self-reported functional limitations and self-perceived symptoms of depression measured by the short-form of the geriatric depression scale (GDS-15) (Yesavage et al. 1982–1983).

Height and weight were measured to calculate body mass index (BMI). People were classified as normal, overweight, obese and underweight according to the WHO standards (WHO 1997).

Only 10.3 % of SF-36 questionnaires were not completed. These were considered missing data and excluded from the analysis. Then the analyses performed in this article are based on 2,143 older subjects.

The SF-36

The questionnaire includes 36 items grouped into eight scales or domains and can be accomplished either through self, interview, or telephone-administration.

The 36 items included in SF-36 are clustered in the following scales: physical functioning (PF) (ten items), role physical (RP) (four items), bodily pain (BP) (two items), general health perceptions (GH) (five items), vitality (VT) (four items), social functioning (SF) (two items), role-emotional (RE) (three items) and mental health (MH) (five items) (Ware et al. 1998a).

Each item was measured in a Likert scale. Two methods for calculating the scale's total scores are commonly used.

The standard method in which the score of each scale is obtained by adding the scores of the items in each scale to get scale scores, afterwards transformed to scores 0–100, where higher scores indicate better health. Transformed scales are calculated as:

$100 \times$ (actual score $-$ lowest possible score)/possible score range (McDowell 2006).

The second method uses norm-based scores with T score transformation having a mean $= 50$ and a standard deviation $= 10$ (McDowell 2006).

Calculation is done as follows

$$T = (z - \text{score}) \times 10 + 50,$$

where z-score $=$ (observed score-population mean)/population standard deviation.

Chilean population means and SD were obtained from de National Survey on Dependency in older persons conducted in a national representative sample of 4,766 people 60 years and older (SENAMA 2010).

Here we followed the methodology used in the IQOLA project (Ware et al. 1998b), where norm-based T scores are used to perform factor analysis estimating two summary measures: the physical component summary (PCS) and the mental component summary (MCS). IQOLA proposed to work in three steps, the first being translation to produce a survey form; the second, the scale construction estimating specific scoring algorithms and the third, the validation and interpretation of the results (Ware and Gandek 1998).

We skipped the first step considering that the Spanish version of SF-36 v2 (Alonso et al. 1995), was adapted syntactically and semantically to the Chilean idiosyncrasy by Olivares (2006) ensuring its suitability and allowing us to use it.

Statistical analysis

Results are expressed as means, standard deviations (SD), 95 % confidence intervals (95 %CI) and relative frequency (%). Cronbach's alpha coefficient was used to test the internal consistency of the items in their corresponding scale and between the scales. Factor analysis using the principal factor method (Mardia et al. 1979) was used to test the generalizability of the two-dimensional summary factors of SF-36 scales in Chilean older people Ware et al. (1998a) We used the criteria proposed Ware et al. (1998a) where two factors (MCS and PCS) could explain more than 60 % of the total variance and greater than 70 % of the reliable variance in SF-36 scale scores. Principal factors were rotated to orthogonal simple structure using the varimax method. The rotation was applied to the Kaiser normalized matrix. The correlation between the rotated factors and the eight scales were calculated to identify the two factors: mental and physical factors. Specific scoring coefficients were estimated using regression method, based on rotated factors.

The PCS and MCS scoring algorithms are shown below:

PCS = (z-score for each scale x specific scoring coefficients) $\times$ 10 + 50
MCS = (z-score for each scale x specific scoring coefficients) $\times$ 10 + 50

As a consequence, the norm-based scores of the eight scales and the two summary factors have the same mean and standard deviation.

Lin's concordance coefficient (Lin 1989) was used to compare summary measures calculated with the Chilean-specific scoring algorithms and the standard (US-based) scoring algorithm.

The 25th percentiles (25p) of each summary factor (MCS and PCS) were used as a cut-point to dichotomize the data. The subjects were classified in low (below 25p) or fair/good (above 25p) categories. Logistic regression analysis was performed to estimate the association between low scores of MCS and PCS factors with both psychosocial factors (education, social engagement, living alone) and health-related factors (functional limitations, obesity, self-perceived symptoms of depression) adjusted by age and gender. The Hosmer–Lemeshow test was used to assess the goodness of fit for the estimated models.

All statistical analyses were performed using STATA 12 software (StataCorp. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP, 2011).

