

# Contribution for the Validation of the Portuguese Version of EQ-5D



## Contributos para a Validação da Versão Portuguesa do EQ-5D

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*Acta Med Port* 2013 Nov-Dec;26(6):664-675

### ABSTRACT

**Introduction:** The EQ-5D allows the achievement of two essential components of any measure of health-related quality of life to be used in cost-utility economic evaluations: (i) a profile describing the health status in terms of domains or dimensions; and (ii) a numeric value associated with the health status described.

**Aim:** The Portuguese version of the EQ-5D questionnaire was completed in 1998, based on guidelines set by the EuroQol Group, including translation and back translation procedures. Despite its wide use in Portugal, until now it had not yet been published studies that initially led to the Portuguese version and the guarantee of acceptability, reliability and validity. The purpose of this article is to document these first values relating to the Portuguese version of the EQ-5D.

**Material and Methods:** We used three different samples: a first one with 1,500 individuals representative of the Portuguese population; a second with 140 individuals just intended for the reliability test; and a third sample with 643 individual patients with cataracts, asthma, chronic obstructive pulmonary disease, or rheumatoid arthritis.

**Results:** The acceptability was assessed by the number of missing responses. It was also found a marked ceiling effect, with a large part of the sample not reporting any problems in the dimensions of the EQ-5D.

**Discussion:** The construct validity was tested by examining the degree to which low values of EQ-5D were positively associated with increasing age, being female, and the sick, as well as the values of dimensions of the SF-36v2 scale. Convergent validity was based on correlations between EQ-5D values and other specific measures. The EQ-5D showed moderate to high correlations with other disease-specific measures of health status and health related quality of life.

**Conclusion:** We can state that the Portuguese version of the EQ-5D has a good accessibility, reliability and validity in measuring health.

**Keywords:** Health Status; Health Surveys; Quality of Life; Portugal; Questionnaires.

### RESUMO

**Introdução:** O EQ-5D permite a junção de duas componentes essenciais de qualquer medida de qualidade de vida relacionada com a saúde a ser usada em avaliações económicas de custo-utilidade: (i) um perfil descrevendo o estado de saúde em termos de domínios ou dimensões; e (ii) um valor numérico associado ao estado de saúde anteriormente descrito.

**Objetivo:** A versão portuguesa do questionário EQ-5D foi finalizada em 1998, com base em normas de orientação definidas pelo Grupo EuroQol, incluindo os procedimentos de tradução e retroversão. Apesar da sua larga utilização em Portugal, até agora ainda não tinham sido publicados os estudos que conduziram inicialmente à versão portuguesa e à garantia de aceitabilidade, fiabilidade e validade. O propósito do presente artigo é, assim, documentar estes primeiros valores referentes à versão portuguesa do EQ-5D.

**Material e Métodos:** Foram utilizadas três amostras diferentes: uma primeira com 1 500 indivíduos representativa da população portuguesa; uma segunda com 140 indivíduos apenas destinada ao teste da fiabilidade; e uma terceira amostra com 643 indivíduos doentes com cataratas, asma, doença pulmonar obstrutiva crónica ou artrite reumatoide.

**Resultados:** A aceitabilidade foi avaliada pelo número de respostas em falta. Foi também encontrado um marcado efeito de teto com grande parte da amostra a não reportar quaisquer problemas nas dimensões do EQ-5D.

**Discussão:** A validade de construção foi testada pela análise do grau com que valores baixos de EQ-5D estavam positivamente associados ao aumento da idade, ao ser do sexo feminino, e ao estar doente, assim como a valores de dimensões da escala SF-36v2. A validade convergente foi baseada nas correlações entre valores do EQ-5D e outras escalas específicas de condição de saúde. O EQ-5D apresentou correlações moderadas a altas com outras medidas de estado de saúde e de qualidade de vida relacionada com a saúde, específicas de cada doença.

**Conclusão:** A versão portuguesa do EQ-5D tem uma boa aceitabilidade, fiabilidade e validade na medição do estado de saúde.

**Palavras-chave:** Estado de Saúde; Portugal; Qualidade de Vida; Medição de Saúde; Questionários.

### INTRODUCTION

#### Framework

The EQ-5D is a generic tool for use as a measure health outcome (QdVRS) allowing for the calculation of a single index value for health status. It was developed by the EuroQoL group in 1987<sup>1</sup>, became public in 1990;<sup>2</sup> and is

based on a health-related classification system of life states consisting of five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each of these dimensions has three associated severity levels, accounting for the absence of health problems (level 1), some

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problems (level 2) and extreme problems (level 3), lived or perceived by the respondent. Therefore, this system allows for the establishment of  $3^5 = 243$  different health states.

The main reason for the initial development of this measuring instrument was the fact that existing questionnaires such as the SF-36 and the NHP did not allow for the calculation of a generic index representing an assigned value (according to preference intensity) given to a health status, that could be used in cost-utility economic assessments. As such, the EuroQoL group filled a need to build a generic health index intended for use in economic assessments. They also projected a measuring instrument that would complete the remaining measures and allow for reference data collection in multinational comparisons.

According to the authors, the descriptive system was obtained over three phases. These included a first revision of the existing major health status generic measuring instruments, an analysis showing the result of the experience of the members of the group in using these instruments and the evidence obtained in face-to-face interviews.<sup>1</sup> Apart from completing this descriptive system, the respondent is asked to record the valuation of his own health status using a visual analogue scale from 0 (worst imaginable health state) to 100 (best imaginable health state), commonly called the EQ-VAS thermometer.

