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Quality of life, grip strength, health indicators, and clinical risk in older adults: A cross-sectional study*

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ABSTRACT

Aim: To examine the relationship between functional status, self-perceived quality of life and other health indicators, and their association with clinical risk and assignment to Clinical Risk Groups (CRGs) in older adults (≥65 years).
Design: Cross-sectional study conducted among older patients attending primary care in a city in Spain.
Methods: Data from 384 community-dwelling older adults were analysed in groups <80 and ≥80 years. Functional status (Barthel Index), hand grip strength (HGS), quality of life (EuroQol-5D-5 L and EQ-VAS), medications and polypharmacy were recorded, together with CRG (G0–G3) from clinical records. Correlation and comparison analyses explored associations between health indicators and CRG assignment.
Results: In both age groups, a higher number of medications was associated with lower Barthel Index, EQ-5D and EQ-VAS scores, and older age with lower HGS. Among patients aged <80 years, Barthel Index, number of medications, polypharmacy and EQ-VAS were significantly associated with CRG assignment. In those aged ≥80 years, CRG classification was mainly related to functional status and medication burden, with no clear association with quality of life. In both age groups, HGS was positively correlated with quality of life but showed no association with CRG category.
Conclusion: Functional dependency, medication burden and, in those under 80 years, self-perceived health-related quality of life were key correlates of clinical risk classification. Incorporating simple indicators such as the Barthel Index, HGS and EQ-5D into CRG-based approaches could improve identification of high-risk older adults in primary care.

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Impact and Implications for the profession and/or patient care

Routine use of the EuroQol-5D-5 L questionnaire and the EQ-VAS by nurses, together with HGS and Barthel Index assessment, may enhance clinical risk stratification by capturing self-perceived health and functional capacity beyond symptoms and biomedical treatment, thereby supporting more proactive and person-centred care for older patients.

Reporting Method: The study adhered to the STROBE checklist.

Patient or Public Contribution: No patient or public contribution.

SUMMARY STATEMENT

What does this paper contribute to the wider global clinical community?

- Significant association on drugs consumed between all CRG categories in the under 80-age group and between G1-G3 in octogenarians and older. This study shows the need to introduce greater surveillance of adherence and review of prescribed drugs in the elderly in order to more accurately assign older adults to the different CRGs.
- This study suggests including the measurement of Hand Grip Strength (HGS) and EQ-5D as parameters for allocation to GRC in older adults, especially in octogenarians and older.

Introduction

The proportion of older adults is expected to continue increasing across many European countries, with Japan showing the most pronounced differences.[1,2] Spain, in particular, is experiencing a faster rate of population ageing than other EU nations.[3] Future projections indicate a substantial rise in the number of so-called "over-aged" individuals, aged 80 years and older, suggesting that dependency ratios will continue to grow in the coming years.

According to projections from the European Commission and Eurostat, the number of individuals requiring long-term care is expected to increase from 30.8 million in 2019 to 38.1 million in 2050,[4] while the prevalence of functional impairment is projected to increase by 30−100 % by 205,0.[2,5] Functional impairment refers to the loss of physical or cognitive abilities that limit independence in performing basic activities of daily living, such as mobility, dressing, or feeding (Verman et al., 2001; [6]).

Monitoring key modifiable risk factors and Quality of Life (QoL) outcomes, including perceived well-being, is central to improving progress towards the health-related Sustainable Development Goals.[7] Future research should focus on how patients perceive their health and its relationship to attributable clinical risk. However, little is known about whether there are differences in the associations of chronic diseases with health-related quality of life (HRQoL) and with self-reported and perceived health.[8]

Therefore, continued study of indicators that may support better allocation of older adults to the corresponding clinical risk group is an important strategy for assessing care and support needs, including, among many others, regional home nursing requirements. Functional health status is not routinely included within risk-adjustment methods but is considered by many to be a significant enhancement to risk adjustment for complex enrollees and patients.[9]

Hand Grip Strength (HGS),[10] number of hospitalisations during the last year,[11] polypharmacy,[12,13] defined as the administration of 5 or more classes of medication,[14] and HRQoL are relevant indicators of risk and morbidity, particularly in older adults. HGS has been used as an indicator of global strength and as a predictor of changes in functionality in older adults.[15] Lower hand grip strength is associated with an increased risk of hospitalisation, frailty, morbidity, and mortality.[16] The Barthel Index (BI) should also be taken into account for the correct assignment to Clinical Risk Groups (CRG). It has been used as a predictor of mortality and medical complications in this population group.[17] It can help to identify those who have a greater need for care and medical attention, and to predict the likelihood of complications and mortality. It is widely used by nursing professionals to measure a person's ability to perform basic activities of daily living with BI.[18] Moreover, it is easy and quick to apply, and allows specific interventions to be planned for each patient group, tailored to their needs and level of risk.[19] The Royal College of Physics recommends it as a useful tool to measure a person's ability to perform certain activities.[20]

Vulnerability and frailty in older people are also related to older adults' self-perception of their health and QoL. Understanding QoL can also help to assign the level of risk.[21] Comorbidity can lead to lower perceived health status and decreased QoL.[22−24] In octogenarians, one of the most widely used tools for its measurement is the EuroQol-5D (EQ-5D) with a visual analogue scale for general self-perception of health (EQ-VAS).[25] The EQ-5D questionnaire is used in a variety of contexts, such as clinical research, health outcome evaluation and health-related decision-making. It is also used in public policy development and resource allocation within the health system. It is easy to use and understand, and has been validated in numerous studies around the world.[26] The relationship between perceived QoL and the evolution of pathologies[27] and alterations in biochemical parameters[28] should always be taken into account.

