Predictors of Health-related Quality of Life and Self-care in a Large Sample of Spanish Adults with Diabetes Mellitus

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Authors' contributions

Article Information

Original Research Article

ABSTRACT

Objective: To assess health-related quality of life (HRQoL) and self – care behaviors in a large sample of diabetic patients (DPts) and to examine which patients' characteristics influence on them.

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Methods: This cross - sectional study included 1,039 DPts (561/478, Men/Women, 156/883 DM1/DM2, mean age 62±15 years old; mean diabetes duration 15±10 years) evaluated in a diabetes (DM) specialized outpatient office, at St Carlos Hospital, in Madrid, from 2012 to 2014. HRQoL was assessed with the EuroQoL- Visual Analogue Scale (EQoL-VAS) and the Diabetes Quality of Life Score (DQoL). Treatment adherence was evaluated using the Self-Care Inventory-revised (SCI- r). Multiple logistic regression analysis were used to examine the relationship between HRQoL, adherence to treatment and several demographic and clinical patients' characteristics.

Results: A lower quality of life was associated with the female gender, the presence of chronic complications and a poor glycemic control (all $p < 0,05$). After adjustment for confounders, obese middle-aged men showed the lowest adherence to treatment. However, women with a prolonged duration of the DM (> 15 years) and DPts receiving insulin treatment showed a better DM self-care ($p < 0.05$).

Conclusions and Implications: The duration of the DM, metabolic control, the type of therapy, and the presence of chronic complications are important determinants of HRQoL and treatment adherence in patients with DM, and should be taken into account when treating DPts. Data obtained could be useful to plan patient-based health decisions.

ABBREVIATIONS

HRQoL: Health-related quality-of-life; EQ-VAS: EuroQoL Visual Analogue Scale; DQoL: Diabetes Quality of Life Score; SCI-r: Self-Care Inventory-revised; BMI: Body Mass Index; WC: waist circumference; HT: hypertension; DR: diabetic retinopathy; PVD: peripheral vascular disease; ABI: ankle/brachial index; GFR: glomerular filtration rate; MDRD: Modification of Diet in Renal Disease; NDS: Neuropathy Disability Score; NSS: Neuropathy Symptoms Score; MNIS: Memphis Neuropathy Instrument Score.

1. INTRODUCTION

Diabetes mellitus has an enormous repercussion on public health due to its high prevalence and its association with chronic complications [1,2]. The evaluation of the impact of chronic diseases must not be limited to the measurement of traditional clinical outcomes such as morbidity and mortality, but also include HRQoL assessment. Measures of HRQoL provide a subjective weighting of health problems that may not be captured with objective physical assessments.

Several studies have found a decline in the HRQoL of patients with DM, in terms of social and psychological well-being as well as physical health [3-5]. Furthermore, HRQoL has also been associated with adverse outcomes in people with type 2 DM, including poor response to therapy, disease progression, and even mortality [6-7].

Therefore, the routine evaluation of HRQoL could be of interest in clinical practice, as it may provide additional information on patient risk independent of demographic and clinical risk factors for mortality.

However, the evaluation of HRQoL can be difficult, as there are multiple patient and disease factors, particularly age, gender and the presence and severity of disease complications that can influence on quality of life (QoL).

In addition to the characteristics of the patients, the type of questionnaire used can also affect the results obtained, and the research comparing generic with diabetes-specific HRQOL measures provide sometimes conflicting results. Thus, when questionnaires are selected inappropriately data can be misinterpreted [8]. Generic instruments are specially useful to compare HRQoL among different illnesses, buy they are less sensitive for the detection of particular aspects specifically related to the disease. Therefore, it is advisable using both generic and specialized instruments in the evaluation of HRQoL, as they provide additional information.

Data on HRQoL in the diabetic population in Spain are scarce, although there is an increasing

interest in the evaluation of QoL in recent years. The Di@bet.es study, which included a representative sample of the Spanish population, studied QoL using the Short Form 12, a generic questionnaire for the assessment of HRQoL. People with DM (even individuals with unknown DM) reported a lower physical and mental scores when compared to participants with a normal glucose metabolism [9]. Previous publications in Spain have reported a worse HRQoL in DPts with chronic complications [10,11].

In addition to HRQoL, treatment adherence is of vital importance in chronic diseases, particularly in DM, where self- management in daily life is crucial. Self-care requires monitoring of blood glucose levels, controlling carbohydrate intake, and practicing physical activity. In developed countries, the treatment adherence rate for chronic diseases is approximately 50%. Another interesting result is the greater lack of adherence in following diets or therapies linked to behavior [12]. Inadequate adherence compromises safety and treatment effectiveness, leading to increased mortality and morbidity, which translates into a considerable increase in healthcare costs [13]. Therefore, increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments [14].