The EQ-5D has been designed as a self-completion measuring instrument. The respondent description of the health status, obtained using a classification system, includes five dimension scales with values of 1 to 3, and a rating scale, the EQ-VAS, which are the components most commonly used by researchers and healthcare professionals only interested in obtaining information on the impact of

health status on life and quality of life. Nevertheless, the responses to this descriptive system may also be aggregated using an algorithm sensible to the society values, i.e., to the values commonly associated by individuals to each health status, thereby producing a value index.

### Descriptive system of EQ-5D

Table 1 presents the dimensions and the levels of the descriptive system of EQ-5D.

For each individual, the result of this description is presented using a five digit number. Therefore, for example, a 21132 health status represents a health status of a person with some problems in mobility, without problems in both self-care and in the pursuit of his usual activities but with intense pain/discomfort and moderately anxious or depressed.

Beyond this description and in order to ensure a first approach to health gains, especially when it is a first assessment, the EQ-5D also allows the respondent to give a perception of his health status, by comparison with his general level of health in the previous 12 months. In this comparison, the respondent is asked to choose between the response options “better”, “the same” or “worse”.

### The value associated to the health status

The EQ-5D involves two ways of associating a value to a person's own health status. The first one, which completes the health status description, allows the respondent to place his own health status in a visual analogue scale, as presented in figure 1. Using the direct measurement technique,<sup>3</sup> the respondent is asked to draw a line between the “box” representing his own health state in that moment,

Table 1 – EQ-5D descriptive system.

Dimension	Level
<b>Mobility</b>	(1) I have no problems in walking about (2) I have some problems in walking about (3) I am confined to bed
<b>Self-care</b>	(1) I have no problems with self-care (2) I have some problems in washing and dressing myself (3) I am unable to wash and dress myself
<b>Usual activities</b>	(1) I have no problems in performing my usual activities (2) I have some problems in performing my usual activities (3) I am unable to perform my usual activities
<b>Pain/discomfort</b>	(1) I have no pain or discomfort (2) I have moderate pain or discomfort (3) I have extreme pain or discomfort
<b>Anxiety/depression</b>	(1) I am not anxious or depressed (2) I am moderately anxious or depressed (3) I am extremely anxious or depressed

and the EQ-VAS rating scale thermometer from 0 to 100, considering 0 as the worst health state imaginable and 100 as the best health state imaginable (Fig.1).

Nevertheless, it should be noted, that this visual analogue scale, despite being a simple process to give

a value, does not allow for the representation of the commitment between quantity and quality of life<sup>4</sup> and, for that reason, it does not yield cardinal values or utilities and as such cannot contribute towards QALY (*quality-adjusted life years*) assessment.

The second way of associating a value with a specific health state, upon its description and classification, is to obtain a value based on the collected preferences of general population. This value lies in a scale of 1 (perfect health) to 0 (death) yet admitting negative valuations corresponding to health states considered worse than death.

The first approach to determine this preference value was developed by Dolan *et al.*<sup>5,6</sup> based in an initial set of 45 health states and 2.997 members of the British population, selected in a study called MVH (Measurement and Value of Health) carried out by York University.<sup>7</sup>

Through the application of generalized linear least-squares regression method, these researchers found an additive function allowing for the conversion a five digit number into a cardinal index which varies between -0.59 and 1.00, adapted to the British reality.<sup>5</sup> This index is sensitive to the severity level of each dimension and includes a constant term  $\alpha$  for any health state different from 11111 and a N3 term identifying a more severe level of any dimension. That is, the additive function is defined by

$$V = 1 - \alpha - MO - CP - AH - DM - AD - N3$$

in which 1 represents a value of perfect health used to rescale the final result in the interval of 0 to 1,  $\alpha$  is a constant value which represents the non-coincidence of the value of any dimension related to the level 1, N3 is another constant which represents the presence of the level 3 in any dimension and the variables MO, CP, AH, DM and AD assume the values given by the first five lines in Table 2 for the level of each of the five dimensions.

For example, for the health state 21132 referred above, we find an index value obtained as follows:

$$V = 1 - 0.081 - 0.069 - 0.000 - 0.000 - 0.386 - 0.071 - 0.269 = 0.124$$

It is possible to obtain a QALY value associated to this health state, with an index obtained in this manner,<sup>8</sup> i.e., it allows for a measurement of healthcare benefit, that may be used in economic assessments.

