Assessing the quality of life in patients with complex chronic conditions: Cronimad study

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Abstract

Background People's life expectancy has increased significantly in the past few decades, which has been associated with an increased prevalence of chronic diseases. Chronic-complex patients (CCP), including those characterized as polypathological patients (PPP), are now the majority among chronic patients and are considered a priority group in healthcare settings. This study aimed to determine the health-related quality of life (QoL) of Spanish CCP and its association with sociodemographic, clinical and functional variables and cognitive status.

Methods Patients identified as CCP or PPP from six hospitals in the Community of Madrid were included. The primary endpoint was to determine the QoL of CCP/PPP. To do so, patients were asked to complete the EuroQol questionnaire that included the visual analog scale (EQ-VAS), and the questionnaire with 5 dimensions and 5 levels (EQ-5D-5 L). Several socio-demographic/health-related variables were further evaluated and correlated with QoL.

Results A total of 128 CCP/PPP were included. A median EQ-VAS score of 60.0 [45.0, 80.0, and 0.64 [0.40, 0.79] on the EQ-5D-5 L Index were observed. Moderate to severe pain, functional impairment, gait disorders, and malnutrition were independently associated with poorer QoL when using the EQ-5D-5 L scale, and with the last two variables (gait disorders and malnutrition) when using the EQ-VAS scale.

Conclusion The present study highlights the need for better strategies to qualify and validate the QoL in this specific group of patients. Given the small sample of respondents, the present findings should be considered preliminary and only for hypothesis generation. Nevertheless, it further sheds some light on the different factors that should be considered, not only to stratify patients at varying levels of QoL but also to modulate the life quality of CCP/PPP in daily care setting.

Trial registration Not applicable.

Keywords Multimorbidity, Chronic complex patients, Polypathological patients, Quality of life, EQ-5D-5L index, Healthcare management

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Introduction

People's life expectancy has increased significantly in the past few decades. According to the World Health Organization (WHO), people lived 6 more years in 2019, compared to 2000 [1]. Specifically in Spain, the average life expectancy ranks among the world's highest, with 20.1% of the population above 65 years old that is expected to increase to 30.4% in 2050 [2].

On the one hand, there has been a clear improvement in living conditions and significant advances in medical care since the 19th century [3]. However, associated with the progressive aging of the population, it is observed a marked increase in the prevalence of chronic diseases (e.g. diabetes, cancer, cardiovascular or chronic obstructive respiratory diseases). Indeed, chronic conditions are responsible for 60% of the total deaths worldwide, leading to a significant deterioration in patients' quality of life (QoL) and imposing a great challenge to physicians in providing cost-effective quality of care [4].

Presently, the most common scenario is the coexistence of multiple chronic pathologies (multimorbidity), rather than a single chronic disease [5]. Considering this, new concepts such as complex chronic patients (CCP), or polyphatologic patients (PPP) have been introduced. While a CCP characterizes a person with one or several long-term diseases of difficult management and related to cognitive or functional impairment [6, 7], a PPP refers specifically to a CCP that suffers from chronic diseases included in two or more of 8 predefined categories [8].

Compared to other patient cohorts, CCP have a hospital prevalence range of 20–45% and share a specific clinical profile of increased age, social frailty, higher vulnerability, poor health-related QoL, prevalence of neurological deficits, functional deterioration, and higher 1-year mortality rate [6, 8]. Importantly, this emergent group of patients is responsible for 20–40% of hospital admissions, 40% being admitted ≥ 3 times, and 13% ≥ 5 times a year [9], making them a priority group in healthcare management [6, 8].

Attending to the significant change in the clinical profile of chronic patients, today's chronic care requires a new reform. Strategies at global and local levels have been proposed since 2002 attempting to reduce the burden of chronic limitations [10] and, more recently, to combat the increased rate of multimorbid patients in the healthcare system [11, 12]. Nonetheless, a deeper knowledge and characterization of these patients is still scarce and, therefore, urgent.

One of the key aspects in this patient group is the assessment of quality of life. To this end, various measurement scales have been employed, including the questionnaire EuroQol 5D (EQ- 5D) a widely used, standardized instrument developed in Europe to assess generic QoL.

Agborsangaya et al. compared the measurement properties of the EQ-5D-3L and EQ-5D-5L in a general population sample, highlighting the advantages of the EQ-5D-5L and illustrating the negative impact of multimorbidity on QoL [13]. Similarly, N'Goran et al. analyzed QoL using the EQ-5D in a Swiss cohort of patients with multimorbidity, reporting significantly lower scores compared to the general population, particularly among individuals under 60 years old and women [14]. Van Wilder et al. also found reduced EQ-5D scores in patients with chronic diseases compared to the general population and developed a comprehensive international catalog of EQ-5D scores for various chronic diseases, providing a valuable reference for future comparisons [15].

The present study aims to assess the health-related QoL of CCP/PPP patients in the Community of Madrid using the EQ-5D-5L questionnaire. Additionally, it seeks to explore the relationship between QoL and key health indicators such as functional and cognitive status, nutritional condition, and hospital admissions.

These findings are expected to contribute to the development of more comprehensive, multidimensional, and patient-centered healthcare management strategies.

Materials and methods

Study design

Prospective multicenter descriptive study carried out in patients identified as PPP or as CCP that consecutively attended the CCP units of the Service of Internal Medicine of six hospitals in the Community of Madrid (Hospital Universitario Infanta Cristina, Hospital Universitario del Tajo, Hospital Universitario Infanta Leonor, Hospital Universitario de Fuenlabrada, Hospital Universitario Gregorio Marañón, and Hospital Universitario Rey Juan Carlos). At the consultation, patients were asked to answer the questionnaire developed by the EuroQol Research Foundation, including the visual analog scale (EQ-VAS) and the questionnaire with 5 dimensions and 5 levels (EQ-5D-5L). At the same appointment, all the patient's sociodemographic data and multidimensional global assessment were collected. The inclusion period was from January 2021 to February 2022. Mortality was analyzed at one year of inclusion by reviewing electronic medical records or telephone calls. The only exclusion criteria were unwillingness to sign the informed consent form.