Results

The socio-demographic characteristics and health situation of the sample by gender are presented in Table 1. The total

Table 1 Socio-demographic characteristics and health situation of the study sample

	Men (n = 696)[a]	Women (n = 1,447)[a]	Total (n = 2,143)
Age years*			
Mean ± SD	68.6 ± 6.6	69.2 ± 7.2	69.0 ± 7.0
95 % CI	(68.1–69.1)	(68.8–69.6)	(68.7–69.3)
Age groups [% (95 % CI)]			
60–69 years	71.1 (67.6–74.5)	68.1 (65.7–70.5)	69.1 (67.1–71.1)
70–79 years	21.3 (18.3–24.5)	20.3 (18.2–22.4)	20.6 (18.9–22.4)
≥80 years	7.6 (5.8–9.8)	11.6 (10.0–13.4)	10.3 (9.1–11.7)
Living alone	8.3 (6.3–10.6)	10.4 (8.9–12.1)	9.8 (8.5–11.1)
Education*** [% (95 %CI)]			
Illiterate***	8.2 (6.2–10.4)	12.2 (10.6–13.9)	10.9 (9.6–12.3)
<6 years	29.7 (26.1–33.5)	37. 8 (35.1–40.6)	35.1 (32.9–37.3)
6–12 years	48.5 (44.5–52.5)	48.8 (46.0–51.7)	48.7 (46.4–51.0)
>12 years	21.8 (18.6–25.3)	13.4 (11.5–15.4)	16.3 (14.6–18.0)
Having social support** [% (95 % CI)]			
	77.5 (73.1–81.5)	82.6 (79.9–85.0)	81.0 (93.9–96.3)
Self-rated health* [% (95 % CI)]			
Good	57.9 (54.8–61.1)	44.6 (42.4–46.8)	48.9 (47.1–50.7)
Fair	37.5 (34.5–40.7)	47.6 (45.4–49.8)	44.3 (42.5–46.1)
Bad	4.6 (3.3–6.0)	7.8 (6.7–9.1)	6.8 (5.9–7.7)
Symptoms of depression*** [% (95 % CI)]			
GDS-15 ≥6	17.3 (15.0–19.8)	28.5 (26.6–30.4)	24.8 (23.4–26.4)
Nutritional state*** [% (95 % CI)]			
Obese	23.8 (20.3–27.5)	34.8 (32.0–37.7)	31.1 (28.9–33.4)
Overweight	46.1 (41.9–50.3)	40.0 (37.1–42.9)	42.0 (39.7–44.4)
Normal	29.1 (25.4–33.0)	24.0 (21.5–26.6)	25.7 (23.6–27.8)
Underweight	1.1 (0.4–2.3)	1.3 (0.7–2.1)	1.2 (0.7–1.8)
Limitation in ≥1 ADL*** [% (95 % CI)]			
	12.8 (10.0–16.1)	23.5 (20.8–26.3)	19.8 (17.8–22.0)
Limitation in ≥1 IADL*** [% (95 % CI)]			
	15.6 (12.5–19.1)	30.9 (28.0–34.0)	25.7 (23.4–28.0)
Number of diseases***			
Median (IQR)	2 (2)	3 (2)	3 (2)
0–1 [% (95 % CI)]	58.7 (0.54–0.64)	41.2 (0.38–0.45)	47.0 (0.44–0.50)
≥2 [% (95 % CI)]	41.3(0.37–0.46)	58.9 (0.55–0.62)	53.0 (0.50–0.56)

SD standard deviation, CI confidence interval, IQR interquartile range

[a] Pearson χ^2 test (except age t student): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$

sample was 2,143 people, 67.5 % women, mean age 68.7 and 69.8 years for men and women, respectively. The age distribution was similar for both men and women. The group 60–69 years included 69.1 % of the total sample, the group 70–79 years comprised 20.6 and 10 % of the subjects 80 years and over. The proportion of people living alone was low (9.8 %) with no gender differences. The perceived social support was high reaching 81 % of the total sample and significantly higher in women than in men (Pearson χ^2 (1) = 8.0466, $p < 0.01$). On the other hand, all the other characteristics described indicate significant inequalities between women and men. In the case of education, literacy and the general educational attainment were higher for men than women (Pearson χ^2 (2) = 25.7, $p < 0.0001$). The proportion of men who self-rated their health as excellent,

very good or good was significantly higher than women (Pearson χ^2 (2) = 16, $p < 0.001$). Consequently, the inverse situation was observed for the self-rated health as bad. The median of chronic diseases was 3 (interquartile range (IQR) = 2) for women (range: 0–8) and 2 (IQR = 2) for men (range: 0–7) with a proportion of 58.9 % of women and 41.3 % of men reporting 2 or more diseases and 41.2 and 58.7 %, respectively reporting no more than one. The prevalence of self-perceived symptoms of depression were also higher for women (28.5 %, about a quarter) than men (17.3 %) (Pearson χ^2 (1) = 46.5, $p < 0.0001$). Women needing assistance with one or more instrumental activities of daily living (IADL) ($n = 447$, 30.9 %) or activities of daily living (ADL) ($n = 340$, 23.5 %) practically doubling men in the same situation ($n = 109$, 15.6 % for IADL and