By 2050, one in four people living in Europe and North America will be 65 years or older. The proportion of people over 80 years of age is increasing dramatically worldwide. The number of people aged 80 years and over is projected to triple from 143 million in 2019 to 426 million in 2050.[29]

It is therefore essential to identify the current situation and future care needs, based on the level of complexity and morbidity of individuals.[30] Health care systems use a variety of methods to group and assign patients to a particular CRG. Internationally, one of the most widely used methods is that developed by 3 M Health Information System.[31,32] This model classifies the user's risk of morbidity into 9 groups and is based on the severity, morbidity and chronicity of the patient's diseases. In Spain, the same classification is not used to assign patients to risk groups. Each Autonomous Community uses its own system, but all must be based on and respect the criteria established in the chronic patient care strategy.[33] Our region, one of the oldest in Spain and Europe, uses a classification with four CRGs.[34]

The criteria used to group patients into CRGs in the community of Castilla y León are based on mutually exclusive clinical categories defined by three clinical indicators: type of disease (acute or chronic), presence of comorbidities, and level of severity according to pathological diagnosis and evolution. Polypharmacy, observed or perceived quality of life, and the BI and HGS are not used as direct indicators. This classification allows specific interventions for each patient group and helps health professionals to intervene proactively with their patients.

This study aimed to examine the correlation between functional status, as measured by the Barthel Index, perceived quality of life, Hand Grip Strength, and other parameters that may directly influence clinical risk and current assignment to clinical risk groups.

Methods

Design and sample

This was a cross-sectional descriptive observational study. It was conducted over a period of six months, from June to November 2023,

in three primary care centres in Soria. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[35] recommendations for cross-sectional research.

Soria is a city with a high ageing rate in the Community of Castilla y León. The study population consisted of older adults, users of the public health system, who attended the health centres by their own means on a routine basis and not because of an emergency. Patients were randomly selected on admission to their health centres and voluntarily agreed to participate in the study after receiving information about the study and providing informed consent. Questionnaires and sociodemographic data were collected from each patient.

Patients were selected according to the following inclusion criteria: 1) aged 65 years or older (≥65 years); 2) being assigned in their clinical history to one of the CRGs, which can be G0, G1, G2 or G3, established by the Castilla y León Health System (SACyL); 3) having an updated BI record within the last 6 months; and 4) having a recorded register of the amount of medication taken. The exclusion criteria were: 1) diagnosis of any type of dementia; 2) visual or hearing impairment with inability to communicate; and 3) patients in the terminal phase.

The selection of subjects was carried out with a representative sample of people aged 65 years and older, randomly selected from the different health centres. After recruitment, 395 patients agreed to take part in the study. The sample size was calculated before starting the study using the G*Power 3.1 program. Based on a medium expected effect, a 5 % level of significance, and 80 % statistical power, the minimum number of patients required was 92. To ensure representativeness and allow for possible missing data, we decided to recruit 395 patients, and finally, 384 were included in the analysis. A broad age range (65 years and older) was intentionally maintained to capture the heterogeneity of the older population and enhance the external validity of the findings. Additionally, subgroup analyses (<80 vs. ≥80 years) were performed to partially control for potential age-related differences.

The aim of this stratification as a cut-off point is to focus attention on octogenarians and older adults, as this part of the population is increasing every year. It is necessary to provide evidence on parameters that improve allocation to clinical risk groups to help maintain quality of life for longer and identify those who may require greater healthcare resources.[36,37]

Data collection

The variables that we intend to measure and relate are quality of life (EQ-5D and EQ-VAS), HGS, BI and number of drugs taken.

Measurement of health-related quality of life

The EQ-5D- questionnaire is a health assessment tool used to measure HRQoL.[11,38] The EuroQol-5D questionnaire consists of two parts: the first part assesses five different dimensions of quality of life (EQ1, mobility; EQ2, self-care; EQ3, activities of daily living; EQ4, pain/discomfort and EQ5 anxiety/depression). Each of these points in turn has three levels of severity, and the resulting values can range from a minimum near zero (corresponding to the worst self-rated health) to a maximum of 1 (the best self-rated health). The EQ-5D index scores were calculated using the social value coefficients established for the Spanish population, as adapted by Badia et al.[39] The second part of EuroQol-5D is a visual analogue scale (VAS) calibrated from 0 (worst health) to 100 (best health).[26] Recommended by the World Health Organization[40] to determine the self-perceived health status and QoL, it offers advantages for older people because of its quick response time and easy comprehension.[18,30,41]

Hand grip strength measurement

Muscular strength was assessed using the HGS test. HGS was measured in the dominant hand by a maximal isometric test using a hand dynamometer.[42] Patients performed the test in a seated position with their elbow flexed at a 90-degree angle and the forearm in a neutral position. They were instructed to squeeze the dynamometer with maximal effort for about three seconds. Each participant performed three trials with their dominant hand, with a 30-second rest period between trials. The average score of three measures was calculated and used for the study. The analysis of HGS was conducted based on age and gender. The European Working Group on Sarcopenia in Older Persons defined weakness on the basis of a HGS <30 kg in men and <20 kg in women.[43]

According to the results of the HGS, the patients were classified into 2 categories: weak-intermediate (<26 and 26–32 kg in men; <16 and 16–20 kg in women) and normal (mean of 36 and average of 28 respectively), according to the cut-off values published by.[44]

Variables collected from the clinical history and clustering of clinical risk groups

Data were obtained from each patient's medical records regarding the number of drugs they were taking chronically, their BI score and the CRG to which they had been assigned.