The study was performed per the Belmont report *"Ethical Principles and Guidelines for the Protection of Human Subjects of Research"* and the up-to-date declaration of Helsinki. All participants received information, accepted, and signed informed consent forms. Data collection was anonymous and used exclusively for the present study. Data confidentiality was maintained under Regulation (EU) 2016/679 of the European Parliament and of the

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Council of 27 April 2016 on Data Protection (GDPR) and the Spanish Organic Law 3/2018, of December 5, on the Protection of Personal Data and Guarantee of Digital Rights. The study was approved by the Clinical Research Ethics Committee of the Instituto de Investigación Puerta de Hierro-Segovia de Arana, Madrid (record no. 20/2019).

Endpoints and variables

The primary endpoint of this study was to determine the QoL of PPP or CCP attending Internal Medicine consultations. The secondary endpoint included examining the potential functional, psychological, and social factors affecting the QoL of these patients.

To measure the QoL, the EQ-VAS and the EQ-5D-5L scales were used. For the EQ-VAS, the patient was asked to identify his QoL by choosing a number (from 0 to 100) out of a thermometer-like millimeter scale of 20 cm, with 0 being the worst possible QoL and 100 the best [16]. The EQ-5D-5L, on the other hand, consisted of a questionnaire with 5 dimensions (EQ-5D; mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). Each of these dimensions had 5 possible responses or severity levels (EQ-5D-5L 1, no problems; 2, mild problems; 3, moderate problems; 4, severe problems; 5, very severe problems). Each respondent indicated the level that best reflected his status for each of the 5 dimensions so that their state of health would be described by five digits taking values from 1 to 5 (11111, indicating no problems in all dimensions, to 55555 indicating very severe problems in all dimensions [17]. The EQ-5D Index was then calculated by adjusting the perfect score of 1 (representing the highest QoL) based on negative coefficients derived from responses that differ from 1. The coefficients used are specific to the Spanish population and were calculated in a previous study [18]. The result is an Index that represents preferences for each of the 3,125 (5^5) possible health states resulting from the combinations of severity levels across the five dimensions, ranging from a maximum of 1 (indicating the best possible QoL, corresponding to 11111) to a minimum of −0.416 (representing the worst possible QoL, corresponding to 55555) [18].

From the EQ-5D Index, the Severity Index was obtained by summing the severity levels across five dimensions (e.g., 11111 = 5, 55555 = 25), subtracting 5, and then multiplying by 5 to create a range from 0 to 100, where 0 means the best QoL and 100 represents the worst QoL [17]. Finally, the Health Index was additionally obtained by subtracting the Severity Index from 100, with 0 being the total absence of QoL, and 100 representing the best perceived QoL [17].

A set of variables that may be associated to health-related perceived quality of life (HRQoL) has been explored. Some may be causes of poor HRQoL perception, such as functional deficits, frailty, cognitive impairments, malnutrition or pain. In this sense, to evaluate functional status, the simplified Barthel Index was used, grouping patients into those with severe dependence (Barthel less than 60), moderate dependence (Barthel 60–90), and independent (Barthel greater than 90) [19]. The FRAIL index was used to screen frailty, which evaluates fatigue, resistance, ambulation, presence of chronic diseases and weight loss, with a cut-off point for suspected frailty of ≥1 points [20]. The Global Deterioration Scale (GDS) of Reisberg was used for the diagnosis of dementia [21]. For those patients without dementia (GDS score lower than 4), the simplified Pfeiffer test was used as a screening for cognitive impairment [22].

Nutritional status was also assessed using the Mini-Nutritional Assessment-Short form (MNA-SF) [23]. A total score of MNA-SF < 8 indicates malnutrition, 8–11 risk of malnutrition, and > 11 no malnutrition.

Chronic pain was inquired, through clinical history or positive responses on the EQ-5D-5L scale.

The number of hospital admissions and emergency room visits in the year prior to study inclusion in the study were reviewed to assess whether this could have an impact on quality of life.

Additionally, patients were also asked about falls that occurred in the previous year using the questions proposed by the Ministry of Health in the "Consensus document on prevention of frailty and falls in the elderly" [24]. Also, extreme polypharmacy (taking more than 10 drugs daily) was assessed. These factors could either be causes or consequences of poor health perception.

Finally, social determinants associated with poor prognosis were evaluated, such as social status, the presence of a caregiver, or cultural level. Each of these variables was divided into several categories, and patients or their companions were asked directly to specify which one they belonged to.

The PROFUND index was used to estimate patient prognosis and to explore the relationship between life expectancy and quality of life, independently of clinical outcomes. This validated tool predicts the one-year mortality risk in PPP and PCC patients, classifying them into four risk levels: low (0–2 points), medium (3–6 points), high (7–10 points), and very high (11–30 points) [6]. Furthermore, one-year mortality was analyzed to determine whether baseline quality of life could serve as a predictor of mortality risk, providing potential insights into its prognostic value in this patient population.

Statistical analysis

First, a descriptive study was performed. Categorical variables were expressed as percentages while quantitative variables were expressed as median and interquartile

range, except for the MNA-SF Index and the number of drugs, which had normal distribution and were expressed as mean and standard deviation (SD).

To analyze possible factors influencing the QoL of these patients, the EQ-5D-5L and EQ-VAS indexes were correlated with 19 variables. The absence of normal distribution of both indexes was confirmed via the Shapiro test. Also, absence of linearity was detected in most of the comparisons. Some transformations of those variables where checked, but all of them failed to correct the violation of the assumptions of normality and linearity. So, Spearman's correlation Index and statistical significance between the EQ-5D-5L Index and quantitative, binary, and ordinal variables were estimated. The Heath Index showed a very good correlation with the weighted EQ-5D-5L Index (ρ 0.97, $p < 0.001$), and similar results were found on its association with the rest of the variables (data not shown). Only the correlations of patients' socio-demographic/health conditioning variables with the EQ-5D-5L and EQ-VAS indexes are shown in the present manuscript.

Correlations with $p < 0.05$ were considered statistically significant. Since the analysis was exploratory, significance was adjusted by Bonferroni correction, according to the following formula: p' = min (1; kp), where p' is the corrected significance, k is the number of correlations explored (19 for each index), and p is the significance of the individual test [25, 26].