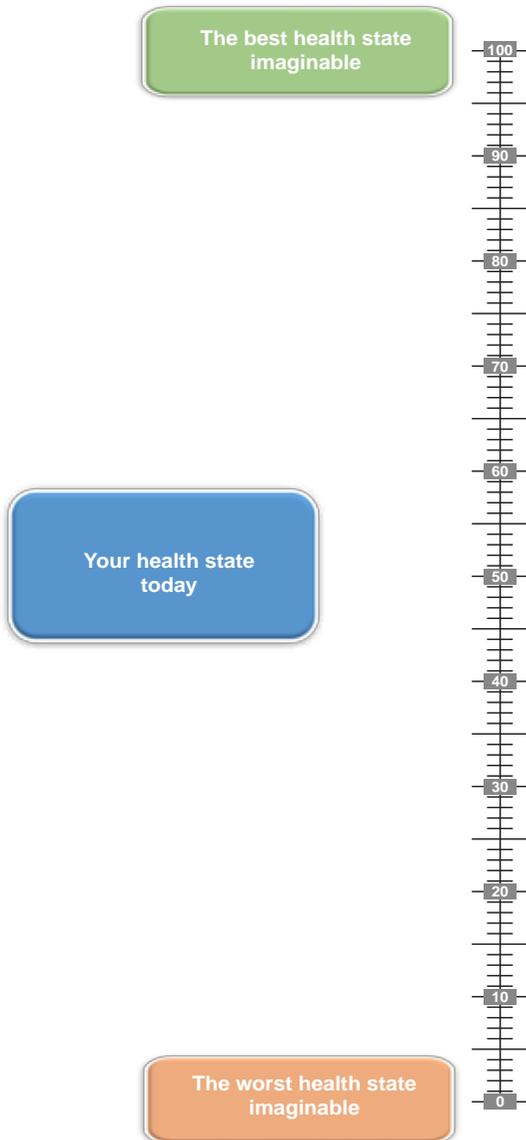


Figure 1 – EQ-VAS rating scale (thermometer).

Table 2 – EQ-5D descriptive system.<sup>5</sup>

Dimension	Level 1	Level 2	Level 3
(MO) Mobility	0.000	0.069	0.314
(SC) Self-care	0.000	0.104	0.214
(UA) Usual activities	0.000	0.036	0.094
(PD) Pain/discomfort	0.000	0.123	0.386
(AD) Anxiety/depression	0.000	0.071	0.236
$\alpha$		0.081	
N3		0.269	

Several European and non-European countries use valuation systems adapted to their own country and/or standards for the EQ-5D.<sup>4,9-13</sup> In Portugal, the Health Studies and Research Centre of the University of Coimbra (*Centro de Estudos e Investigação em Saúde da Universidade de Coimbra (CEISUC)*) with the financial support of the ACS (*Alto Comissariado para a Saúde*) and Pfizer Laboratories led a major health measurement and valuation project using EQ-5D, with the first publications already available online.<sup>14,15</sup> Divided in two parts (valuation and standards), its objectives were (1) to validate the EQ-5D for the Portuguese reality, (2) to determine a valuation system for Portugal adapted to the cultural Portuguese reality and (3) to measure the QdVRS of the Portuguese population and therefore, to determine the Portuguese standards for EQ-5D.

The purpose of this study is to document the first valuations regarding the Portuguese EQ-5D version. At first, the creation process of the Portuguese EQ-5D version will be described, followed by its semantic and linguistic equivalence, upon which some aspects regarding its validation will be analysed.

## MATERIAL AND METHODS

### Data

For this paper, we collected data mainly from three samples:

In the first sample, data was collected by a specifically recruited market research company, using telephone interviews and a randomized sample, stratified by NUTS II, gender and age, of 1,500 individuals from the Portuguese population aged 18 or more and living in all regions of Portugal (18 districts of Portuguese mainland, Azores and Madeira). The researchers had only access to the anonymous data.

The 150 records in the second sample were also collected by the same market research company and each participant was contacted by phone one week later. In this sample, although the company interviewers obviously knew the identity of the people they were again interviewing, that information was never included in the database nor was revealed to the researchers.

The third sample included 643 patients in four groups of pathology: 352 had cataracts, 115 had asthma, 72 had chronic obstructive pulmonary disease (COPD) and 104 had rheumatoid arthritis (RA). The patients with asthma and DPOC were consecutively recruited by chest physicians during slightly more than one year.<sup>16</sup> Patients with cataracts were selected from a waiting list for surgery in two public hospitals<sup>17</sup> and patients with RA were recorded in a database from the Portuguese Rheumatic Diseases League (*Liga Portuguesa de Combate às Doenças Reumáticas (LPCDR)*) and were referred by rheumatologists.<sup>18</sup>

All these samples had patient's explicit and informed consent, as well as Ethics Committee approval. Patients unable to complete the questionnaire, due to some pathology or due to illiteracy were helped by nursing professionals.

### Statistical analysis

Acceptability. In order to test this property, we intended to verify the feasibility of the EQ-5D and to what extent it is well accepted by the respondents. Based on the three samples, the response rates and the rates of fully completed instruments were determined. We assumed the following hypothesis:

H<sub>1</sub>: The individuals do not present major problems when filling the EQ-5D, as reflected by a low rate of missing data;

H<sub>2</sub>: The EQ-VAS, as slightly more complex than the descriptive system, is associated with a higher percentage of missing data.

Distribution. Data from the three samples enabled the analysis of response distribution. We also intended to identify the presence of a ceiling effect, i.e., a great percentage of respondents recording high valuations for health states. Therefore, we assumed the following hypothesis:

H<sub>3</sub>: The EQ-5D descriptive part presents a ceiling effect.