The aim of the present study was to assess HRQoL and self-care behaviours in DPts who were referred to a DM specialized outpatient clinic, with the goal of identifying DPts' characteristics associated with a lower HRQoL and treatment adherence. Understanding the key determinants of HRQoL could play an important role in establishing priorities for health policy strategies directed towards improvement of the management of DM.

2. MATERIALS AND METHODS

2.1 Design and Ethical Approval

We performed a cross-sectional study to describe HRQoL and treatment adherence in a group of patients suffering from DM. The study protocol was approved by the Ethics Committee of the St Carlos Hospital and conducted according to the Declaration of Helsinki. A written informed consent was obtained.

2.2 Subjects

Patients were sampled consecutively in a DM specialized outpatient office, at St Carlos Hospital, in Madrid, Spain. All the patients who attended to this office from June 2012 to December 2014 were included. No exclusion criteria were applied. 1039 DPts were included, 561 men and 478 women, 156/883 DM1/DM2, with an average age of 62 ±15 years old, the mean HbA_{1c} was 7.7±1.6% and the mean duration of the DM was 15.3±10.5 years.

A global evaluation of the DPts was performed in this DM unit. The staff of the outpatient office included three nurses and an endocrinologist who elaborated a final report on the condition of the patient. In a single visit it was assessed the degree of metabolic control, the presence of chronic complications (retinopathy, polyneuropathy, kidney disease and peripheral vascular disease), HRQoL, treatment adherence, body composition and pharmacological treatment. Dietary habits were also evaluated, and advice given on how to improve lifestyle.

The anthropometric measures used were: Body Mass Index (BMI, calculated as kg/m^2) and waist circumference (WC). To estimate the degree of metabolic control, the following parameters were evaluated: HbA1c, hypertension (HT) (blood pressure >140/90 mmHg or pharmacological treatment for HT), LDL cholesterol (good control if <100 mg /dL), HDL cholesterol (good control if >40 mg /dL in men and >50 mg / dL in women) and triglycerides levels (TG) (good control if <150 mg / dl). Hyperlipidemia was diagnosed if at least one of the following variables was present: LDL >100 mg/dl, HDL <40 mg/dl in men or <50 mg/dl in women, TG > 150 mg/dl, or treatment with fibrates or statins.

For the screening of diabetic retinopathy (DR) several images were taken using a non - mydriatic camera (Topcon TRC - NW200). Images were interpreted by the endocrinologist in charge, who had been previously trained for this task, and supervised by an ophthalmologist when necessary.

The presence of peripheral vascular disease (PVD) was evaluated with the measurement of the ankle/brachial index (ABI). An ABI between 0.9 and 1.25 ruled out PVD, a value <0.9 was a criterion for referral to vascular surgery for suspected PVD, and a value >1.25 was considered as non-classifiable (if the patients were symptomatic they were remitted to the vascular surgeon).

Kidney function was evaluated assessing the glomerular filtration rate (GFR) according to the

equation MDRD (Modification of Diet in Renal Disease), and considered normal if it was > 60 ml/min, moderate kidney disease if values were between 30-60 ml/min or severe kidney disease if the GFR was < 30 ml/min.

The Neuropathy Disability Score (NDS) was used for the screening of neuropathy. A score > 6 was diagnostic of diabetic neuropathy [15]. The Neuropathy Symptoms Score (NSS) and the Memphis Neuropathy Instrument Score (MNIS) were also applied to complete the screening (data not shown). To stratify the risk for developing an ulcer, the vibratory threshold by biothensiometer and pressure sensitivity with the 10-g monofilament were evaluated. Patients with a positive screening for neuropathy attended a course for education in self-care of their feet.

2.3 Health – Related Quality of Life

For the evaluation of HRQoL, a generic questionnaire, the EuroQoL Visual Analog Score (EQ-VAS) as well as another one specific for DM, the Diabetes Quality of Life (DQoL) were used. The EQ-VAS it is a part of the EuroQoL instrument and it was chosen because it is simple to administer and to score, it is validated for Spanish population and it is relevant to people with DM [16-18].

The EQ-VAS is a standard vertical 20 cm visual analog scale, similar to a thermometer, with a range from 0 to 100. The ends of the scale are labeled as "best imaginable health state" and "worst imaginable health". 0 represents the worst imaginable health state and 100 indicate "perfect health".