We then conducted a multivariate analysis using beta regression to examine the associations between the EQ-VAS and EQ-5D-5L indices and the 19 variables previously explored in the correlation analysis. Beta regression requires that the dependent variable take values within the open interval (0,1). To rescale the index values accordingly: the EQ-VAS (range 0–100) was divided by 100; the EQ-5D-5L index (range −0.416 to 1) was normalized using the formula:

$$EQ - 5D - 5L' = (EQ - 5D - 5L - (-0.416)) \\ / (1 - (-0.416))$$

Next, we applied the transformation proposed by Smithson and Verkuilen (2006) [27] to both variables to avoid boundary values equal to 0 or 1:

$$y' = (y\,(n-1) + 0.5)/n$$

where *y* is the rescaled original value, *n* is the sample size, and *y'* is the transformed value.

For each index, we first performed bivariate analyses with each independent variable, selecting as candidates those with a p-value < 0.2. We then estimated a full model and conducted backward stepwise regression, removing at each step the variables with p-values greater than 0.1.

Among all estimated models, we selected the one with the lowest Akaike information Criterion (AIC) value (AIC=−29.4 for EQ-VAS model and −140.3 for EQ-5D-5L index model).

From the selected models, we extracted a table of Average Marginal Effects (AME) and their 95% confidence intervals for each variable included. The coefficient for each variable represents the variation in the index per one-unit increase in the independent variable, on the [0,1] scale. To express the AMEs of the EQ-5D-5L index on the original scale, we multiplied the AME values by the range of the index (1 − (−0.416)). The additive constant (i.e., the minimum: −0.416) was not applied, as AMEs represent changes rather than levels. For the EQ-VAS index, the variation should be multiplied by 100.

Statistical analysis was performed with the Stata software package version 18 (StataCorp. 2023. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC).

Results

Study population
Between January 2021 and January 2022, data were collected from 128 patients across six public hospitals in the Autonomous Community of Madrid, of whom 56% were women, with a median age of 83.3 years old [77.3–89.0]. All demographic data are presented in Table 1.

Data collected demonstrated that patients frequently used the Hospital services, with a median of 1 hospitalization [0.5–3.0] and 1 emergency department visits [0.0–2.0] per year. While 55% of patients were widowed, divorced, or single, only 17.1% lived alone. Concerning the presence of a caregiver, 72.7% either had no caregiver or indicated their caregiver was not a spouse.

Looking at the health-associating factors, the prevalence of moderate to very severe cognitive impairment within this population was low, at 7.9%. However, among those without a cognitive impairment diagnosis (GDS Index < 4), 16.5% had a positive Peiffer screening test (Table 1). Moreover, severe dependence (Barthel < 60) was present in 16.7% of patients, yet among those who were independent in daily activities, defined by a Barthel greater than 90 (35.2%), 75.8% had a FRAIL Index ≥ 1.

Falls were common, with 23.4% of patients reporting at least one fall in the previous year, 15.3% experiencing two or more (Table 1), and 6.5% requiring medical assistance as a consequence of a fall. Additionally, malnutrition was a concern with an average MNA SF score of 10.34 (SD = 2.56), 16.3% of patients malnourished (MNA SF score 0–7) and 43.9% at risk of malnutrition (MNA SF score 8–11).

Regarding drug prescription and administration, this analysis demonstrated that patients were taking an average of 12.6 (SD 3.81) drugs, with 76.7% being prescribed
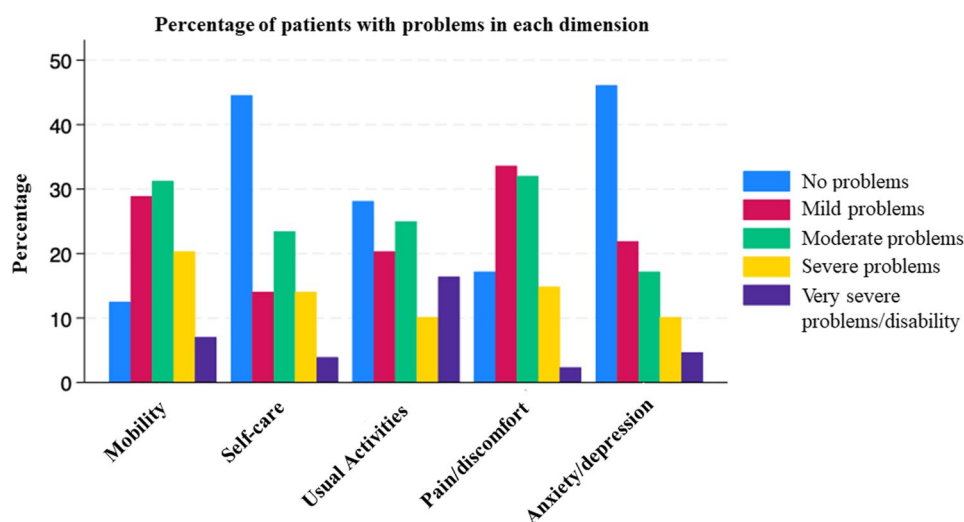
Table 1 Association of the EQ-5D-5L index and the EQ-VAS index with the different variables