The BI may be less reliable if patients have cognitive impairment[17]; however, as dementia was an exclusion criterion, this was not expected to bias the study. The BI consists of ten items that assess the patient's ability to perform specific tasks of daily living, such as eating, grooming, dressing, toileting, mobility and ability to control bowel and bladder. Each item is scored according to the patient's ability to perform the task independently. The highest score is 100, which indicates total independence. A score between 91 and 99 is considered mild dependence, between 61 and 90 moderate dependence, between 21 and 60 severe dependence, and totally dependent if below 20. A low BI score indicates lower functional capacity and a higher risk of medical complications and mortality.[18,45]

With regard to medication in this study, the number of medicines was recorded, and polypharmacy was considered to be present if patients were taking five or more medicines, in line with the scientific evidence presented in the introduction section.

Statistical analysis

Descriptive statistics were used to summarize demographic and health-related variables. The normality of continuous variables was assessed using the Shapiro–Wilk test and by visual inspection of histograms. For variables following a normal distribution, parametric tests (Student's *t*-test, ANOVA, and Chi-square, as appropriate) were applied. For variables not meeting the assumption of normality, non-parametric tests were used. Spearman's rank correlation coefficient was employed to examine associations between continuous variables that were not normally distributed. Missing data were reviewed and handled using a listwise deletion approach; only patients with complete information for all study variables were included in the final analyses. Statistical significance was set at $p < 0.05$. All analyses were performed using SPSS version 27.0.

Ethical approval and consent to participate

This study received approval from Clinical Research Committee of the XXXXX (Ref. XXX). All patients received oral and written information on the research in Spanish language and provided signed informed consent forms prior to participation.

Table 1
Demographic characteristics, medication, health status and CRG classification of the patients.

Variable	All patients n = 384	<80 years old n = 185	≥80 years old n = 199	p value
Demographic characteristics				
Female (%)	207 (53.9)	104 (55.1)	105 (52.8)	0.358
Age (years)	78.9 (7.9)	71.9 (4.3)	85.5 (3.8)	<**0.001**
Medication				
Number of drugs	4.9 (3.6)	4.2 (3.4)	5.7 (3.7)	<**0.001**
Polypharmacy−n* (%)	169 (44.1)	82 (44.4)	133 (66.7)	<**0.001**
Health status measurements				
BI	82.4 (16.6)	86.4 (13.0)	78.6 (18.6)	<**0.001**
EQ-5D	0.8 (0.2)	0.8 (0.2)	0.7 (0.2)	<**0.001**
EQ-VAS	69.2 (16.7)	72.0 (16.4)	66.6 (16.6)	**0.001**
HGS	32.8 (21.7)	40.4 (23.5)	25.3 (16.9)	<**0.001**
Classification into a Risk Group				
CRG (%)				
G0	109 (28.5)	62 (33.5)	47 (23.6)	<**0.001**
G1	156 (40.6)	82 (44.3)	74 (37.2)	
G2	71 (18.6)	29 (15.8)	42 (21.1)	
G3	47 (12.3)	11 (6.0)	36 (18.1)	

Except for gender, polypharmacy and CRG, the values are given as mean (±SD). Abbreviations: BI (Barthel Index), EQ-5D (EuroQol-5D), EQ-VAS (Visual Analogue Scale of general self-perception of health), HGS (Hand Grip Strength), CRG (Clinical Risk Groups), G (Group). *Administration of 5 or more drugs.

Results

Sample characterictics

Three hundred and ninety-five patients agree to participate in the study. After a primary revision, 11 patients were excluded because of lack of data. So, a total of 384 patients were included in the final analysis, from which 207 (53.9 %) were women. The average age was 78.9 (SD±7.9). Attending the stratification by age group, 48.2 % were under 80 years of age and 51.8 % were 80 years of age or older. Table 1 shows the main characteristics of the sample.

The study patients presented a good QoL with a degree of dependence close to moderate. Considering that the patients are elderly people, but without associated dementia pathologies, the results provided by this study can be considered in standards of normality consistent with the performance of basic activities of daily life (ADL). The same situation applies to the results of the EQ-5D and EQ-VAS; although there are significant differences for both age groups, from the clinical point of view the differences are not relevant.

Correlations between health status and QoL

As expected, we observed negative correlations between the number of medicines and BI, EQ-5D and EQ-VAS scores in both age groups. We also observed a negative correlation between age and HGS (see Table 2a and 2b). Among patients under 80 years of age, there was a positive correlation between age and the number of medicines taken (p = 0.003). Moreover, in this group we found statistically significant, although modest, positive correlations between HGS and QoL (EQ-5D) (p = 0.010), and between BI and QoL (EQ-5D and EQ-VAS) (p = 0.020 and p = 0.025, respectively).

In patients aged 80 years and older, we observed positive correlations between HGS and QoL (EQ-5D and EQ-VAS) (p = 0.002 and p = 0.014, respectively).

Table 2a
Pearson`s correlation coefficients of the variables analyzed to age <80 years old (n = 185).

		Age	Number of drugs	BI	EQ-5D	EQVAS	HGS
Age	Pearson	1	0.219**	−0.087	−0.047	−0.176*	−0.236*
	Sig.		**0.003**	0.237	0.525	**0.017**	**0.001**
Number of drugs	Pearson		1	−0.367**	−0.184*	−0.278**	−0.046
	Sig.			<**0.001**	0.013	<**0.001**	0.544
BI	Pearson			1	0.171*	0.164*	0.043
	Sig.				**0.020**	**0.025**	0.561
EQ-5D	Pearson				1	0.386**	0.084
	Sig.					<**0.001**	0.253
EQ-VAS	Pearson					1	0.188*
	Sig.						**0.010**
HGS	Pearson						1
	Sig.						-

* $p < 0.05$.
** $p < 0.01$, BI (Barthel Index), EQ-5D (EuroQol-5D), EQ-VAS (Visual Analogue Scale of general self-perception of health), HGS (Hand Grip Strength).