The DQoL is a DM-specific instrument that was developed by the group of the Diabetes Control and Complications Trial [19] and validated for the Spanish population [20]. This questionnaire evaluates the impact of DM and its treatment on a broad range of life domains. The questionnaire is a 43-item multiple choice self-administered tool, with four primary subscales including: "Satisfaction" (15 questions) (score range 15-75), "Impact" (17 questions) (score range 17-85), "Social / Vocational worry" (7 questions) (score range 7-35) and "Diabetes - related worry" (4 questions) (score range 4-20). The response to each item was rated from 1 (very satisfied, no impact and never worried) to 5 (very dissatisfied, strong impact and always worried). Therefore, a higher score represented a lower HRQoL. The scores of all items in each subscale were

summed giving a total subscale score; the scores of all items of the four scales were summed as well, resulting in a grand measure score, which ranged from 45 to 215. The questionnaire was considered valid if the patient had filled in at least an 80% of the items. These instruments were self-administered during the visit to the study center.

2.4 Treatment Adherence

The Self-Care Inventory-revised (SCI-r) assesses the adherence to recommended behaviours in patients with DM (21). It is a 15-item self-report questionnaire. It evaluates patients' perceptions of different self-care behaviours: diet (4 items), glucose monitoring (2 items), medication administration (3 items), exercise (1 item), and low glucose levels (2 items), preventive / routine aspects of care (3 items). This questionnaire has been validated for its use in Spain (22). Respondents rate their own self-care on a 5-point Likert scale to reflect how well they followed recommendations during the past month (i.e. from "never" (Scored as 1) to "always" (Scored as 5). The final score ranged from 15 to 75 points (a higher score meant a higher self-adherence).

2.5 Statistical Analysis

Descriptive statistics were calculated for all variables measured. Continuous variables were expressed as means and standard deviation (SD), and categorical data were expressed as absolute frequencies. Comparisons of mean levels were performed using the Student's t-test for unpaired samples and the one-way analysis of variance (ANOVA) and Chi square test was used for qualitative variables. We calculated the mean± SD of the EQ-VAS, DQoL and SCI-r measures and performed subgroup analyses to examine the association of demographic and clinical characteristics, level of glycemic control and DM complications with questionnaires' scores.

A poor HRQOL was defined as a score below the median in the EQoLVAS or higher than the median in the DQOL questionnaire and poor adherence was defined as a score less than the median in the SCI-r.

Additionally, logistic regression models were built in order to adjust for potential confounders. The model was based on stepwise backward algorithm with the p value set at 0.20 for entering

the model. All results of the regression model were presented using the odds ratio (OR) and its 95% CI. The variables included in the model were: age divided into 4 groups: < 45, 45-65, 65-79 or ≥ 80 years old; BMI divided into 3 groups: < 25 kg/m^2, 25-30 kg/m^2 or > 30 Kg/m^2, DM type 1 vs DM 2; the duration of the diabetes ≤ 15 or >15 years, HbA1c was introduced as a continuous variable; kidney disease it was diagnosed if the GFR was < 60 ml/min; Insulin treatment was coded as YES / NO and the presence of retinopathy, polyneuropathy or peripheral vascular disease were coded as YES / NO.

The null hypothesis was rejected with a type 1 error less than 0.05 (α <0.05).

The data were analyzed using SPSS computer software version 15.0 for Windows (SPSS, Chicago, IL, USA).

3. RESULTS

3.1 Patients' Characteristics

The characteristics of the individuals included in this study are shown in Table 1.

3.2 Quality of Life and Adherence to Treatment Stratified by Sex

Women reported a lower HRQoL, showing more "diabetes concern" than men, but also a higher adherence to treatment. No sex differences were observed as regards to satisfaction, impact or social concern (Table 2).

3.3 Quality of Life and Adherence to Treatment According to Age, BMI, Type of Diabetes and Duration of Diabetes

Aging was associated with a higher satisfaction, a lower impact of DM and a lower social concern. This trend was observed in men and women (p<0.05).

Overweight patients showed a tendency towards a higher HRQoL with the questionnaire DQoL compared to the group with normal weight or-severe obese patients (p<0.05). The group of patients with severe obesity (IMC > 35 kg/m2) had the worst HRQoL of all groups (only differences with the DQoL instrument were found). Obese patients were less adherent to self-care behaviors.