	No. (%)/ Median [Q1-Q3]	EQ-5D-5L Index: Median [Q1-Q3]	Spearman co-efficient (ρ); P value	EQ-VAS Index: Median [Q1-Q3]	Spearman coefficient (ρ); P value
Age (years) (N = 126)	83.3 [77.3–88.90]	0.6 [0.4–0.8]	−0.12; 1.0000	60.0 [45.0–80.0]	−0.05; 1.0000
Women (N = 126)			−0.23; 0.1734		−0.18; 0.9943
No	55 (43.7%)	0.74 [0.47–0.84]		70.00 [50.00–80.00]	
Yes	71 (56.3%)	0.59 [0.28–0.76]		50.00 [40.00–75.00]	
Death in the following year (N = 128)			−0.02; 1.0000		0.07; 1.0000
No	119 (93.0%)	0.64 [0.42–0.79]		60.00 [40.00–80.00]	
Yes	9 (7.0%)	0.62 [0.28–0.81]		67.50 [50.00–77.50]	
Level of education (N = 125)			0.17; 1.0000		0.08; 1.0000
No studies	55 (44.0%)	0.56 [0.30–0.76]		60.00 [45.00–75.00]	
Primary education	58 (46.4%)	0.70 [0.47–0.79]		50.00 [35.00–70.00]	
Secondary education	8 (6.4%)	0.58 [0.36–0.90]		80.00 [75.00–80.00]	
University degree	4 (3.2%)	0.86 [0.65–0.96]		77.50 [75.00–80.00]	
Caregiver (N = 121)			0.17; 1.0000		0.19; 0.7456
No caregiver or non-spouse	88 (72.7%)	0.60 [0.35–0.78]		50.00 [40.00–70.00]	
Caregiver spouse	33 (27.3%)	0.71 [0.48–0.87]		72.50 [50.00–80.00]	
Lives alone (N = 123)			0.00; 1.0000		−0.15; 1.0000
No	102 (82.9%)	0.61 [0.42–0.79]		60.00 [45.00–80.00]	
Yes	21 (17.1%)	0.70 [0.43–0.77]		50.00 [30.00–60.00]	
Number of hospital admissions in the previous year (N = 128)	1.0 [0.5-3.0]	0.6 [0.4–0.8]	−0.14; 1.0000	60.0 [45.0–80.0]	−0.01; 1.0000
Number of visits to the emergency department in the previous year (N = 128)	1.0 [0.0–2.0]	0.6 [0.4–0.8]	−0.05; 1.0000	60.0 [45.0–80.0]	0.05; 1.0000
FRAIL Index (N = 114)	2.0 [1.0–3.0]	0.6 [0.4–0.8]	−0.50; 0.0000	60.0 [50.0–80.0]	−0.30; 0.0199
MNA-SF Index (N = 123)	10.0 [8.0–13.0]	0.6 [0.4–0.8]	0.36; 0.0009	60.0 [42.5–80.0]	0.39; 0.0002
PROFUND Index (N = 122)	6.0 [3.0–9.0]	0.6 [0.4–0.8]	−0.34; 0.0027	60.0 [42.5–80.0]	−0.16; 1.0000
Falls in the last year (N = 124)			0.01; 1.0000		0.04; 1.0000
No	95 (76.6%)	0.64 [0.43–0.79]		50.00 [45.00–80.00]	
Yes	29 (23.4%)	0.64 [0.33–0.84]		67.50 [40.00–77.50]	
More than two falls per year (N = 124)			0.03; 1.0000		−0.12; 1.0000
No	105 (84.7%)	0.64 [0.36–0.79]		60.00 [50.00–80.00]	
Yes	19 (15.3%)	0.60 [0.47–0.84]		50.00 [10.00–75.00]	
Gait disturbance (N = 122)			−0.50; 0.0000		−0.28; 0.0453
No	59 (48.4%)	0.79 [0.59–0.87]		70.00 [50.00–80.00]	
Yes	63 (51.6%)	0.48 [0.28–0.69]		50.00 [30.00–70.00]	
Cognitive impairment (GDS) (n = 127)			−0.05; 1.0000		−0.07; 1.0000
Absent-mild	117 (92.1%)	0.64 [0.36–0.80]		60.00 [45.00–80.00]	
Moderate-severe	5 (3.9%)	0.62 [0.54–0.79]		60.00 [50.00–80.00]	
Severe-very severe	5 (3.9%)	0.53 [0.46–0.54]		50.00 [40.00–50.00]	
Suspected dementia (GDS < 4) (N = 97)			−0.27; 0.1574		−0.21; 0.5772
No	81 (83,6%)	0.71 [0.46–0.81]		67.50 [50.00–80.00]	
Yes	16 (16.5%)	0.45 [0.18–0.68]		40.00 [30.00–70.00]	
Barthel Index (N = 108)			0.47; 0.0000		0.13; 1.0000
Barthel < 60	18 (16.7%)	0.47 [0.26–0.59]		60.00 [50.00–75.00]	
Barthel 60–90	52 (48.1%)	0.59 [0.33–0.77]		50.00 [30.00–75.00]	
Barthel > 90	38 (35.2%)	0.79 [0.64–0.88]		70.00 [50.00–80.00]	
Polypharmacy (> 10 drugs) (N = 84)			0.04; 1.0000		−0.04; 1.0000
No	20 (23.3%)	0.66 [0.46–0.79]		50.00 [40.00–80.00]	
Yes	66 (76.7%)	0.69 [0.47–0.80]		60.00 [50.00–80.00]	
Moderate to extreme pain (N = 128)			−0.55; 0.0000		−0.36; 0.0009

Table 1 (continued)

	No. (%)/ Median [Q1-Q3]	EQ-5D-5L Index: Median [Q1-Q3]	Spearman co-efficient (ρ); P value	EQ-VAS Index: Median [Q1-Q3]	Spearman coefficient (ρ); P value
No	65 (50.8%)	0.79 [0.60–0.85]		70.00 [50.00–80.00]	
Yes	63 (49.2%)	0.46 [0.21–0.64]		50.00 [30.00–70.00]	

MNA-SF Mini-Nutritional Assessment-Short form; *GDS* Global deterioration scale; *EQ-VAS* EuroQol questionnaire-Visual analogue scale; *EQ-5D-5L* EuroQol questionnaire with 5 dimensions and 5 levels

Fig. 1 Frequency of responses to the EQ-5D-5 L questionnaire

10 or more medications (extreme polypharmacy). Despite this, the majority (92.7%) showed to have good treatment adherence. Importantly, 49.2% of patients experienced moderate to extreme pain.

Concerning the patient's prognosis, the median PROFUND Index was 6 [3.0–9.0], corresponding to a 21.5% probability of death within one year, increasing to 21–31% one-year post-hospital discharge in case of admission. Finally, based on the assessment of patient information and medical records, it was concluded that the mortality one year after inclusion in the study was 7%, lower than the one estimated by the PROFUND index (Table 1).

Quality of life

Self-reported QoL was evaluated using the EQ-VAS and EQ-5D-5L questionnaires. Patients presented a median QoL score of 60.0 [45.0, 80.0] (mean 56.0, SD = 25.2) on the EQ-VAS scale and 0.64 [0.40, 0.79] (mean 0.57, DS = 0.29) on the EQ-5D-5L Index. According to the EQ-5D-5L questionnaire, patients reported moderate to severe problems with mobility, usual activities, pain or discomfort, self-care, and anxiety/depression in 58.1, 51.6, 49.2, 41.4, and 32.0% of cases, respectively (Fig. 1).