$n = 90$, 12.8 % for ADL) (Pearson χ^2 (1) = 39, $p < 0.0001$; Pearson χ^2 (1) = 21, $p < 0.0001$; respectively). Obesity was also significantly higher in women than in men (Pearson χ^2 (3) = 21.9, $p < 0.0001$).

The internal consistency for each of the eight scales was high and homogenous, ranging narrowly from 0.8579 for the vitality scale to 0.8737 for the bodily pain scale (MH: 0.8623; RE: 0.8661; RP: 0.8678; GH: 0.8697; SF: 0.8703 and PF: 0.8705). Internal consistency for the eight scales was 0.8820 (Cronbach's alpha).

Summary statistics of the eight SF-36 scales (PF, RP, BD, GH, VT, SF, RE and MH) calculated for 0–100 scale and for the based-norm scale by gender are presented in Table 2. Men had significantly higher scores than women in all the scales (Two-sample Wilcoxon rank-sum (Mann–Whitney) test, $p < 0.0001$).

Factor analysis for Chilean older people yielded two factors accounting for 65.3 % of the total variance, and 74 % of the reliable variance as shown in Table 3. The first factor was associated with MH, VT, RE, SF and GH, scales and the second factor with RP, PF and BP scales. As MH, RE, SF and VT scales had the higher loading with the first factor and PF, RP and BP with the second factor, we identified the former as MCS and the later as PCS. The Pearson's correlation coefficients of the eight scale scores with MCS indicated a high correlation for MH, VT, RE and SF fluctuating from $r = 0.94$ (MH) to $r = 0.61$ (SF). On the other hand, the highest correlations for PCS were obtained for the scales RP, PF, and BP ranging from $r = 0.86$ (RF) to $r = 0.72$ (BP). GH correlated similarly with MCS ($r = 0.61$) and PCS ($r = 0.58$).

Table 4 shows the population Chilean mean and SD for the eight scales and factor specific coefficients of MCS and PCS for Chilean older people estimated using regression method (based on rotated factors).

The Lin's concordance coefficient between US-based Scoring algorithms and Chilean-Specific were high for both MCS ($\rho = 0.80$; 95 % CI: 0.79–0.81) and PCS ($\rho = 0.85$; 95 % CI: 0.84–0.86).

Table 3 Rotated factor loadings and variance explained

	Factor 1[a] MCS	Factor 2[a] PCS
Physical functioning	0.3233	**0.6097**
Role physical	0.3180	**0.6621**
Bodily pain	0.3156	**0.5401**
General health	**0.4944**	0.4491
Vitality	**0.6953**	0.4072
Social functioning	**0.5039**	0.4620
Role-emotional	**0.5550**	0.4612
Mental health	**0.7612**	0.3086
Variance explained		
Total (%)	55.3	10.0
Reliable[b] (%)	62.8	11.4

Results of a factor analysis (two factors retained) using the principal factor method with a varimax rotation. MCS and PCS: Mental and Physical health summaries

[a] Bold values indicate variables included in the factors: loading >0.49

[b] Reliable variance = total variance explained divided by the internal reliability (Cronbach's *a*) of the scale

The adjusted association between low MCS and PCS scores (<25p) with psycho-social and health-related variables is shown in Table 5. Self-perceived symptoms of depression and chronic diseases were strongly associated with both PCS lower than 25p (OR = 26.89 and OR = 3.77; $p < 0.001$, respectively) and MCS lower than 25p (OR = 17.99 and OR = 3.41; $p < 0.001$, respectively). Besides, the model for MCS suggests a significant positive association between low scores and being illiterate (OR: 5.25, $p < 0.01$). On the other hand, having social support had a strong reverse association with a low MCS score (OR: 0.54, $p < 0.01$). The model for PCS demonstrates the strongest positive association for low scores (<25p) with functional limitations, in one ADL or more and in one IADL or more (OR: 18, $p < 0.01$; OR: 4.89, $p < 0.001$; respectively), followed by chronic diseases, self-perceived symptoms of depression and obesity (OR = 4.23,