Table 2b
Pearson`s correlation coefficients of the variables analyzed to age ≥80 years old (n = 199).

		Age	Number of drugs	BI	EQ-5D	EQVAS	HGS
Age	Pearson	1	0.039	−0.100	−0.247**	−0.186**	−0.306**
	Sig.		0.592	0.160	<**0.001**	**0.009**	<**0.001**
Number of drugs	Pearson		1	−0.172*	−0.258**	−0.213**	−0.014
	Sig.			**0.017**	<**0.001**	**0.003**	0.853
BI	Pearson			1	−0.038	0.049	0.047
	Sig.				0.597	0.496	0.516
EQ-5D	Pearson				1	0.442**	0.224**
	Sig.					<**0.001**	**0.002**
EQ-VAS	Pearson					1	0.177*
	Sig.						**0.014**
HGS	Pearson						1
	Sig.						-

* $p < 0.05$.
** $p < 0.01$, BI (Barthel Index), EQ-5D (EuroQol-5D), EQ-VAS (Visual Analogue Scale of general self-perception of health), (HGS (Hand Grip Strength).

CRG and health status and qol

We observed a statistically significant association between CRG classification and number drugs, polypharmacy and BI in both age groups (Table 3a and 3b). In the case of the BI, significant differences were found across all CRG categories. For the number of drugs, significant differences were found across all CRG categories in patients under 80 years of age, and between G1−G3 (p = 0.024) and G3−G0 (p = 0.039) in patients aged 80 years and over. In addition, among patients under 80 years of age, we observed statistically significant differences in mean age between those classified in G3 and those in G1 (p = 0.004).

When comparing CRG classification and QoL, we only observed a statistically significant association in patients under 80 years of age. The higher the assigned CRG category, the lower the EQ-VAS score (p = 0.004). In addition, a statistically significant association was found between having any problem in dimension 2 or 3 of the EQ-5D (EQ2 or EQ3) and being assigned to CRG group three (p = 0.003 and $p < 0.001$, respectively).

No relationship was observed between QoL and CRG in patients aged 80 years and over (see Table 3b). Furthermore, in both age groups, we did not find any association between HGS and CRG classification (p = 0.524 and p = 0.731, respectively).

QoL dimensions and health status

We analysed the five EQ-5D dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) across age categories. Different associations were observed in each age group. Among patients under 80 years of age, we found: an association between having any personal care problem (EQ2) and a higher number of medications taken (p = 0.007); statistically significant, albeit modest, associations between EQ2 or EQ3 and BI (p = 0.021 and p = 0.041, respectively); and a marginal association between having no problem in EQ3 and higher HGS values (p = 0.030) (see Table 4a).

Table 3a
Demographic and clinical variables, and questionnaire scores by Clinical Risk Groups in the <80 years group.

GROUP	G0 *n* = 62	G1 *n* = 81	G2 *n* = 29	G3 *n* = 13	All patients *n* = 185	*p value*
Demographic characteristics						
Female-n (%)	39 (62.9)	41 (50.6)	14 (48.3)	8 (72.7)	101 (55.1)	0.252
Age, years	71.9 (4.1)	71.1 (4.3)	73.2 (4.1)	75.4 (2.8)	72.0 (4.3)	**0.004**
Medication						
Number of drugs	2.0 (2.4)	4.3 (2.5)	6.5 (2.9)	9.3 (4.8)	4.2 (3.4)	<**0.001**
Polypharmacy−n (%)	8 (13.3)	38 (46.8)	26 (89.3)	10 (90.9)	88 (44.49)	<**0.001**
Health status measurements						
BI	94.5 (7.6)	87.0 (11.9)	78.4 (8.5)	60.0 (8.7)	86.5 (13.1)	<**0.001**
EQ-5D:	0.8 (0.2)	0.8 (0.2)	0.8 (0.2)	0.7 (0.2)	0.8 (0.2)	0.160
EQ1−n (%)	14 (22.6)	17 (21.0)	8 (27.6)	5 (45.5)	48 (24.0)	0.328
EQ2−n (%)	2 (3.2)	4 (4.9)	0 (0.0)	3 (27.3)	10 (4.9)	**0.003**
EQ3−n (%)	4 (6.5)	6 (7.4)	2 (6.9)	5 (45.5)	19 (9.3)	<**0.001**
EQ4−n (%)	24 (38.7)	37 (45.7)	13 (44.8)	5 (45.5)	86 (43.2)	0.402
EQ5 −n (%)	14 (22.6)	24 (29.6)	9 (31.0)	4 (36.4)	56 (27.9)	0.676
EQ-VAS	74.9 (15.7)	73.2 (15.5)	68.1 (13.0)	57.3 (26.2)	72.0 (16.4)	**0.004**
HGS	40.4 (23.6)	40.1 (23.7)	43.2 (22.7)	30.8 (21.8)	40.4 (23.5)	0.524

Except for gender, polypharmacy and EQ1, EQ2, EQ3, EQ4, EQ5, the values are given as mean (±SD). Abbreviations: BI (Barthel Index), EQ-5D (EuroQol-5D), EQ1 (mobility), EQ2 (self-care), EQ3 (activities of daily living), EQ4 (pain/discomfort), EQ5 (anxiety/depression) EQ-VAS (Visual Analogue Scale of general self-perception of health), HGS (Hand Grip Strength), G (Group).
† report any problem.