Factors influencing the QoL of PPP and CCP

Attempting to identify significant variables influencing the QoL in these patients, the EQ-5D-5L and the EQ-VAS indexes were correlated with 19 variables (Table 1).

No significant association was found between aging and poorer QoL (ρ = −0.12; $p = 1.000$ for EQ-5D-5L and ρ = −0.05; $p = 1.000$ for EQ-VAS).

Notably, although not reaching statistical significance, female sex exhibited a negative correlation with the EQ-5D-5L Index (ρ = −0.23), suggesting a potential trend toward lower quality of life among female patients. To further elaborate on this point, an analysis of a possible association between patient gender and different health variables was conducted. Indeed, it was observed that women in this study were less likely to have a spousal caregiver (OR 0.38, 95% CI 0.17–0.86; $p = 0.021$), more likely to have walking difficulties (OR 2.24, 95% CI 1.07–4.68; $p = 0.032$), or to have a higher risk of malnutrition (OR 2.78, 95% CI 1.32–5.88; $p = 0.007$).

It was observed that the FRAIL Index showed a significant negative association with both the EQ-5D-5L (ρ −0.50; $p < 0.001$), and the EQ-VAS indexes (ρ −0.30; $p = 0.020$). Similarly, the presence of moderate to extreme pain also associated with worse QoL in both indexes (ρ −0.55; $p < 0.001$ vs ρ −0.36; $p < 0.001$ for EQ-5D-5L and EQ-VAS respectively), and the same was also observed for walking disturbances (ρ −0.50; $p < 0.001$ vs. ρ −0.28;

$p = 0.045$, for EQ-5D-5L and EQ-VAS respectively). The MNA-SF Index, on the other hand, resulted in a significant positive correlation with both the EQ-5D-5L Index (ρ 0.36; $p = 0.001$) and the EQ-VAS Index (ρ 0.39; $p < 0.001$). Another positive correlation was found significant between the Barthel Index and the QoL measured by the EQ-5D-5L Index (ρ 0.47; $p < 0.001$), revealing that a higher functional dependence and a higher level of malnutrition are linked to a poorer QoL in the surveyed patients.

Patients with a higher PROFUND Index, and therefore worse prognostic estimation, showed to be associated with poorer QoL (ρ −0.34; $p = 0.003$), when evaluated using the EQ-5D-5L Index. Nevertheless, QoL was not shown to be a predictor of poor prognosis (Table 1).

In the multivariate analysis, moderate to severe pain, functional impairment, gait disorders, and malnutrition showed independent association with poorer quality of life when using the EQ-5D-5L scale, and with the last two variables (gait disorders and malnutrition) when using the EQ-VAS scale. In the final model for the EQ-5D-5L, the cognitive impairment variable was retained solely for adjustment purposes, without statistical significance (Table 2).

Discussion

The present study found that the QoL on CCP/PPP patients, as measured by the EQ-5D-5L, is lower than that reported by individuals of the same age in Spain. More than half of the patients experienced moderate or severe impairments in mobility and performance of daily activities [17].

Greater functional dependence, gait impairment, higher levels of malnutrition, and the presence of moderate or severe chronic pain were associated with poorer QoL in this population.

The prevalence of patients with multimorbidity in the hospital setting and primary care is high and is expected to increase even more in the upcoming years [6]. Particularly, CCP are already the majority of patients in certain health departments in Switzerland [28], Scotland [29], Portugal [5], and Spain [8]. These are patients characterized by a higher fragility, risk of malnutrition, and extreme polypharmacy, with a significant proportion of them suffering from moderate or severe pain. For this reason, considering their complexity, greater vulnerability, and weight on caregivers, families, and medical areas, healthcare models are now subjected to important reforms aiming to implement and offer more friendly and

Table 2 Unadjusted and adjusted average marginal effects values of variables included in multivariate beta regression analysis of EQ-VAS and EQ-5D-5 L indexes associations

EQ-VAS					EQ-5D-5 L			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	AME (CI 95%)	*p*-value	AME (CI 95%)	*p*-value	AME (CI 95%)	*p*-value	AME (CI 95%)	*p*-value
Level of education								
No studies	Ref.	-	Ref.	-				
Primary education	−0.220 (−0.586 to 0.146)	0.238	−0.074 (−0.158 to 0.010)	0.083				
Secondary education	0.646 (−0.097 to 1.389)	0.088	0.188 (0.041 to 0.335)	0.012				
University degree	0.644 (−0.371 to 1.660)	0.214	0.122 (−0.083 to 0.327)	0.244				
MNA-SF index	0.036 (0.021 to 0.051)	0.000	0.031 (0.016 to 0.047)	0.000	0.042 (0.024 to 0.060)	0.000	0.021 (0.008 to 0.034)	0.002
Gait disturbance	−0.166 (−0.246 to −0.086)	0.000	−0.123 (−0.203 to −0.043)	0.003	−0.276 (−0.361 to −0.192)	0.000	−0.121 (−0.194 to −0.047)	0.001
Barthel Index								
<60					Ref.		Ref.	
60–90					0.538 (−0.049 to 1.124)	0.072	0.043 (−0.061 to 0.147)	0.421
>90					1.638 (0.995 to 2.280)	0.000	0.216 (0.102 to 0.330)	0.000
Cognitive impairment (GDS scale)								
Absent-mild					Ref.		Ref.	
Moderate-severe					0.285 (−0.920 to 1.489)	0.643	0.115 (−0.022 to 0.253)	0.100
Severe-very severe					−0.684 (−1.845 to 0.477)	0.248	−0.012 (−0.162 to 0.137)	0.871
Moderate to extreme pain					−0.302 (−0.381 to −0.223)	0.000	−0.248 (−0.311 to −0.185)	0.000

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Table 3 EQ-VAS and EQ-5D-5 L outcomes between the study population and the Spanish National Health Survey

Age (years)	Study population		NHS (Spain)		NHS community of Madrid	
	EQ-VAS (mean)	EQ-5D-5 L(mean)*	EQ-VAS (mean)	EQ-5D-5 L (mean)*	EQ-VAS (mean)	EQ-5D-5L(mean)*
65–74	59.44	59.38	69.82	86.49	76.42	90.3
75–84	53.78	53.54	62.57	78.12	68.66	80.7
+85	58.31	58.44	54.55	62.51	67.70	70.0
Total			64.82	79.84		

EQ-VAS EuroQol questionnaire-Visual analogue scale; *EQ-5D-5 L* EuroQol questionnaire with 5 dimensions and 5 levels; *NHS* National Health Survey 2011–2012 [14]

* EQ-5D-5 L value x 100

patient-centred daily care strategies [11]. The better we know the state of health of these patients, the easier it will be to adjust their needs and implement/execute the aforementioned strategies.