Reliability. As the EQ-5D is mainly used for economic assessment studies and health policies and not in clinical practice, was tested at an aggregated level. Test-retest reliability was assessed in sample 2, in which each respondent was questioned twice in a two-week period. We used for this purpose the Cohen's kappa coefficient calculator as well as the criteria defined by Landis and Koch.<sup>19</sup> In addition, internal consistency was measured using Cronbach's alpha coefficient and using established qualification criteria.<sup>20</sup>

Construct validity. In order to test this type of validity, we analysed the existing correlations between the EQ-5D scores in sample 1 and, in sample 3, in specific health states. Both samples also allowed correlation between the valuations obtained through EQ-5D or EQ-VAS with the socio-demographic variables or with valuations of the SF-36v2, an instrument that allows for the measurement of eight main health dimensions, all of them using several items and scored on a 0 to 100 scale. In the latter, extreme values correspond to the worst and the best possible HRQOL respectively. The measured dimensions included physical functioning (PF), role-physical (RP) role-emotional (RE), bodily pain magnitude (BP), general health (GH), vitality (VT), social functioning (SF) and mental health (MH).<sup>21-24</sup>

The following four hypotheses for EQ-5D and four more for EQ-VAS were tested:

H<sub>4</sub>: Respondents pointing out problems on any dimension of the

EQ-5D will present lower valuations on all dimensions scales of the SF-36v2;

H<sub>5</sub>: Respondents referred with EQ-5D anxiety/depression problems will present larger reductions on the SF and MH SF-36v2 dimensions;

H<sub>6</sub>: Respondents with pain/discomfort problems will also describe lower valuations on SF-36v2 BP dimension;

H<sub>7</sub>: Elder respondents of those referring some disease present worse valuations of health state dimensions;

H<sub>8</sub>: The EQ-VAS valuations will be higher in respondents describing a best health in the self-valuation SF-36v2 scale;

H<sub>9</sub>: The EQ-VAS valuations correlate negatively with aging;

H<sub>10</sub>: Respondents who describe the presence of a disease present lower EQ-VAS valuations;

H<sub>11</sub>: Women describe lower EQ-VAS valuations than men.

These hypotheses were tested using chi-square, *t*-Student, Mann-Whitney and Kruskal-Wallis tests and Spearman correlation coefficient. We used the Scheffé post-hoc method for multiple comparisons adjustment. On the other hand, we tested multiple regression models to assess the relationship between the EQ-5D and the valuations obtained by the specific health state instruments. In order to test the discriminant validity we assessed how functional disability measured by SF-36v2 would be discriminated by the three response levels of each dimension.

Criteria validity. As there is no *gold standard* for HRQOL, the criteria validity was tested by comparing with the utility valuations obtained by SF-6D in sample and with the data obtained in sample 3 collected in patients with a pathology and at the same time who have given specific measures of their pathology.

The SF-6D is another index based in preferences, obtained upon conversion of 11 items for SF-36 in a classification system with six dimensions, each one with four to six levels, allowing for the overall description of 18.000 different health states.<sup>25,26</sup> The SF-6D descriptive system includes the following dimensions: physical functioning, role participation, social functioning, bodily pain, mental health and vitality.

Therefore, for the subsamples relating to cataracts, asthma, COPD and rheumatoid arthritis, beyond EQ-5D and SF-6D, the Portuguese versions of Catquest, Asthma Quality of Life Questionnaire (AQLQ(S)), Asthma Control Questionnaire (ACQ), Clinical COPD Questionnaire (CCQ) and Arthritis Impact Measurement Scales 2 (AIMS2-SF) were used.

Catquest has been designed with the purpose of analysing cataract surgery results, not only regarding visual acuity, but also regarding the impact of surgery on daily activities, visual constraints, symptoms associated with cataracts and patient's level of independence.<sup>27,28</sup>

AQLQ is a specific questionnaire for patients with asthma, with questions regarding four domains (symptoms, activity constraints, emotional functioning and environmental exposure). AQLQ(S) is a standardized version of AQLQ<sup>29,30</sup> in which the five questions regarding the activity domain are generic and relate to the five more commonly chosen by patients in AQLQ original version.

ACQ is a small questionnaire including seven items and also developed by Juniper *et al.*<sup>31</sup> with the purpose of measuring the asthma control. Five of these items concern symptoms and activity constraints, one pertaining to the estimated FEV1 percentage and another to the use of short-acting bronchodilators.

CCQ is a small clinical questionnaire measuring COPD breathing difficulties, obtaining information regarding

symptom severity, related constraints and the effect of therapy.<sup>32</sup> It is available in several languages and in two versions: one with a weekly periodicity and another one covering a 24-hour period, which may be used as a diary. It includes ten items, divided in three domains: symptoms, functional state and mental state.

Finally, the AIMS2-SF is a specific health quality specific instrument for patients with rheumatoid arthritis, initially developed by Meenan *et al.*<sup>33</sup> and subject to several updates.<sup>34</sup> It allows for the measurement of five components of health quality: physical, symptoms, affect, social interaction and role.

This form of convergent validity has been tested using the following hypotheses and using Spearman and Pearson correlation coefficients:

H<sub>12</sub>: Correlation between EQ-5D/VAS and SF-6D;

H<sub>13</sub>: Correlation between EQ-5D/VAS and Catquest;

H<sub>14</sub>: Correlation between EQ-5D/VAS and AQLQ;

H<sub>15</sub>: Correlation between EQ-5D/VAS and ACQ;

H<sub>16</sub>: Correlation between EQ-5D/VAS and CCQ.

H<sub>17</sub>: Correlation between EQ-5D/VAS and AIMS2-SF.

Data were analysed with IBM SPSS Statistics, version 20. For every statistical analysis, a maximum significance level of 0.05 was adopted.

## RESULTS

### Semantic and linguistic adaptation

EQ-5D Portuguese version has been created in 1997 by CEISUC followed by the translation classical process.<sup>35-37</sup> Later on, in a harmonisation process between the versions in Latin based languages, some aspects requiring adaptation have emerged. That was the case of the third level of response to the question about mobility. Initially, the sentence 'I am confined to bed' was translated by '*Eu estou acamado(a)*' which may be considered as too harsh, regarding the intensity planned by the authors in the original version. It has been decided to change to '*Tenho de estar na cama*'.