Table 1. Patients' characteristics stratified by sex

	All (n=1039)	Men (n=561)	Women (n=478)	p value
Age (years)	62 ± 15	60 ± 15	64 ± 15	0.000
BMI (Kg.m^{-2})	28.4 ± 6	28.2±5.2	28.7 ± 6.9	NS
Waist (cm)	103 ± 14	105 ± 14	100 ± 14	0.000
Creatinine (mg/dl)	0.9 ± 0.3	1.1 ± 0.3	0.9 ± 0.4	0.000
HbA1c (%)	7.7 ± 1.6	7.8 ± 1.6	7.7 ± 1.6	NS
Total-C. (mg/dl)	179.3 ± 39.7	176.4 ± 40	182.8 ± 37.8	0.011
HDL-C. (mg/dl)	52.8 ± 14.8	48.9 ± 14.1	57.3 ± 14.1	0.000
LDL-C. (mg/dl)	95.2 ± 30.3	95.3 ± 32.2	95.1 ± 27.9	NS
Tg (mg/dl)	152.2 ± 102	156 ± 101.1	147.89 ± 104.9	NS
Duration of DM (years)	15±10.3	14.9±10.3	15.8±10.7	NS
Treatment DL: yes (%)	65.2	61.9	69	0.019
Treatment HT: yes (%)	61	60	64	NS
Insulin treatment: yes (%)	53	54	53	NS
DR	26.4	27.3	25.3	NS
DN	16.3	18.5	13.9	0.007
PVD	35.1	38.3	31.3	0.009
KD	17.7	14.6	21.5	0.000

Data are expressed as Mean±SD. DM: diabetes mellitus, BMI: body mass index, Total-C: total cholesterol, HDL-C: high density lipoprotein cholesterol, LDL-C: low density lipoprotein cholesterol, Tg: triglycerides, DL: dyslipidemia, HT: hypertension, DR: diabetic retinopathy, DN: diabetic neuropathy, PVD: peripheral vascular disease (Ankle brachial index < 0.9 and >1.25 was considered as PVD), KD kidney disease. NS = non-significant

Table 2. Scores for Quality-of-Life questionnaires (EQ-VAS and DQoL with its 4 subscales) and for the adherence questionnaire (SCI-r), stratified by sex

N	All (n= 1039)	Men (n= 561)	Women (n= 478)	p - value
EQ-VAS	70.4 ± 13.6	71.7 ± 12.5	68.9 ± 14.7	0.001
Satisfaction	35.8 ± 10.5	35.9 ± 10.7	35.7 ± 10.1	NS
Impact	32.1 ± 9.5	31.8 ± 9.1	32.5 ± 9.9	NS
Social Worry	11.9 ± 4.8	11.9 ± 4.8	11.9 ± 4.8	NS
Diabetes Worry	8.9 ± 3.6	8.3 ± 3.4	9.3 ± 3.6	0.001
TOTAL DQoL	88.7 ± 22.4	88.1 ± 21.9	89.4 ± 22.9	NS
Adherence: SCI-r	51.9 ± 8.4	51.2 ± 8.5	53.7 ± 8.4	0.004

Data are expressed as Mean ± SDM. EQ-VAS: Euro Quality of Life Visual Analogue Scale, DQoL: Diabetes Quality of Life. Total DQOL is the summatory of the scores of the 4 subscales. SCI-r: Self Care Inventory revised. DM: diabetes mellitus. NS = non-significant

Regarding QoL depending on the DM type, patients with DM1 had a greater impact of the illness, more social concern but a higher adherence to treatment when compared to patients with DM2.

DPts with a duration of DM > 5 years reported a lower HRQoL. However, the ones with the longest DM evolution (> 15 years), instead of a lower QoL had the highest adherence.

3.4 Quality of Life and Adherence to Treatment According to Metabolic Control, Insulin Treatment, Dyslipidemia and HT Treatment

The HRQoL decreased as glycemic control deteriorated. A higher level of HbA1c was related to less satisfaction, independently of sex and a higher impact and social worry in women (p<0.05). No relationship between metabolic control and the SCI-r was observed.

Insulin treatment was associated with a lower HRQoL when using the DQoL, mainly due to a higher impact, although no differences in satisfaction were found.

However, the group treated with insulin was more adherent to self-care behaviors. No differences in HRQoL or adherence were found in patients with or without treatment for dyslipidemia or hypertension (Table 4).

3.5 Quality of Life and Adherence to Treatment According to the Presence of Chronic Complications

Patients with pre - existing chronic complications had a general tendency to rate QoL worse than those without complications. This was only statistically significant for retinopathy, men with PVD and women with neuropathy and nephropathy. No clear relationship between chronic complications and adherence was observed, except for a higher SCI-r score in men with DR (Table 5).