When evaluating the QoL of our population aged 65 years and older, who constitute most of the sample, it is evident that the average QoL index values are consistently lower than the national average for a population of a similar age (Table 3). However, an exception is observed in the EQ-VAS scores for individuals over 85 years old, where our population reports slightly higher values (58.31 vs. 54.55, respectively). The differences in QoL scores are even more pronounced when comparing our data with those published for the Community of Madrid, highlighting a significant disparity (Table 3) [17].

Focusing on the responses to the EQ-5D-5L questionnaire, national data showed that most of the *very severe* problems described by the age-matched population were associated with the performance of their usual activities (8.8% of a total of 3,165 people ≥ 75 years old). The most common *moderate to very severe* problems were associated with mobility (36.1% of a total of 3,165 people ≥ 75 years old), usual activities (29.4%), and pain/discomfort (35.1%). Interestingly, although these results align with our data, at a percentage level, one may acknowledge the higher percentages of *very severe* and *moderate to very severe* problems in all three dimensions (mobility, 58.1%; usual activities, 51.6%; pain/discomfort, 49.2%) observed for our CCP/PPP group. Moderate to severe problems in self-care and anxiety/depression were also more reported in our series than in national data (41.4% and 32.0% versus 21.2% and 12.8%, respectively) [17].

Looking at the socio-demographic characteristics, these results could be partly justified by the high presence of respondents with no education/only primary education (90.4%), without caregivers (72.7%), or by the presence of 56.3% female participants. In fact, studies carried out at national and global levels have not only shown that there is a relationship between the level of education and the health status in the elderly population but have also described a lower QoL associated with women vs. men [17, 30, 31]. More interestingly, related to the presence/absence of caregivers, Molina-Mula et al.., revealed a significant association between the number of nurse home visits and the level of dependence on the CCP, leading to a worse perception of the QoL [9]. On the other hand, judging by the average age of the respondents, the aging-associated processes could also justify the relatively low QoL value observed [10]. Nonetheless, our correlation analysis suggests that neither aging nor the presence of a caregiver interfered in the QoL of CCP/PPP, but rather a set of health conditioning factors.

Importantly, poorer quality of life was significantly associated with the presence of gait disturbances, increased functional dependence, malnutrition, higher frailty levels, and moderate to severe chronic pain.

All these variables have long been associated with the QoL of either older people or chronic patients [32–36]. However, there is a large gap in studies that corroborate its use for the characterization of QoL in CCP. Focusing on the EQ-5D-5L Index, our data further demonstrates that CCP/PPP have a poorer QoL when suffering functional dependence, which is in accordance with previous data showing a positive correlation between the Barthel Index and the EuroQoL-5D-5L scales in patients with multiple chronic conditions [9].

Regarding frailty, it is important to emphasize that it represents a transitional stage preceding dependency and is widely recognized as one of the most robust predictors of adverse outcomes—including falls, hospitalizations, disability, and mortality—independently of other clinical parameters such as multimorbidity. Crucially, frailty is a potentially reversible condition [37]. Indeed, various interventions have demonstrated efficacy in mitigating frailty, particularly those focusing on physical exercise programs, social engagement to reduce loneliness, and fall prevention strategies [38, 39].

Beyond frailty, targeted interventions addressing malnutrition [40, 41], as well as multicomponent exercise regimens [34] which combine strength, endurance, balance, and gait training, have also been shown to improve patients' QoL [42].

These findings underscore a critical window of opportunity for intervention in complex chronic patients (CCPs), with the potential to delay functional decline and enhance overall well-being.

In our study, quality of life was not found to be a prognostic marker for mortality, as has been demonstrated in

other studies, probably related to the low one-year mortality rate [43].

Finally, it is worth mentioning that a slight tendency for a worse QoL in women CCP was observed, as described in other studies [14, 43, 44]. Based on the above data, this could result from the significant association observed between women with both gait disturbance and nutritional problems. However, other factors associated with this gender difference have been described. For example, in a Spanish study in people over 60 years of age, the QoL was worse in women compared to men, showing that sociodemographic factors, such as lower educational level, and lifestyle factors, such as greater sedentary lifestyle, can explain a substantial part of the differences between women and men in QoL [45].

We acknowledge the several limitations of this study. The sample size is small, so we consider the present findings valid only for hypothesis generation. Therefore, more studies are needed to corroborate these preliminary results.

Another limitation of our study is that the general population data used for comparison with CCP were collected more than a decade ago, and it is known that the perception of QoL evolves over time, albeit slowly, and can be influenced by economic or health crises [46, 47].

Even so, our data strongly imply that accurate access to QoL in these patients can only be done by a complex and complete assessment of all the variables, rather than using only the most validated ones. We, therefore, believe that conducting a multidimensional assessment of a vulnerable population, such as the PCC, is of great value for tailoring the healthcare system into a more patient-driven one with increased functionality and decreased unnecessary and spiralling visits to hospital settings, this way ameliorating patients' well-being and increasing the number of years CCP/PPP will spend with good QoL [48].

In conclusion, the study identifies that patients with CCP/PPP have a poorer quality of life than patients of the same age. This could be influenced by functional dependence potentially but reversible factors such as frailty, malnutrition, and pain. In the multivariate models, the negative impact of malnutrition, gait disorders, pain, and level of dependency on quality of life remains significant. However, the effects observed for other variables in the bivariate analysis do not persist, likely due to confounding or mediation by variables with independent effects. Interestingly, having completed secondary education is also associated with better quality of life, as measured by the EQ-VAS scale, compared to having no formal education.