In the options of response to the dimension 'usual activities' the authors of the original version have questioned whether the verb '*desempenhar*' should be changed by the verb '*realizar*' in order to be better understood by Portuguese respondents. It was considered as more correct to keep the Portuguese initial proposal, despite the verb used in the Spanish version.

The third aspect concerned the dimension 'pain/discomfort' and the use of the adjective '*moderados*' and '*extremos*' at the end of the sentences in order to assure they were related with pain, as well as with discomfort. This was a translation option which has been immediately changed.

In the introductory sentences to the analogue visual scale the word '*quão*' was initially used. This was the case of the sentences '*Para ajudar as pessoas a classificarem quão bom ou mau é o seu estado de saúde hoje*' and '*Gostaríamos que indicasse nesta escala quão bom ou mau é, na sua opinião, o seu estado de saúde hoje*'.

Table 3 – Social-demographic and clinical data distribution.

Variable	Values	Sample 1		Sample 2		Sample 3	
		N	%	N	%	N	%
<b>Size</b>		1 500	100.0	150	100.0	643	100.0
<b>Gender</b>	Female	789	52.6	78	52.0	377	58.7
	Male	711	47.4	72	48.0	265	41.3
<b>Age</b>	18 – 29 years	346		39		12	
	30 – 49 years	494		44		100	
	50 – 69 years	388	23.1	50	26.0	206	1.9
	70 or + years	272	32.9	17	29.3	320	15.7
	Minimum	18	25.9	18	33.3	18	32.3
	Maximum	91	18.1	85	11.3	92	50.2
	Mean	48.0		46.4		64.9	
	Standard deviation	18.8		17.7		15.5	
<b>Family situation</b>	Single	375	25.2	41	27.5	52	8.1
	Married or cohabiting	894	59.9	91	61.1	419	65.2
	Divorced or separated	100	6.7	9	6.0	40	6.2
	Widow	123	8.2	8	5.4	132	20.5
<b>Educational level</b>	≤ 6 years	469	31.5	39	26.2	469	72.9
	7-12 years	682	45.8	69	46.3	111	17.3
	> 12 years	337	22.6	41	27.5	63	9.8
<b>Occupational status</b>	Employed	725	48.6	60	40.0	179	27.9
	Unemployed	176	11.7	29	19.3	15	2.3
	Retired or pensioner	380	25.5	39	26.0	416	64.9
	Student	127	8.5	14	9.3	0	0.0
	Domestic work	83	5.6	7	4.7	31	4.8
	Other	1	0.1	1	0.7	0	0.0
<b>Household</b>	1 to 2 elements	642	43.3	61	40.7	587	91.3
	3 or + elements	840	56.7	89	59.3	56	8.7
<b>Pathology</b>	Yes	594	39.9	58	38.9	643	100.0
	No	894	60.1	91	61.1	0	0.0

In the harmonisation process, it was decided that this word, although existing in Portuguese, it is not commonly used and could create problems of understanding to some respondents. Therefore, these sentences have been updated without using this word

It has been submitted in 1998 as the Portuguese version of the EQ-5D, from this review, which since then has been used in Portugal, and made available, upon request, by the CEISUC.

### Sample

Social-demographic data of the respondents in the three samples are represented on Table 3.

We found in all samples a slight predominance of female subjects, married or non-married couples. Sample 3 presents, as expectable given these pathologies involved, an older population, with a lower education level, pensioners living alone or with the partner.

### Acceptability and distribution

The distribution of the five dimensions in each sample, for the EQ-5D and EQ-VAS is shown in Table 4.

In the three samples, 2,293 respondents completed the EQ-5D questionnaire, without any missing data in the three first dimensions, 1 (0.1%) missing data in the pain/discomfort dimension and 7 (0.5%) missing data in the anxiety/depression dimension, what confirms the H<sub>1</sub> hypothesis. No difficulties were encountered as regards the understanding of the questionnaire. As regards EQ-VAS, only 25 respondents (1.7%) did not answer this question on sample 1, 5 (3.3%) on sample 2 and 52 (8.1%) on sample 3, confirming the H<sub>2</sub> hypothesis.

Between the five EQ-5D dimensions, the proportion of having any problem was higher for pain/discomfort and for anxiety/depression. EQ-VAS average was 74.9 for samples 1 and 2 and 58.6 for sample 3 with unhealthy respondents. Whenever the H<sub>3</sub> hypothesis was confirmed, we found a ceiling effect, i.e., few respondents were placed on level 3 for the five dimensions. In fact, on samples 1 and 2, the mobility, self-care and usual activities dimensions, always presented valuations above 83% on level 1 (no constraint). In addition, in the pain/discomfort and anxiety/depression dimensions, more than half of the respondents selected level 1. A similar situation occurred on sample 3, in which

Table 4 – Distribution of the responses to EQ-5D and ERQ-VAS dimensions in the three samples.