3.6 Multivariate Regression Analysis

To examine whether the reported differences might have been influenced by some confounders, multivariate logistic regression analysis were conducted. The following factors were included in the analyses: sex, age, BMI, metabolic control, type of DM, DM duration, insulin treatment and the presence of chronic complications (DR, kidney disease, PVD and neuropathy).

The data of the factors that remained as significant after the adjustment are reported in Table 6.

4. DISCUSSION

This study provides a unique opportunity to assess HRQOL and DM self – care behaviours in a large sample of patients in daily clinical practice. This model of integrated care where the presence of several complications related to DM are evaluated in a single medical act, is kind of unusual so far, but really convenient for the patient.

It is important to note that more differences in HRQoL were found with the diabetes-specific questionnaire DQoL, as compared to the EQ-VAS. This is probably related to the fact that generic HRQoL questionnaires are less sensitive when evaluating specific aspects of the disease [8].

Table 3. Scores for quality-of-life questionnaires (EQ VAS and DQOL with 4 spheres) and the adherence questionnaire (SCI-r) according to age, BMI, type of diabetes and duration of diabetes, stratified by sex

		EQoL-VAS	Satisfaction	Impact	Social worry	Diabetes worry	Total DQoL	Adherence SCI-r
Age (years)								
Men								
≤ 45	97	68.7 ± 13.3	37.3 ± 10.9*	34.3 ± 9.6	14.5 ± 5.5*	9.0 ± 3.1	95.2 ± 23.8*	51 ± 8.7*
45-65	210	72.7 ± 12.3	37.0 ± 10.6	31.5 ± 9.4	11.5 ± 4	8.6 ± 3.6	88.6 ± 22.3	48.6 ± 7.6
> 65	255	72.1 ± 12.4	34.5 ± 10.7	31.1 ± 8.6	11.2 ± 4.4	8.2 ± 3.4	84.9 ± 20.4	52.2 ± 8.8
> 80	52	68.9 ± 10.4	34.7 ± 9.8	32.7 ± 8.1	10.9 ± 3.1	8.2 ± 2.3	86.5 ± 15.6	52.2 ± 7.1
Women								
≤ 45	66	69.6 ± 14.1	37.5 ± 9.1*	35.0 ± 9.1*	14.6 ± 5.1*	10.1 ± 3.2	95.2 ± 21.7*	53.1 ± 6.4
45-65	142	69.8 ± 13.9	36.8 ± 11.4	33.5 ± 12.3	13.1 ± 5.9	10.1 ± 4.1	93.5 ± 28.5	53.4 ± 9.8
> 65	268	68.3 ± 15.3	35.2 ± 9.7	31.4 ± 8.4	10.5 ± 3.5	8.8 ± 3.4	85.8 ± 19.1	52.2 ± 8.0
> 80	74	65.2 ± 17.9	34.6 ± 9.2	30.5 ± 8.0	10.3 ± 3.8	8.2 ± 3.0	83.5 ± 17	52.3 ± 7.0
BMI (Kg.m^{-2})								
Men								
≤ 25	118	72.0 ± 11.5	35.8 ± 10.6	31.9 ± 8.9	12.8 ± 5.6	8.6 ± 3.6	89.1 ± 22.8*	53.4 ± 7.6*
25-30	212	72.3 ± 12.0	35.5 ± 11.0	31.4 ± 9.5	11.3 ± 4.0	8.3 ± 3.1	86.5 ± 22.3	51.5 ± 9
30-35	205	71.0 ± 13.9	36.4 ± 10.8	32.1 ± 9.0	11.8 ± 5.0	8.5 ± 3.7	88.9 ± 21.3	49.5 ± 7.7
> 35	15	74.3 ± 17.5	35.5 ± 13.6	40 ± 18	12.4 ± 7.4	9.8 ± 5.7	93.6 ± 38.7	49.8 ± 4.7
Women								
≤ 25	100	69.8 ± 14.5	34.9 ± 10.9*	33.9 ± 11.2*	13.1 ± 5.8*	9.5 ± 3.5	91.4 ± 26.3*	53.9 ± 6.2
25-30	131	69.7 ± 13.9	35.3 ± 9.5	32.4 ± 9.9	11.7 ± 4.5	9.0 ± 3.3	88.4 ± 22.5	53.0 ± 6.5
30-35	205	67.9 ± 15.7	36.5 ± 10.3	32.0 ± 9.4	11.3 ± 4.4	9.6 ± 4.0	89.4 ± 21.8	51.9 ± 10.2
> 35	29	67.6 ± 19.5	38.9 ± 11.4	29.7 ± 9.8	11.3 ± 5.7	10.6 ± 4.7	93.9 ± 28.1	51.3 ± 6.6
Type of DM								
Men								
DM1	82	69.9±13.3	35.7±11	33.9±10.1*	14±5.6*	9.1±3.1	92.5±23.9*	53.6±7.6*
DM2	479	71.9±12.6	36.2±11.8	31±10.1	11±5.3	8.1±3.9	87.3±21.6	50.7±8.6
Women								
DM1	74	68.2±15.5	36.1±10.5	36.2±12.5*	15.4±6.2*	9.7±3.6	95.5±27.4*	54.4±6.2*
DM2	404	69±14.7	35.7±12.2	30.4±11	10.6±5.5	9.4±4.2	88.2±21.8	52.3±8.8