All of this highlights the need for a comprehensive assessment that allows for early diagnosis of these conditions and the implementation of multidimensional interventions to prevent functional dependence and activities of daily living.

We hope this study results will help improve chronic disease management and identify those most in need of healthcare support.

Abbreviations

CCP	Chronic-complex patients
EQ-5D-5L	EuroQol questionnaire with 5 dimensions and 5 levels
MNA-SF	Mini-Nutritional Assessment-Short form
QoL	Quality of life
SD	Standard deviation
WHO	World Health Organization
EQ	EuroQol questionnaire
GDS	Global Deterioration Scale
NHS	National Health Survey
PPP	Polypathological patients
VAS	Visual analogue scale

Author contributions
All authors have contributed equally to the conceptualization, writing, and revision of this manuscript.

Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study was performed per the Belmont report *"Ethical Principles and Guidelines for the Protection of Human Subjects of Research"* and the up-to-date declaration of Helsinki. All participants received information, accepted, and signed informed consent forms. The study was approved by the Clinical Research Ethics Committee of the Instituto de Investigación Puerta de Hierro-Segovia de Arana, Madrid (record no. 20/2019).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. World Health Organization. GHE: Life expectancy and healthy life expectancy [Internet]. Available from: https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-life-expectancy-and-healthy-life-expectancy.
2. Instituto Nacional de Estadística. Proyecciones de Población 2022–2072 [Internet]. Available from: https://www.ine.es/prensa/pp_2022_2072.pdf.
3. Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. Public Health Rep. 2014;129(1suppl2):19–31.
4. European Union. EU Reflection on Chronic Disease [Internet]. Available from: https://health.ec.europa.eu/document/download/4fdb23ef-d0b4-4078-b09b-a84e9c3d48df_en.
5. Prazeres F, Santiago L. Prevalence of Multimorbidity in the adult population attending primary care in portugal: a cross-sectional study. BMJ Open. 2015;5(9):e009287.
6. Bernabeu-Wittel M, Ollero-Baturone M, Moreno-Gaviño L, Barón-Franco B, Fuertes A, Murcia-Zaragoza J, et al. Development of a new predictive model for polypathological patients. The PROFUND index. Eur J Intern Med. 2011;22(3):311–7.
7. Martín-Escalante MD, Quirós-López R, Martos-Pérez F, Olalla-Sierra J, Rivas-Ruiz F, Aguilar-García JA, et al. Validation of the PROFUND index to predict early post-hospital discharge mortality. QJM: Int J Med. 2019;112(11):854–60.
8. Wittel MB, Romero LG, Zaragoza JM, Mancera RG, Santos RA, Manglano JD, et al. Characterization of patients with chronic diseases and complex care needs: A new High-Risk emergent population. J Biomed Res Environ Sci. 2022;3(12):1321–36.
9. Molina-Mula J, Miguélez-Chamorro A, Taltavull-Aparicio JM, Miralles-Xamena J, Ortego-Mate MDC. Quality of life and dependence degree of chronic patients in a chronicity care model. Healthcare. 2020;8(3):293.
10. Ministerio de Sanidad. Strategy for Addressing Chronicity in the National Health System [Internet]. Available from: https://www.sanidad.gob.es/areas/calidadAsistencial/estrategias/abordajeCronicidad/docs/Resumen_Ejecutivo_Estrategia_Abordaje_Cronicidad_ENGLISH_02.pdf.
11. Rijken M, Stüssgen R, Leemrijse C, Bogerd MJL, Korevaar JC. Priorities and preferences for care of people with multiple chronic conditions. Health Expect. 2021;24(4):1300–11.
12. Comunidad de Madrid. Estrategia de atención a las personas con enfermedades crónicas de la Comunidad de Madrid [Internet]. Available from: https://www.comunidad.madrid/transparencia/sites/default/files/plan/document/432_474_libro_estratpac_enfcroniccommadrid_ip_0.pdf.
13. Agborsangaya CB, Lahtinen M, Cooke T, Johnson JA. Comparing the EQ-5D 3L and 5L: measurement properties and association with chronic conditions and Multimorbidity in the general population. Health Qual Life Outcomes. 2014;12:74.
14. N'Goran AA, Déruaz-Luyet A, Haller DM, Zeller A, Rosemann T, Streit S, et al. Comparing the self-perceived quality of life of multimorbid patients and the general population using the EQ-5D-3L. PLoS ONE. 2017;12(12):e0188499.
15. Van Wilder L, Rammant E, Clays E, Devleesschauwer B, Pauwels N, De Smedt D. A comprehensive catalogue of EQ-5D scores in chronic disease: results of a systematic review. Qual Life Res. 2019;28(12):3153–61.
16. Rabin R, Charro FD. EQ-SD: a measure of health status from the EuroQol group. Ann Med. 2001;33(5):337–43.
17. Ministerio de Sanidad. Encuesta nacional de salud España 2011/12.
18. Ramos-Goñi JM, Craig BM, Oppe M, Ramallo-Fariña Y, Pinto-Prades JL, Luo N, et al. Handling data quality issues to estimate the Spanish EQ-5D-5L value set using a hybrid interval regression approach. Value Health. 2018;21(5):596–604.
19. Bernabeu-Wittel M, Díez-Manglano J, Nieto-Martín D, Ramírez-Duque N, Ollero-Baturone M, Abella-Vázquez L, et al. Simplificación de La Escala de Barthel Para El Cribado de fragilidad y dependencia Severa En Pacientes pluripatológicos. Revista Clínica Española. 2019;219(8):433–9.
20. Ministerio de Sanidad. Actualización del documento de consenso sobre prevención de la fragilidad en la persona mayor. (2022) [Internet]. Available from: https://www.sanidad.gob.es/areas/promocionPrevencion/envejecimientoSaludable/fragilidadCaidas/docs/ActualizacionDoc_FragilidadyCaidas_personamayor.pdf.
21. Reisberg B, Ferris SH, de Leon MJ, Crook T. The global deterioration scale for assessment of primary degenerative dementia. AJP. 1982;139(9):1136–9.
22. Bernabeu-Wittel M, Nieto Martín D, Moreno-Gaviño L, Ollero-Baturone M. Valor Diagnóstico de Un cuestionario de Pfeiffer simplificado En Pacientes pluripatológicos. Revista Clínica Española. 2017;217(6):320–4.
23. Sysal P, Veronese N, Arik F, Kalan U, Smith L, Isik AT. Mini nutritional assessment Scale-Short form can be useful for frailty screening in older adults. CIA. 2019;14:693–9.
24. Documento de consenso sobre prevención de fragilidad y caídas en la persona mayor. Estrategia de promoción de la salud y prevención en el SNS. 2024 [Internet]. Available from: https://www.sanidad.gob.es/areas/promocionPrevencion/envejecimientoSaludable/fragilidadCaidas/estrategiaSNS/docs/FragilidadyCaidas_personamayor.pdf.
25. Stata. Spearman's and Kendall's correlations [Internet]. Available from: https://www.stata.com/manuals/rspearman.pdf.
26. Armstrong RA. When to use the B onferroni correction. Ophthalmic Physiologic Optic. 2014;34(5):502–8.
27. Smithson M, Verkuilen J. A better lemon squeezer? Maximum-likelihood regression with beta-distributed dependent variables. Psychol Methods. 2006;11(1):54–71.
28. Excoffier S, Herzig L, N'Goran AA, Déruaz-Luyet A, Haller DM. Prevalence of Multimorbidity in general practice: a cross-sectional study within the Swiss Sentinel surveillance system (Sentinella). BMJ Open. 2018;8(3):e019616.
29. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of Multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet. 2012;380(9836):37–43.
30. Medhi G, Sarma J, Bhattacharyya H, Pala S, Visi V, Bora P. Sociodemographic variations in health-related quality of life (HRQOL) among elderly individuals in an urban locality in India. J Family Med Prim Care. 2019;8(7):2473.
31. Lee KH, Xu H, Wu B. Gender differences in quality of life among community-dwelling older adults in low- and middle-income countries: results from the study on global ageing and adult health (SAGE). BMC Public Health. 2020;20(1):114.
32. Mhesin D, Nazzal H, Amerah J, Azamtta M, Ismail Y, Daralammouri Y, et al. Prevalence of pain and its association with quality of life of patients with heart failure in a developing country: findings from a multicenter cross-sectional study. BMC Cardiovasc Disord. 2022;22(1):426.
33. Jørstad EC, Hauer K, Becker C, Lamb SE, on behalf of the ProFaNE Group. Measuring the psychological outcomes of falling: A systematic review. J Am Geriatr Soc. 2005;53(3):501–10.
34. Herman T, Giladi N, Gruendlinger L, Hausdorff JM. Six weeks of intensive treadmill training improves gait and quality of life in patients with parkinson's disease: A pilot study. Arch Phys Med Rehabil. 2007;88(9):1154–8.
35. Rasheed S, Woods RT. Malnutrition and quality of life in older people: A systematic review and meta-analysis. Ageing Res Rev. 2013;12(2):561–6.
36. Chang YW, Chen WL, Lin FG, Fang WH, Yen MY, Hsieh CC, et al. Frailty and its impact on health-related quality of life: a cross-sectional study on elder community-dwelling preventive health service users. PLoS ONE. 2012;7(5):e38079 Vina J, editor.
37. Abizanda P, Romero L, Sanchez-Jurado PM, Martinez-Reig M, Alfonso-Silguero SA, Rodriguez-Manas L. Age, frailty, disability, institutionalization, Multimorbidity or comorbidity. Which are the main targets in older adults? J Nutr Health Aging. 2014;18(6):622–7.
38. Ožić S, Vasiljev V, Ivković V, Bilajac L, Rukavina T. Interventions aimed at loneliness and fall prevention reduce frailty in elderly urban population. Medicine. 2020;99(8):e19145.
39. Gwyther H, Bobrowicz-Campos E, Luis Alves Apóstolo J, Marcucci M, Cano A, Holland C. A realist review to understand the efficacy and outcomes of interventions designed to minimise, reverse or prevent the progression of frailty. Health Psychol Rev. 2018;12(4):382–404.
40. Bharaniidharan J, Reshmi SK. Review on malnutrition: impact and prevention. IJARI. 2019;7(3):49–55.
41. Vivanti A. Improving the quality of life of aged care residents through the joy of food. Australas J Ageing. 2018;37(4):252–3.
42. Belmonte Darraz S, González-Roldán AM, de María Arrebola J, Montoro-Aguilar CI. [Physical exercise impact on variables related to emotional and functional well-being in older adults]. Rev Esp Geriatr Gerontol. 2021;56(3):136–43.
43. Gobbens RJJ, van der Ploeg T. The prediction of mortality by quality of life assessed with the WHOQOL-BREF: a longitudinal analysis at the