Tabla 3b
Demographic and clinical variables, and questionnaire scores by Clinical Risk Groups in the ≥80 years group.

GROUP	G0 *n* = 47	G1 *n* = 74	G2 *n* = 42	G3 *n* = 36	All *n* = 199	*p value*
Demographic characteristics						
Female-n (%)	25 (53.2)	40 (54.1)	20 (47.6)	20 (55.6)	105 (52.8)	0.894
Age, years	84.9 (3.5)	85.8 (4.4)	85.2 (3.7)	85.8 (3.0)	85.5 (3.8)	0.574
Medication						
Number of drugs	5.0 (3.4)	5.1 (3.3)	6.2 (3.6)	7.2 (4.3)	5.7 (3.7)	**0.013**
Polypharmacy−n (%)	26 (55.8)	43 (57.5)	35 (82.5)	29 (80.6)	133 (66.7)	**0.005**
Health status measurements						
BI	95.3 (8.0)	84.9 (8.0)	71.1 (12.4)	52.9 (18.7)	78.6 (18.6)	<**0.001**
EQ-5D:	0.7 (0.2)	0.7 (0.2)	0.7 (0.1)	0.7 (0.2)	0.7 (0.2)	0.954
EQ1−n (%)	26 (55.3)	40 (54.1)	18 (42.9)	16 (44.4)	100 (50.3)	0.510
EQ2−n (%)	10 (21.3)	15 (20.3)	9 (21.4)	11 (30.6)	45 (22.6)	0.657
EQ3−n (%)	11 (23.4)	14 (18.9)	10 (23.8)	11 (30.6)	46 (23.1)	0.600
EQ4−n (%)	28 (59.6)	34 (45.9)	23 (54.8)	20 (55.6)	105 (52.8)	0.487
EQ5−n (%)	25 (53.2)	39 (52.7)	20 (47.6)	18 (50.0)	102 (51.3)	0.945
EQ-VAS	66.0 (16.2)	67.0 (15.7)	66.0 (16.9)	67.1 (19.1)	66.6 (16.6)	0.976
HGS	25.4 (17.9)	24.6 (17.5)	27.8 (18.3)	23.6 (12.6)	25.3(16.9)	0.731

Except for gender, polypharmacy and EQ1, EQ2, EQ3, EQ4, EQ5, the values are given as mean (±SD). Abbreviations: BI (Barthel Index), EQ-5D (EuroQol-5D), EQ1 (mobility), EQ2 (self-care), EQ3 (activities of daily living), EQ4 (pain/discomfort), EQ5 (anxiety/depression) EQ-VAS (Visual Analogue Scale of general self-perception of health), HGS (Hand Grip Strength), G (Group).
† report any problem.

Table 4a
Values of EQ-5D dimensions according to age categories and Health status in the <80 years old group (*n* = 185).

GROUP	EQ1		EQ2		EQ3		EQ4		EQ5	
	Mean (±SD)	*p value*	Mean (±SD)	*p value*	Mean (±SD)	*p value*	Mean (±SD)	*p value*	Mean (±SD)	*p value*
Age	71.9 (4.3)	0.429	71.9 (4.3)	0.527	71.9 (4.3)	0.349	71.9 (4.3)	0.908	71.9 (4.3)	0.434
no problem	71.8 (4.3)		71.9 (4.3)		71.8 (4.3)		71.8 (4.6)		72.0 (4.4)	
any problem	72.3 (4.3)		72.8 (4.4)		72.8 (4.2)		72.0 (4.0)		71.5 (4.1)	
Drugs	4.1 (3.4)	0.106	4.2 (3.4)	**0.007**	4.2 (3.4)	0.146	4.2 (3.4)	0.176	4.2 (3.4)	0.095
no problem	3.9 (3.1)		4.0 (3.2)		4.1 (3.3)		3.8 (2.9)		3.9 (3.2)	
any problem	4.9 (3.9)		7.1 (4.3)		5.3 (4.1)		4.7 (3.8)		4.8 (3.7)	
BI	86.5 (13.0)	0.324	86.5 (13.0)	0.021	86.5 (13.0)	**0.041**	86.5 (13.0)	0.243	86.5 (13.0)	0.340
no problem	87.0 (13.0)		87.0 (12.5)		87.1 (12.5)		86.9 (13.8)		87.0 (11.1)	
any problem	84.8 (13.1)		76.7 (18.9)		80.3 (16.9)		86.2 (11.9)		85.0 (17.1)	
EQ-5D	0.8 (0.2)	<**0.001**	0.8 (0.2)	<**0.001**	0.8 (0.2)	<**0.001**	0.8 (0.2)	<**0.001**	0.8 (0.2)	<**0.001**
no problem	0.9 (0.1)		0.8 (0.2)		0.9 (0.2)		0.9 (0.1)		0.9 (0.2)	
any problem	0.6 (0.1)		0.5 (0.1)		0.6 (0.2)		0.7 (0.1)		0.7 (0.1)	
EQ-VAS	72.0 (16.4)	<**0.001**	72.0 (16.4)	<**0.001**	72.0 (16.4)	<**0.001**	72.0 (16.4)	**0.020**	72.0 (16.4)	<**0.001**
no problem	75.2 (14.0)		73.0 (15.4)		73.6 (15.0)		75.0 (15.0)		74.7 (15.6)	
any problem	61.9 (19.1)		52.8 (23.6)		55.9 (20.9)		68.2 (17.5)		64.9 (16.4)	
BMI	3.0 (0.9)	0.386	3.0 (0.9)	0.232	3.0 (0.9)	0.958	3.0 (0.9)	0.331	3.0 (0.9)	0.650
no problem	3.0 (0.8)		3.0 (0.8)		3.0 (0.9)		2.9 (0.8)		3.0 (0.8)	
any problem	3.1 (1.0)		3.3 (1.6)		3.0 (1.1)		3.1 (1.0)		2.9 (1.0)	
HGS	41.6 (23.6)	0.245	40.4 (23.5)	0.552	40.4 (23.5)	**0.030**	40.4 (23.5)	0.915	40.4 (23.5)	0.473
no problem	36.9 (23.0)		40.7 (23.4)		41.6 (23.6)		41.1 (23.9)		41.2 (24.4)	
any problem	40.4 (23.5)		35.9 (26.3)		28.7 (18.9)		39.6 (23.1)		38.4 (21.0)	