Table 2 Mean scores of the eight SF-36 scales (0–100 and norm-based) by gender

	0–100 scores[a]		Norm-based scores[a]	
	Women Mean (SD)	Men Mean (SD)	Women Mean (SD)	Men Mean (SD)
Physical functioning	75.5 (22.0)	85.6 (18.5)	51.1 (7.6)	54.5 (6.4)
Role physical	67.1 (41.1)	77.1 (35.6)	46.7 (14.5)	50.1 (12.6)
Bodily pain	54.2 (27.5)	66.6 (28.0)	46.8 (9.2)	50.9 (9.3)
General health	60.2 (20.5)	65.0 (20.3)	53.3 (10.6)	55.7 (10.5)
Vitality	65.8 (22.0)	75.5 (20.0)	47.7 (10.0)	52.1 (9.1)
Social functioning	81.6 (24.6)	87.3 (21.0)	50.8 (10.3)	53.2 (8.8)
Role-emotional	65.5 (43.3)	78.3 (37.5)	43.8 (18.2)	49.1 (15.8)
Mental health	65.3 (23.1)	76.1 (20.3)	45.8 (11.1)	51.1 (9.7)

SD Standard deviation

[a] Two-sample Wilcoxon rank-sum (Mann–Whitney) test: $p < 0.0001$

Table 4 Population Chilean mean and SD[a], and Chilean-specific factor scores to calculate MCS and PCS scores in the Chilean sample

	Mean (SD)	MCS coefficients	PCS coefficients
Physical functioning	72.7 (28.7)	−0.07902	0.28206
Role physical	76.8 (28.3)	−0.11294	0.35446
Bodily pain	64.1 (30.0)	−0.05169	0.20926
General health	54.1 (19.3)	0.07816	0.10260
Vitality	71.3 (22.0)	0.31983	−0.02377
Social functioning	79.6 (24.0)	0.09236	0.10560
Role-emotional	80.8 (23.7)	0.13351	0.08884
Mental health	74.4 (20.8)	0.46376	−0.19023

SD standard deviation, *MCS* and *P* mental and physical health summaries

[a] Mean and SD obtained in 2010 from the National Survey on Dependency in the elderly, Chile (0–100 scoring)

$p < 0.001$; OR = 3.41, $p < 0.001$; 2.22, $p < 0.001$; respectively). A significant inverse association was found between PCS <25p and living alone (OR: 0.37, $p < 0.01$).

Discussion

In this paper, we demonstrated the reliability and validity of SF-36 questionnaire to evaluate health-related quality of life, reporting Chilean-Specific factor score coefficients for MCS and PCS based on national Chilean means and standard deviations for older people. We have shown the importance of the mental summary component to evaluate

QoL in Chilean older people and its relation with gender, self-perceived symptoms of depression and socio-demographic variables as illiteracy and having social support.

The high correlations between mental health, vitality, role-emotional and social functioning scales scores with MCS on the one hand, and role physical, physical functioning and body pain with PCS on the other, demonstrated the validity of the mental and physical summary components estimated with Chilean weights. The high Cronbach's coefficients obtained (0.86–0.87 for all scales) showed the internal consistency of the items with their corresponding scale and between the scales. Several authors have demonstrated the reliability and validity of SF-36 questionnaire and their two factors structure in patients suffering from different diseases (Alonso et al. 1995; Lam et al. 2005; Vilagut et al. 2005; Lugo et al. 2006; Wollmerstedt et al. 2006; Mohammadpour and Yousefi 2008). Furthermore, studies performed in USA, Australia, UK and China have demonstrated the reliability and validity of SF-36 questionnaire and their two factors structure in older people (Syddall et al. 2009; Bohannon and DePasquale 2010; Walters et al. 2001; Bartsch et al. 2011; Hu et al. 2010). In the present study, the two summary measures explained 65.3 % of the total variance and 74.2 % of the reliable variance. These values are almost the same to those obtained in Spain (65.6 and 76.3 %, respectively) and in the ten countries analyzed in the IQOLA Project (Ware et al. 1998a) where the total variance explained was 65.6–71.6 % and the reliable variance 76.3–84.7 %.