		EQoL-VAS	Satisfaction	Impact	Social worry	Diabetes worry	Total DQoL	Adherence SCI-r
Duration DM (years)								
Men								
< 5	83	72.4 ± 12.0	33.8 ± 10.4	28.6 ± 6.7*	11.6 ± 4.3	8.5 ± 3.5	82.6 ± 18.6*	50.7 ± 8.9*
5-15	211	71.4 ± 12.9	38.1 ± 10.6	32.4 ± 8.9	12.1 ± 5.0	8.4 ± 3.7	90.9 ± 21.6	49.7 ± 9.6
> 15	246	71.8 ± 12.8	35.0 ± 10.9	32.4 ± 9.9	11.8 ± 4.7	8.6 ± 3.2	87.8 ± 23.4	52.7 ± 8.2
Women								
< 5	58	70.4 ± 12.7	35.6 ± 10.7	30.2 ± 8.2*	11.4 ± 4.2	9.2 ± 3.4	86.4 ± 20.3*	52.0 ± 14.1*
5-15	181	68.2 ± 14.3	36.5 ± 10.2	32.3 ± 9.9	11.6 ± 4.7	9.2 ± 3.6	89.6 ± 22.1	51.3 ± 7.9
> 15	207	68.6 ± 16.2	35.0 ± 10.1	33.4 ± 10.6	12.0 ± 5.0	9.6 ± 3.7	90.1 ± 24.4	54.1 ± 6.7

*Data are expressed as Mean ± SDM. BMI: body mass index, EQ- VAS: Euro Quality of Life-Visual Analogue Scale, DQoL: Diabetes Quality of Life. Total DQOL is the summatory of the scores of the 4 subscales. SCI-r: Self Care Inventory revised. * p <0.05*

Table 4. Scores for quality-of-life questionnaires (EuroQoL EQ VAS and DQoL with 4 spheres) and for the adherence questionnaire (SCI-r) according to HbA1c, treatment for dyslipidemia or HT and insulin treatment, stratified by sex

		EQ-VAS	Satisfaction	Impact	Social worry	Diabetes worry	Total DQoL	Adherence SCI-r
HbA1c								
Men								
< 7.0	205	72.6 ± 12.7*	33.6 ± 9.9*	30.7 ± 8.3	11.5 ± 4.1	8.3 ± 3.5	84.1 ± 20.5*	51.3 ± 9.8
7.0-8.0	126	71.5 ± 12.8	36.2 ± 10.7	32.0 ± 8.2	11.6 ± 4.4	8.1 ± 3.1	87.8 ± 20.3	52.1 ± 7.6
> 8.0	195	70.9 ± 11.9	38.6 ± 10.7	32.9 ± 10.1	12.5 ± 5.7	9.1 ± 3.6	93.1 ± 23.2	50.7 ± 7.2
Women								
< 7.0	193	70.1 ± 14.4	34.4 ± 11.0*	31.0 ± 9.1*	11.2 ± 4.2*	8.8 ± 3.7	85.4 ± 21.8*	52.9 ± 9.4
7.0-8.0	110	69.1 ± 13.5	33.4 ± 8.9	30.9 ± 8.1	11.6 ± 4.0	9.0 ± 2.9	84.8 ± 18.0	53.6 ± 6.5
> 8.0	147	68.7 ± 15.3	38.8 ± 9.5	35.5 ± 11.2	12.9 ± 5.8	10.2 ± 3.8	97.5 ± 25.5	53.2 ± 8.5
Insulin								
Men								
Yes	251	72.1±11.6	35.4±11.1	32.9±11.2*	12.5±4.5	8.7±3.7	90.2±24.7*	53.1±6.9*
No	303	72.4±9	35.6±9.8	30.4±9.5*	11.8±4.4	8.4±3.9	86.2±19	50.3±5.6
Women								
Yes	221	70.9±11.8	35.8±9	34.5 ± 11.8*	12.9±5.2*	9.9±3.7	93.4±23*	53.6±5.5*
No	255	69.5±13	36.4±10.9	27.8 ± 9*	10.5±4*	8.9±4	85.7±21.9	50±6