BI (Barthel Index), EQ-5D (EuroQol-5D), EQ-VAS (Visual Analogue Scale of general self-perception of health), BMI (Body Mass Index), HGS (Hand Grip Strength).

Table 4b
Values of EQ-5D dimensions according to age categories and Health status in the ≥80 years group (*n* = 199).

GROUP	EQ1		EQ2		EQ3		EQ4		EQ5	
	Mean (±SD)	*p value*	Mean (±SD)	*p value*	Mean (±SD)	*p value*	Mean (±SD)	*p value*	Mean (±SD)	*p value*
Age	85.5 (3.8)	**0.042**	85.5 (3.8)	<**0.001**	85.5 (3.8)	**0.003**	85.5 (3.8)	0.0100	85.5 (3.8)	0.286
no problem	84.9 (3.6)		84.9 (3.6)		85.0 (3.7)		84.7 (3.8)		85.2 (3.8)	
any problem	86.0 (4.0)		87.4 (3.9)		86.9 (3.8)		86.1 (3.8)		85.8 (3.9)	
Drugs	5.7 (3.7)	**0.012**	5.7 (3.7)	<**0.001**	5.7 (3.7)	<**0.001**	5.7 (3.7)	**0.008**	5.7 (3.7)	**0.028**
no problem	5.0 (3.5)		5.1 (3.4)		5.0 (3.4)		4.9 (3.4)		5.1 (3.5)	
any problem	6.3 (3.7)		7.5 (4.0)		7.9 (3.5)		6.3 (3.8)		6.2 (3.8)	
BI	78.6 (18.6)	0.400	78.6 (18.6)	0.502	78.6 (18.6)	0.456	78.6 (18.6)	0.607	78.6 (18.6)	0.713
no problem	77.5 (19.5)		79.1 (17.9)		79.2 (17.8)		77.9 (17.8)		78.1 (19.4)	
any problem	79.8 (17.6)		77.0 (21.0)		76.9 (21.1)		79.3 (19.3)		79.1 (17.9)	
EQ-5D	0.7 (0.2)	<**0.001**	0.7 (0.2)	<**0.001**	0.7 (0.2)	<**0.001**	0.7 (0.2)	<**0.001**	0.7 (0.2)	<**0.001**
no problem	0.9 (0.1)		0.8 (0.1)		0.8 (0.1)		0.8 (0.2)		0.8 (0.2)	
any problem	0.6 (0.2)		0.4 (0.2)		0.5 (0.2)		0.6 (0.2)		0.6 (0.2)	
EQ-VAS	66.6 (16.6)	<**0.001**	66.6 (16.6)	<**0.001**	66.6 (16.6)	<**0.001**	66.6 (16.6)	<**0.001**	66.6 (16.6)	**0.001**
no problem	71.4 (15.4)		69.7 (15.7)		69.4 (15.8)		71.9 (15.2)		70.5 (15.9)	
any problem	61.8 (16.4)		55.9 (15.4)		57.0 (15.8)		61.8 (16.5)		62.8 (16.5)	
BMI	2.5 (0.9)	0.098	2.5 (0.9)	**0.015**	2.5 (0.9)	**0.034**	2.5 (0.9)	0.2200	2.5 (0.9)	0.184
no problem	2.6 (1.0)		2.5 (0.9)		2.5 (0.9)		2.5 (0.8)		2.5 (0.9)	
any problem	2.3 (0.9)		2.2 (1.0)		2.2 (1.1)		2.4 (1.0)		2.4 (0.9)	
HGS	25.3 (16.9)	**0.014**	25.3 (16.9)	**0.003**	25.3 (16.9)	**0.011**	25.3 (16.9)	0.073	25.3 (16.9)	0.238
no problem	28.3 (18.2)		27.2 (17.7)		26.9 (17.3)		27.6 (19.7)		26.8 (15.9)	
any problem	22.3 (15.1)		18.2 (10.8)		19.4 (13.9)		23.2 (13.7)		23.9 (17.8)	

BI (Barthel Index), EQ-5D (EuroQol-5D), EQ-VAS (Visual Analogue Scale of general self-perception of health), BMI (Body Mass Index), HGS (Hand Grip Strength).

In patients aged 80 years and older, we observed an association between having any problem in each EQ-5D dimension and taking a greater number of medications (see Table 4b). In addition, higher HGS values were related to having no problems in EQ1, EQ2 and EQ3 (see Table 4b).