EQ-5D		Sample 1		Sample 2		Sample 3	
		N	%	N	%	N	%
Mobility	No problems	1 249	83.3	129	86.0	405	63.0
	Moderate problems	244	16.3	21	14.0	238	37.0
	Extreme problems	7	0.5	0	0.0	0	0.0
Self-care	No problems	1 428	95.2	145	96.7	561	87.2
	Moderate problems	66	4.4	5	3.3	73	11.4
	Extreme problems	6	0.4	0	0.0	9	1.4
Usual activities	No problems	1 255	83.7	125	83.3	402	62.5
	Moderate problems	209	13.9	23	15.3	235	36.5
	Extreme problems	36	2.4	2	1.3	6	0.9
Pain/discomfort	No problems	830	55.4	80	53.3	256	39.8
	Moderate problems	599	40.0	66	44.0	350	54.4
	Extreme problems	70	4.7	4	2.7	37	5.8
Anxiety/depression	No problems	980	65.6	102	68.0	283	44.0
	Moderate problems	449	30.1	43	28.7	330	51.3
	Extreme problems	64	4.3	5	3.3	30	4.7
EQ-VAS	Percentile 5	34.8		40.0		30.0	
	Percentile 10	50.0		50.0		37.0	
	Percentile 25	60.0		60.0		50.0	
	Percentile 50	80.0		80.0		59.0	
	Percentile 75	90.0		90.0		70.0	
	Percentile 90	99.0		100.0		80.8	
	Percentile 95	100.0		100.0		90.0	
	Minimum	0.0		5.0		20.0	
	Maximum	100.0		100.0		100.0	
	Mean	74.9		74.9		58.6	
Standard deviation	21.2		20.3		17.0		

Table 5 – Distribution of EQ-5D dimensions in the subsamples per pathology.

EQ-5D Dimension		Cataracts <sup>15</sup> (n = 352)		Asthma <sup>14</sup> (n = 115)		COPD <sup>36</sup> (n = 72)		RA <sup>16</sup> (n = 104)	
		N	%	N	%	N	%	N	%
Mobility	No problems	220	62.5	82	71.3	55	76.4	48	46.2
	Moderate problems	132	37.5	33	28.7	17	23.6	56	53.8
	Extreme problems	0	0.0	0	0.0	0	0.0	0	0.0
Self-care	No problems	316	89.1	109	94.8	68	94.4	68	65.4
	Moderate problems	32	9.1	6	5.2	3	4.2	32	30.8
	Extreme problems	4	1.1	0	0.0	1	1.4	4	3.8
Usual activities	No problems	220	62.5	87	75.7	55	76.4	40	38.5
	Moderate problems	128	36.4	28	24.3	15	20.8	64	61.5
	Extreme problems	4	1.1	0	0.0	2	2.8	0	0.0
Pain/discomfort	No problems	108	30.7	76	66.1	56	77.8	16	15.4
	Moderate problems	216	61.4	38	33.0	16	22.2	80	76.9
	Extreme problems	28	8.0	1	0.9	0	0.0	8	7.7
Anxiety/depression	No problems	136	38.6	71	61.7	52	72.2	24	23.1
	Moderate problems	192	54.5	43	37.4	19	26.4	76	73.1
	Extreme problems	24	6.8	1	0.9	1	1.4	4	3.8

cut-points were obviously lower, in 62% and 40%, respectively, yet still very high. A more detailed analysis of subsamples by pathology, in sample 3, allowed us to observe that this ceiling effect was even more evident than initially observed (Table 5).

The mode of the distributions of dimensions related with mobility, self-care and usual activities is represented on

the first level, meaning a strong ceiling effect for cataracts, asthma and COPD, as expected for elderly patients with a restrictive disease in what concerns usual activities. The same applies to the pain/discomfort and anxiety/depression dimensions in the patients with asthma and COPD, as with the self-care dimensions in patients with RA. As regards pain/discomfort and anxiety/depression dimensions in

patients with cataracts and in the remaining four dimensions in patients with RA, mode is situated at the second level.

### Reliability

Table 6 presents three indices that demonstrate the reliability of this measuring instrument: percentage agreement, Spearman correlation coefficient and Cohen kappa coefficient.

The values obtained indicate very good correlation values and moderate (self-care and pain/discomfort) to good kappa values (remaining dimensions).

The value of Cronbach alpha coefficient for EQ-5D was 0.716, which signifies an acceptable internal coherence. In addition, Intraclass Correlation Coefficient (ICC) for EQ-VAS between the two periods was high (0.862 with a confidence interval of 0.808 to 0.901), as well as the Pearson correlation coefficient (0.768;  $p < 0.001$ ).

### Construct validity

In order to answer the question regarding construct validity, relating EQ-5D with SF-36v2 dimensions, as well as the three first hypotheses referred above, the values for each level without/with problems on each of the EQ-5D dimensions, the median value of the several SF-36v2 dimensions' scores, as well as the statistical significance indicator are presented in Table 7.

Our findings are in agreement with hypothesis H<sub>4</sub>, as the distributions of respondents that reported moderate or extreme problems in each EQ-5D dimension always presented a significantly lower median than those that did not describe any problems, as already described.<sup>38</sup> Also, in the anxiety/depression dimension, the differences regarding median of values for SF-36v2 MH dimension (32.0 points) and SF (25.0 points) are higher than the difference for PF (15.0 points), in agreement with hypothesis H<sub>5</sub> and already observed.<sup>39</sup> The difference in points for the median of the SF-36v2 PR dimension, between those referring in EQ-5D that do not have any pain and those referring problems regarding pain is of 39.0 points (hypotheses H<sub>6</sub>), also previously demonstrated.<sup>40</sup>

In order to answer hypothesis H<sub>7</sub>, the relationship between responses to EQ-5D dimensions, age and the presence of pathology are presented in Table 8.

As illustrated, the elderly and the most severely ill patients are those who significantly reported more problems in all EQ-5D dimensions.