		EQ-VAS	Satisfaction	Impact	Social worry	Diabetes worry	Total DQoL	Adherence SCI-r
Dyslipidemia								
Men								
Yes	355	72.3 ± 12.5	35.8 ± 10.6	31.3 ± 8.9	11.4 ± 4.4	8.4 ± 3.5	88.9 ± 21.3	50.9 ± 7.4
No	201	70.8 ± 13.3	36.4 ± 11.2	32.6 ± 9.6	12.5 ± 5.3	8.5 ± 3.5	90.1 ± 23.3	51.1 ± 8.5
Women								
Yes	324	68.8 ± 15.4	35.8 ± 10.9	32.4 ± 10.5	11.5 ± 4.7	9.3 ± 3.8	89.0 ± 24.1	52.6 ± 8.4
No	143	68.9 ± 13.8	35.5 ± 8.7	32.6 ± 9.0	12.5 ± 4.9	9.4 ± 3.3	89.9 ± 21.0	52.9 ± 8.6
HT								
Men								
Yes	336	71.7 ± 12.9	35.1 ± 10.5	31.1 ± 8.9*	11.3 ± 4.7	8.3 ± 3.6	88.8 ± 21.6	50.9 ± 8.6
No	211	71.6 ± 12.8	37.4 ± 11.2	33.2 ± 9.5	12.7 ± 4.9	8.7 ± 3.1	92.0 ± 22.5	51.0 ± 8.2
Women								
Yes	298	68.9 ± 15.2	35.9 ± 10.7	32.4 ± 9.8	11.4 ± 4.5	9.2 ± 3.7	89.0 ± 22.5	52.4 ± 8.0
No	163	68.8 ± 14.9	35.3 ± 9.5	32.7 ± 10.6	12.5 ± 5.3	9.4 ± 3.6	89.8 ± 24.4	53.2 ± 9.4

*Data are expressed as Mean ± SDM. EQ-VAS: Euro Quality of Life-Visual Analogue Scale, DQoL: Diabetes Quality of Life. Total DQoL is the summatory of the scores of the 4 subscales. SCI-R: Self Care Inventory Revised. HT :hypertension. * p <0.05*

Table 5. Scores for quality- of-life questionnaires (EuroQoL EQ-VAS and DQoL with 4 spheres) and for the adherence questionnaire (SCI-r) according to the presence of diabetic complications: diabetic neuropathy, diabetic retinopathy, kidney disease and peripheral vascular disease, stratified by sex

		EQ-VAS	Satisfaction	Impact	Social worry	Diabetes worry	Total DQoL	Adherence SCI-r
Neuropathy								
Men								
Yes	47	71.4 ± 11.0	35.4 ± 11.1	33.5 ± 11.2	11.5 ± 4.5	8.3 ± 3.3	88.7 ± 26.2	52.7 ± 14.5
No	506	71.8 ± 12.7	36.0 ± 10.7	31.7 ± 8.9	11.9 ± 4.8	8.5 ± 3.4	88.0 ± 21.5	51.0 ± 7.7
Women								
Yes	26	62.1 ± 17.3*	39.1 ± 10.7*	37.6 ± 13.9*	12.9 ± 7.4	10.5 ± 4.5	99.8 ± 32.8*	51.8 ± 5.5
No	446	69.3 ± 14.5*	35.5 ± 10.1*	32.2 ± 9.6*	11.8 ± 4.6	9.3 ± 3.6	88.8 ± 22.1	52.7 ± 8.5
Retinopathy								
Men								
Yes	131	69.8 ± 13.8*	37.2 ± 10.9*	33.9 ± 9.6*	12.4 ± 5.3	8.9 ± 3.4	92.4 ± 23.2*	53.15 ± 6.9*
No	348	72.6 ± 12.6	35.4 ± 10.7	31.1 ± 8.9	11.7 ± 4.5	8.3 ± 3.3	86.4 ± 21.5	50.7 ± 9.3