Discussion

Nowadays, it is evident that life expectancy is on the rise,[46] as is the development of new medical technologies, which implies a progressive ageing of the population and, consequently, an increasing prevalence of chronic diseases.[47] Classification systems respond to structural needs, the distribution of resources and care processes that must be organised, taking into account comorbidity and the life expectancy of the population.[48]

The sustainability of health systems in addressing ageing and chronic care requires a change in the delivery of health services to respond to the emerging needs of the population. There is a need to promote the use of tools capable of predicting the risk of death and the inappropriate use of health systems. This topic remains underexplored. The strength of this study lay in the fact that it was the first to be conducted with older people in one of the most ageing cities in Europe and the first study to establish a relationship between health or functional status and the assigned CRG. Previous authors have published several tools used to identify high-risk patients, most of which have focused on hospital and emergency admissions.[49,50] However, gaps remain in relation to clinical, social, anthropometric, frailty and perceived QoL information when assigning older adults to one clinical risk group or another.[51]

As mentioned above, one of the most widely used systems is the CRG.[52,53] In the present study, the distribution of the elderly population into this CRG was similar to that obtained in previous studies[54]. Patients classified in group G0 (healthy or non-users) represented 28.38 % of the sample, which is higher than the mean obtained in other studies that, in addition, included a younger population (Inoriza et al., 2009).

As expected, a direct relationship was found between the BI and the number of medications consumed and the assignment to each of the CRGs (G0, G1, G2 and G3) as established by the SACyL computer system, in both age groups.[55] Patients assigned to G3, both older and younger than 80 years, had a significant relationship between BI score and polypharmacy. There was a relationship between BI and polypharmacy and the risk group assigned by the computer system, in line with other studies.[56,57]

The present study analysed 384 patients, mostly female, with a mean age of 78.9 years. In our study, we stratified by age (under and over 80 years). Factors such as gender and age have been found to directly influence the perception of quality of life or health status,[25] which was also evidenced in this study. However, we found no significant association between any of the variables analysed (number of medications, BI, EQ-5D, EQ-VAS or BMI) and gender, except HGS (data not shown). As expected, in both age groups, women had lower HGS values than men. Despite this, the distribution of males and females was the same in both age groups, so this was a fully compensated effect. Most such studies have shown that HGS declines with age in both sexes and that the decline is faster in men. Only a few longitudinal studies have examined the role of a broader range of potential determinants of change in grip strength ([58–60]; Sydall et al., 2017) and, to date, few consistent predictors of grip strength decline have been identified. In order to establish with greater certainty which factors are predictive of grip strength decline in men and women, there is a need for further large longitudinal studies of older people of both sexes and with a wide range of health status items evaluated.

It is possible that people over the age of 80 are taken off certain medications, given that many may have more risks than benefits at that age. Furthermore, in this group we observed a positive correlation between HGS and QoL (EQ-5D) and a marginal positive correlation between BI and QoL (EQ-5D and EQ-VAS). We highlight the need to assess quality of life because of its relationship with these two parameters, functional capacity and HGS, which are closely related to comorbidity and clinical risk factors.[61]

On the other hand, we found no association between CRG and QoL (EQ-5D and EQ-VAS) or physical performance measured with HGS, except in the group of older adults under 80 years of age. In this group, a statistically significant association was observed between EQ2, EQ3 or EQ-VAS and CRG. These results suggest that the CRG classification does not include all relevant parameters to monitor the elderly population and identify high-risk patients. Among individuals aged $\geq$80, the absence of significant associations may be explained by several factors. Older adults may experience a “response shift”, adjusting their internal standards and expectations of health and functioning, which modifies their perception of QoL despite physical limitations. Moreover, survival bias might lead to a relatively healthier subgroup among octogenarians, while greater physiological heterogeneity and cognitive or sensory decline could reduce the sensitivity of QoL instruments such as EQ-5D or EQ-VAS at advanced ages.

Sarcopenia and frailty are important conditions that become increasingly prevalent with age. Sarcopenia consists in the loss of muscle mass and function, and frailty can be defined as a multi-system impairment associated with increased vulnerability to stressors.[62] There is overlap between the two conditions, especially in terms of the physical aspects of the frailty phenotype: low grip strength, gait speed and muscle mass. These measurements have been associated with a wide range of ageing outcomes and can be assessed in the clinical setting. Diagnostic criteria are clearly essential for the recognition of sarcopenia and frailty in clinical practice. The algorithm for sarcopenia published by the European Working Group on Sarcopenia in Older People (EWGSOP) requires the presence of either low gait speed or low grip strength.[63]

Grip strength has been recommended as the most practical method of measuring muscle strength in the clinical setting.[64] Weaker grip strength has also been associated with disability, increased length of hospital stay and mortality rates.[65]

One of the purposes of our study was to determine whether the currently implemented classification (CRG) is ideal for clinical use and covers the necessary items in ageing and chronic care. Considering grip strength, measured with HGS, and sarcopenia, the clinical risk group assignment system in our study did not include these indicators. Future adaptations of CRG models could benefit from integrating frailty indicators such as HGS, BI or validated frailty scales. Incorporating these functional and biological markers could improve the predictive validity of CRGs and allow for earlier identification of high-risk older adults. The proposal of a “CRG + frailty” framework in primary care could strengthen the capacity of health systems to provide more personalised and preventive care.

Only in the group of under 80 years of age did we observe that cumulative comorbidity contributed to a worse perception of QoL, although this relationship was weak. We also found a statistically significant association between having a problem in self-care or ADLs and cumulative comorbidity. The association between the BI (a test designed to assess activities of daily living) and cumulative comorbidity could be the explanation. This supports the recommendations of other authors to monitor frailty indicators in older people to identify prevention programmes.[66]

On the other hand, we did not observe any relationship between accumulated comorbidity and a poorer perception of QoL in the group of patients older than 80 years. In addition, all the CRG categories presented similar mean ages, in contrast to the under-80 group. This seems to indicate that the concept of QoL is complex and depends on many factors.[25] Older adults having chronic conditions for a long period of time may alter their expectations, resulting in changes in their internal standards, values and conceptualisation of QoL.[67] This phenomenon may explain the lack of observed differences in the measurement of EQ-5D among the population aged 80 years and older.