domain and item levels using a seven-year follow-up period. Qual Life Res. 2021;30(7):1951–62.

44. Otero-Rodríguez A, León-Muñoz LM, Balboa-Castillo T, Banegas JR, Rodríguez-Artalejo F, Guallar-Castillón P. Change in health-related quality of life as a predictor of mortality in the older adults. Qual Life Res. 2010;19(1):15–23.

45. Guallar-Castillón P, Sendino AR, Banegas JR, López-García E, Rodríguez-Artalejo F. Differences in quality of life between women and men in the older population of Spain. Soc Sci Med. 2005;60(6):1229–40.

46. Fernandez A, Garcia-Alonso J, Royo-Pastor C, Garrell-Corbera I, Rengel-Chica J, Agudo-Ugena J, et al. Effects of the economic crisis and social support on health-related quality of life: first wave of a longitudinal study in Spain. Br J Gen Pract. 2015;65(632):e198–203.

47. Davalos ME, French MT. This recession is wearing me out! Health-related quality of life and economic downturns. J Ment Health Policy Econ. 2011;14(2):61–72.

48. Vallejo Maroto I, Cubo Romano P, Mafé Nogueroles MC, Matesanz-Fernández M, Pérez-Belmonte LM, Said Criado I, et al. Recommendations on the comprehensive, multidimensional assessment of hospitalized elderly people. Position of the Spanish society of internal medicine. Revista Clínica Española (English Edition). 2021;221(6):347–58.

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