In our study, the SF-36 factor structure showed a higher loading of MCS than PCS among Chilean older people than in the samples used in the IQOLA project and in USA. The

Table 5 Logistic regressions for the association of 25th percentiles of MCS and PCS with psychosocial and health-related variables adjusted by age and gender

	MCS OR (95 % CI)	PCS OR (95 % CI)
Unable to read and write	5.25 (1.07–5.92)**	1.44 (0.31–6.74)
Education		
<6 years of education	1.75 (0.76–4.03)	0.95 (0.46–1.96)
6–12 years of education	0.68 (0.33–1.37)	1.24 (0.69–2.23)
Living alone	0.39 (0.15–1.00)*	0.37 (0.17–0.80)**
Having social support	0.54 (0.30–0.97)**	1.09 (0.66–1.80)
Self-perceived symptoms of depression (GDS-15 ≥5)	26.89 (15.31–47.21)***	3.41 (2.13–5.45)***
Chronic diseases (≥2)	3.77 (1.41–10.06)***	4.23 (1.85–9.69)***
Limitations in ≥1 ADL	3.40 (0.80–14.45)*	17.99 (1.95–166.34)**
Limitations in ≥1 IADL	1.18 (0.47–2.94)	4.89 (2.54–9.44)***
Obesity	1.06 (0.63–1.79)	2.22 (1.48–3.34)***

Reference categories: able to read and write; >12 years of education; having 0–1 chronic diseases; nutritional state normal or overweight

OR odds ratios, *CI* confidence interval, *MCS* and *PCS* mental and physical health summaries. Odds ratios are from logistic regression related 25th percentiles of MCS and PCS with psychosocial and health-related variables adjusted by age and gender

* $p < 0.10$; ** $p < 0.05$; ***$p < 0.01$. Hosmer–Lemeshow ($p = 0.635$ and 0.488; respectively) indicated the goodness of fit of the models are satisfactory

MCS explained 55 % out of 65 % of the total variance, accordingly with the high prevalence of depressive symptoms in Chilean older adults (Albala et al. 2005; SENAMA 2010; Albala et al. 2011). Our results are similar to the two-factor structure of Persian version (Mohammadpour and Yousefi 2008), where the first factor (MCS) was highly related with the mental health scale and the MCS explained a larger proportion of the total variance than the PCS. This is different from what has been observed in other populations where PCS explains more variance (Ware et al. 1998a).

After adjusting by age and gender, the main predictors of low health-related QoL in Chilean older people were self-perceived symptoms of depression, the presence of two or more chronic diseases and socio-economic factors, such as illiteracy. Important gender inequalities were observed in all of these results, being consistently less favourable in women than in men. Bartsch et al. (2011) reported that men had better health than women, with the exception of the vitality scale. Similar results were found by Chan et al. (2006) and Chachamovich et al. (2008) where depression was an important predictor of impairments in quality of life and attitudes towards ageing for older adults. On the other hand, we found that having social support is a strong protecting factor for the mental health component of QoL meanwhile living alone has a similar association with the physical health component. The relation between health and psychosocial factors with QoL was also studied by Webb et al. (2011) in England, arriving to similar conclusions with this study. That is, the most important factors associated with QoL were self-perceived symptoms of depression, unfavourable social and family network, and low income (Webb et al. 2011).

In this sense, this study has corroborated that in a context of high inequality, such as the Chilean case, self-perceived symptoms of depression remains the most important risk factor for a poor quality of life in older adults. This highlights the importance of an early detection of symptoms of depression at the primary health care level to assure early access to treatment and control of this mental condition.

The SF-36 Spanish version used in this paper has been shown to be a suitable instrument for use in gerontology research (Vilagut et al. 2005). The specific score algorithms estimated for the Chilean older population has been shown to be accurate for scoring both mental and physical components allowing researchers to have more precise indicators for this age group in Chile. In countries facing a population ageing process, the development and adaptation of specific indicators for older people is a fundamental task. A valid and reliable indicator for the assessment of QoL in Chilean older people helps to go further in the development of easy to apply and analyze instruments, in order to evaluate geriatric interventions and monitor the possible impact of public policies aimed to decrease inequalities and improve QoL in the older population.

It is important to point out some limitations and strengths of the present study, and to take them into account when interpreting findings and making recommendations. The main strengths are the calculus of specific coefficients score factors based in national Chilean means and standard deviations calculated in a national representative sample of 4,766 Chilean people of 60 years and older (Servicio Nacional del Aduto Mayor (SENAMA) 2010). A limitation of our study is that we did not confirm a higher order or more general construct of SF-36 but validated the SF-36 instrument using explanatory's analysis. Another limitation is that the sample used to validate the SF-36, although large enough and composed with similar proportion of people from high SEL, is not national representative sample. Therefore, it should be recommended first to incorporate these Chilean-specific scores to evaluate QoL in older people in clinical studies in Chile and second, to confirm this model or a higher order model of SF-36 in a future research.

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