The HGS test was used as an indicator of physical performance and as an efficient tool to predict future outcomes in ageing adults.[68] As expected, we observed that the values declined with advancing age due to the loss of skeletal muscle mass and function.[63] Our results suggested that preserving physical performance may promote a better QoL and enhance health span during the ageing process, and that advancing age and multimorbidity were correlates of both lower levels and accelerated loss of grip strength in later life. Our results were in accordance with other studies.[68,69] However, since this was a cross-sectional study, causality could not be inferred from these associations. Longitudinal or interventional studies are needed to confirm whether maintaining or improving HGS and functional capacity can lead to measurable gains in QoL and reduced clinical risk.

Furthermore, the analysis of the dimensions of the EQ-5D showed that, in the group of elderly people over 80 years of age, those with a problem in EQ1, EQ2 or EQ3 had lower HGS values. Therefore, it might be that the aforementioned dimensions of EQ-5D are mainly influenced by HGS in the older population. Weakness of strength could cause activity restriction and reduced QoL in elderly adults.[61]

Previous studies have indicated a negative correlation between depression/anxiety or hopelessness and medication in older adults.[70,71] More research is needed to address the domain of subjective well-being in terms of mental health.

Given the increasing number of older adults with multiple diseases and frailties, health care providers should make geriatric assessment a routine part of health care.[72] Beyond general recommendations, specific actions could include the routine use of HGS assessment in annual check-ups for adults aged 65 and over, integration of EQ-5D or similar tools into electronic health records, and the implementation of combined CRG and frailty screening protocols in primary care. These strategies could support early identification of functional decline and promote preventive interventions at both clinical and policy levels.

Finally, the transferability of the results is an important aspect. The findings apply mainly to populations with chronic diseases managed through treatment and self-management, and to settings with similar health systems. In this study, the differences between the groups analysed demonstrated the need for more precise tools to assign older adults accurately to the appropriate CRG category. It is also important to recognise that other unmeasured confounding factors, such as socioeconomic status, education, social isolation or comorbidity burden, may influence both functional outcomes and quality of life. Future studies should consider these variables to better understand the multidimensional nature of health and vulnerability in older adults.

Limitations

The present study has several limitations. One of them is the absence of data in some medical records, which reduced the sample size, although the final sample was representative of the study population in the health area. The results of the analysis could also have been influenced by the adaptability to comorbidity of older adults who have been living with chronic diseases for a long time. Secondly, data on the specific type of medication taken and its side effects, as well as the severity of the chronic disease, were not considered and might have influenced the patients' responses. Finally, voluntary participation may have introduced selection bias, as individuals in better health and with higher motivation might have been more likely to participate and to provide more positive responses.

In addition, possible differences between rural and urban areas in relation to perceptions of quality of life were not considered. This was because most of the population of Soria lives in the city during the winter and in rural areas during the summer months; thus, it was not possible to classify this variable accurately, which could imply a source of bias. However, there is evidence from other studies of differences between rural and urban areas in terms of the social life of the elderly population.[73,74]

Relevance for clinical practice

Our study proposes the use of HGS and EQ-5D, in addition to CRG and BI, to identify older adults at risk of physical decline. In addition, it demonstrates the usefulness of these tools so that they can be considered as parameters for the automatic assignment to clinical risk groups, as they have not been taken into account to date.

This study provides information on how EQ-5D-5 L, EQ-VAS and HGS assessments complement CRG assignment and differ in adults with chronic conditions. It allows for improved interpretation of self-perceived health status and functional capacity in adults aged 65 years and over and those aged 80 years and over, who are the groups that require constant screening using parameters that can pre-emptively detect increased clinical risk.

Conclusions

Our study proposes integrating HGS and EQ-5D, in addition to existing CRG assignment systems, to achieve a more accurate allocation of older adults, especially octogenarians and the oldest old, to clinical risk groups.

Appropriate allocation to one CRG or another can inform healthcare professionals on how to care for these patients according to their needs and can ensure early detection of particularly frail older patients, especially in those under 80 years of age.

Including and continually reviewing the factors involved in appropriate clinical risk assignment in older people supports data sharing, progress monitoring and decision-making processes that are crucial for healthcare organisations and governments.

Ethical approval and consent to participate

This study received approval from the Clinical Research Committee Burgos-Soria (Ref. CREC-1446). All participants received oral and written information on the research and provided signed informed consent forms prior to participation.

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Data availability

All data and materials can be obtained from the corresponding author upon request.

Statistics

The author(s) affirm that the methods used in the data analyses are suitably applied to their data within their study design and context, and the statistical findings have been implemented and interpreted correctly.

Declaration of competing interest

All authors have declared no conflict of interest.

CRediT authorship contribution statement

Ana Fernandez-Araque: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Andrea Giaquinta-Aranda:** Methodology, Investigation, Data curation, Conceptualization. **Veronica Velasco-Gonzalez:** Writing – review & editing, Writing – original draft, Formal analysis. **María Sainz-Gil:** Writing – review & editing, Writing – original draft, Formal analysis. **Patricia Romero Marco:** Writing – review & editing, Writing – original draft. **Zoraida Verde:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization.

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