Table 9 present the average values of EQ-VAS for each of the levels of variables, allowing for testing hypotheses H<sub>8</sub> to H<sub>11</sub>.

EQ-VAS was initially analysed as regards self-evaluation of the health state (question 1 of SF-36v2) and the age group. As shown in this table, EQ-VAS is strongly related

Table 6 – EQ-5D reliability.

EQ-5D Dimension	Concordance (%)	Correlation ( $\alpha$ )	Cohen's kappa
<b>Mobility</b>	91.9	0.677	0.647
<b>Self-care</b>	97.3	0.586	0.586
<b>Usual activities</b>	89.3	0.661	0.308
<b>Pain/discomfort</b>	77.3	0.633	0.555
<b>Anxiety/depression</b>	85.0	0.661	0.633

Table 7 – SF-36v2 median for each EQ-5D dimension.

EQ-5D Dimension	N	PF	RP	BP	HG	RE	VT	SF	MH
<b>Mobility</b>		**	**	**	**	**	**	**	**
No problem	1 249	95.0	93.7	74.0	62.0	91.7	70.0	87.5	80.0
Problem	251	45.0	50.0	51.0	44.4	58.3	45.0	62.5	56.0
<b>Self-care</b>		**	**	**	**	**	**	**	**
No problem	1 428	90.0	93.7	72.0	62.0	91.7	70.0	87.5	80.0
Problem	72	25.0	31.3	31.0	40.0	41.7	35.0	50.0	52.0
<b>Usual activities</b>		**	**	**	**	**	**	**	**
No problem	1 255	95.0	93.7	72.0	62.0	91.7	70.0	87.5	84.0
Problem	245	45.0	50.0	42.0	40.0	58.3	40.0	62.5	55.0
<b>Pain/discomfort</b>		**	**	**	**	**	**	**	**
No problem	830	95.0	100.0	100.0	67.0	100.0	75.0	100.0	84.0
Problem	669	75.0	68.7	61.0	50.0	75.0	50.0	75.0	68.0
<b>Anxiety/depression</b>		**	**	**	**	**	**	**	**
No problem	980	95.0	100.0	74.0	65.0	100.0	71.7	100.0	88.0
Problem	513	80.0	75.0	62.0	50.0	66.7	50.0	75.0	56.0

PF – Physical functioning. RP – Role-physical. BP – Bodily pain magnitude. GH – General health. RE – Role-emotional. VT – Vitality. SF – Social functioning. MH – Mental health.

\*\*  $p < 0.001$

with health self-evaluation, as the difference between the average on each health level is significant ( $p < 0.001$ , except for the rise between levels 'ótima' and 'muito boa'), confirming hypothesis  $H_8$ , also reported by other authors.<sup>41,42</sup>

In addition (hypothesis  $H_9$ ), EQ-VAS was observed to decrease significantly with increasing age ( $p < 0.001$  for all age groups, except between 18-29 and 30-49 age groups, in which  $p < 0.01$ ), confirming previous findings.<sup>42,43</sup>

Respondents with some disease also presented worst global evaluations of their health than healthy respondents (hypothesis  $H_{10}$ ), and the same occurred with female vs. men (hypothesis  $H_{11}$ ).

#### Criterion validity

In order to test this type of validity, we compared the valuations collected by EQ-5D, initially with those obtained by SF-6D and subsequently with those obtained with specific measuring instruments. These results are presented in Table 10.

In what concerns the comparison between measuring instruments based in preferences (hypothesis  $H_{12}$ ) and although these are measured with different descriptive systems, we compared the results for EQ-5D and EQ-VAS with SF-6D dimensions. We found moderate correlations, in line with other studies.<sup>44-46</sup>

Regarding the subsample of Patients with cataracts, we compared the EQ-5D indexes with the Catquest areas

(hypothesis  $H_{13}$ ). We demonstrated, as expected, the pre-sence of moderate and inverse correlations between utility measurement and the level of Activity, symptoms for cataracts and general opinion about Catquest.<sup>17</sup> We highlight the presence of another moderate and inverse correlation between EQ-VAS and disability, what could be interpreted to mean that an improvement in one of these areas may lead to a rise in the patient's health state utility and therefore to an improvement in HRQOL.

With the analysis of consistency between EQ-5D and the results of asthma specific instruments, we observed that AQLQ(S) domains and their global valuations are directly and moderately/strongly correlated with the utility measures (hypothesis  $H_{14}$ ), which could be interpreted as improvement in some of these areas increasing utility. On the other hand, we observe the presence of strong and inverse correlations between the ACQ global valuation and the EQ-5D measures (hypothesis  $H_{15}$ ).

In what concerns COPD, EQ-VAS seemed to be correlated with all CCQ dimensions and the descriptive part of the EQ-5D presented a good correlation with the global value (hypothesis  $H_{16}$ ).

Finally, with the analysis of the results of the application of the specific measuring instrument of life quality in Patients with RA, we demonstrated the presence of strong and inverse correlations between the utility measures

Table 8 – Relationship between EQ-5D responses. Age group and pathology, N (%).

Variable	EQ-5D dimentions with problems				
	Mobility	Self-care	Usual activities	Pain/discomfort	Anxiety/depression
<b>Age</b>	**	**	**	**	**
< 65 years	115 (10.3%)	38 (3.4%)	121 (10.8%)	409 (36.5%)	361 (32.3%)
≥ 65 years	134 (36.7%)	33 (9.0%)	121 (33.2%)	250 (68.7%)	146 (40.6%)
<b>Pathology</b>	**	**	**	**	**
No	63 (7.0%)	11 (1.2%)	50 (5.6%)	273 (30.5%)	225 (25.3%)
Yes	185 (31.1%)	61 (10.3%)	192 (32.3%)	385 (64.9%)	282 (47.6%)

\*\*  $p < 0.001$

Table 9 – Relationship between EQ-VAS, health self-assessment and context variables.

Variable	Level	N	Mean	Standard variation	Mean Comparison	
					F	Sig.
<b>Health self-valuation</b>	Excellent	216	88.3	14.8	241.9	**
	Very good	319	87.7	9.7		
	Good	391	78.8	14.9		
	Reasonable	451	63.0	18.5		
	Weak	98	42.7	28.9		
<b>Age</b>	18 – 29 years	345	84.3	14.2	86.2	**
	30 – 49 years	493	79.8	18.3		
	50 – 69 years	383	68.5	22.2		
	70 or more years	254	62.2	23.6		
<b>Pathology</b>	No	887	80.8	17.7	197.1	**
	Yes	578	65.9	22.8		
<b>Gender</b>	Female	768	72.9	23.2	15.1	**
	Male	707	77.1	18.5		

\*\*  $p < 0.001$

Table 10 – Correlation between SF-6D and EQ-5D.

Measuring instrument	Dimensions	EQ-5D	EQ-VAS
SF-6D	Physical functioning	-0.520**	-0.486**
	Role-physical	-0.412**	-0.449**
	Social functioning	-0.419**	-0.428**
	Pain magnitude	-0.509**	-0.607**
	Mental health	-0.480**	-0.541**
	Vitality	-0.442**	-0.411**
Catquest	Disability	-0.07	-0.20**
	Cataract symptoms	-0.13*	-0.31***
	Activity level	-0.29***	-0.23***
	General opinion	-0.29***	-0.33***
	Car driving	0.10	0.08
AQLQ(S)	Activity limitations	0.50***	0.55***
	Symptoms	0.56***	0.53***
	Emotional function	0.33***	0.35***
	Environmental stimuli	0.31***	0.37***
	Global evaluation	0.53***	0.55***
ACQ	Global evaluation	-0.51***	-0.51***
CCQ	Symptoms	-0.278*	-0.362**
	Functional status	-0.527**	-0.523**
	Mental status	-0.059	-0.304**
	Global evaluation	-0.358**	-0.540**
AIMS2-SF	Physical dimension	-0.01	0.07
	Symptoms	-0.93**	-0.76**
	Affect	-0.40**	-0.29
	Social interaction	-0.41**	-0.59**
	Performance	-0.05	0.14

\*  $p < 0.05$  \*\*  $p < 0.01$  \*\*\*  $p < 0.001$ 

and symptom-associated dimensions, affect and social interaction of the AIMS2-SF (hypothesis  $H_{17}$ ).

## CONCLUSIONS

Health results measures are becoming more and more essential for monitoring clinical practice, especially when gain associated to different therapies is considered to be marginal. One of the instruments used to measure these health results is the EQ-5D. It is applicable to a large set of health states and therapies, and not only does it set a health profile, but also it sets an index which expresses HRQOL of the respondents.

The results obtained using the EQ-5D may be used for planning and allocating resources in health sector, at national and at regional level and also by pathology, allowing as well for integration in the Health National Plan, as already practiced in other countries. Therefore, there is a clear practical application of the results by health authorities, national and/or regional.

The utility values of health states of the Portuguese population may also be used in economic assessments

of health technology, for drug economic assessment, as well as different health programs (when choosing between different alternatives, the one that allows reaching the health state with higher utility should be preferred). Nevertheless, any measuring instrument, before its implementation, needs acceptable properties. We can assume, with this study, the following general conclusions regarding the Portuguese version of the EQ-5D:

- The translation and cultural adaptation have been made based on the best practice held in scientific terms;
- It presented a great acceptability of the respondents, with few missing data and presence of the expected ceiling effect;
- The test-re-test reliability has been confirmed and considered high and the internal coherence has been considered as acceptable;
- The construct validity has been checked through confirmation of previously defined hypotheses.
- The criterion validity has been successfully tested through the behaviour analysis with the EQ-5D and EQ-VAS in relation to another instrument based on preferences (the

SF-6D). The latter instrument, although generic for health measuring, was utilized with specific instrument dimensions for cataracts, asthma, COPD and RA.

Thus, we can say that the Portuguese version of the EQ-5D has a good acceptability and validity in health state measuring.

## ACKNOWLEDGEMENTS

The authors wish to acknowledge Maria do Céu Machado, ex High Commissioner Officer for Health, for her support. They also wish to thank the medical and nursing teams at *Centro Hospitalar do Barlavento Algarvio* and at Faro Central Hospital who collected data on patients with

cataracts, the chest physicians and cardiopneumology technicians at Faro Central Hospital who collected patients' data on asthma and COPD, as well as the LPCDR and rheumatologists that allowed data collection regarding rheumatoid arthritis.

## CONFLICTS OF INTEREST

Nothing to declare.

## FINANCING SOURCES

The Health High Commission and Pfizer Laboratories granted the financial support that allowed data collection of samples 1 and 2.

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Acta Med Port 2013;26:664-675

Publicado pela **Acta Médica Portuguesa**, a Revista Científica da Ordem dos Médicos

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ISSN:0870-399X | e-ISSN: 1646-0758



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