		EQ-VAS	Satisfaction	Impact	Social worry	Diabetes worry	Total DQoL	Adherence SCI-r
Women								
Yes	107	67.6 ± 14.6*	36.4 ± 10.0	34.6 ± 11.9*	12.5 ± 5.3	9.9 ± 3.9	93.3 ± 25.7*	53.1 ± 6.2
No	318	69.2 ± 15.6	35.6 ± 10.2	31.9 ± 8.9	11.6 ± 4.6	9.2 ± 3.6	88.4 ± 21.3	52.5 ± 9.3
GFR> 60 ml/min								
Men								
Yes	440	72.1 ± 12.1	36.1 ± 10.6	31.9 ± 9.2*	12.0 ± 5.0	8.6 ± 3.5	88.6 ± 22.3	51.1 ± 8.8
No	75	69.6 ± 13.1	36.6 ± 11.3	33.0 ± 8.9	11.1 ± 3.4	8.1 ± 2.7	88.8 ± 20.4	51.2 ± 6.2
Women								
Yes	340	69.2 ± 14,7*	36.0 ± 10.1*	32.9 ± 10.1*	12.1 ± 5.1*	9.4 ± 3.7	90.4 ± 23.6*	52.8 ± 9.0
No	93	64.9 ± 15	34.1 ± 10.6	30.9 ± 8.8	10.8 ± 3.9	9.0 ± 3.5	84.9 ± 20.6	52.5 ± 6.6
PVD (ABI)								
Men								
0.9-1.25	347	72.8 ± 8.4*	35.9 ± 11.3*	31.7 ± 9.5	12.1 ± 4.9	8.4 ± 3.5	88.2 ± 22.3*	51.3 ± 9.1
> 1.25	109	69.2 ± 13.3*	35.3 ± 9.2	31.9 ± 9.1	11.3 ± 4.5	8.4 ± 3.4	86.9 ± 20.8	50.7 ± 7.4
< 0.9	72	69.5 ± 13.0*	38.1 ± 10.8	32.2 ± 7.7	11.6 ± 4.6	8.6 ± 3.2	90.6 ± 18.8	49.9 ± 8.8
Women								
0.9-1.25	328	70.1 ± 14.3	35.5 ± 10.4	32.3 ± 9.6	12.0 ± 4.8	9.5 ± 3.7	89.3 ± 22.7	52.7 ± 8.5
> 1.25	72	69.6 ± 13.0	38.1 ± 10.8	32.2 ± 7.7	11.6 ± 4.6	8.6 ± 3.2	90.6 ± 18.8	49.9 ± 8.8
< 0.9	52	69.1 ± 11.4	35.5 ± 8.9	31.4 ± 8.6	11.2 ± 4.2	8.5 ± 3.4	86.6 ± 19.8	52.7 ± 11.8

*Data are expressed as Mean ± SDM. EQ-VAS: Euro Quality of Life - Visual Analogue Scale, DQoL: Diabetes Quality of Life. Total DQoL is the summatory of the scores of the 4 subscales. SCI-r: Self Care Inventory revised. GFR: glomerular filtration. PVD: peripheral vascular disease. ABI: ankle brachial index. * p <0.05*

Table 6. Demographic and clinical factors influencing on having a lower HRQoL (EQoL score < median and DQoL score > median) and a lower adherence (SCI-r < median) (multivariate regression analysis), stratified by sex

EQoL < median (worse HRQoL)
Women
Kidney disease OR 1,6 (CI 95% 1,03-2,5) (p = 0,035)
DQoL > median (worse HRQoL)
Men
Higher HbA1c OR 1,2 (CI 95% 1,01-1,3) (p = 0,025)
Diabetic retinopathy OR 1,6 (CI 95% 1,005-2,4) (p = 0,047).
Women
Higher HbA1c OR 1,39 (CI 95% 1,2-1,6) (P = 0,0001)
Age 65-79 years OR 0,49 (0,25-0,97) (p = 0,041)
Age > 80 years OR 0,39 (CI95% 0,18-0,86) (p= 0,019).
SCI-r < median (worse adherence)
Men
Age 45-65 years OR 2,7 (CI 95%1,3-5,7) (p = 0,008)
Obesity (IMC> 30kg/m2) OR 2,7 (CI 95% 1,6-4,8) (p = 0,001)
Diabetic retinopathy OR 0,56 (CI 95% 0,36-0,88) (p = 0,012)
Insulin treatment OR 0,64 (CI 95% 0,43-0,95) (p = 0,03)
Women
DM duration > 15 years OR 0,49 (CI 95% 0,32-0,77) (P = 0,002)
Insulin treatment OR 0,64 (CI95% 0,41-0,99) (p = 0,046)

Data are expressed by odds ratio (95 % CI) (p value). EQ-VAS: Euro Quality of Life-Visual Analogue Scale, DQoL: Diabetes Quality of Life. SCI-r: Self Care Inventory Revised.

The average score in the EQ-VAS in this report was 70.4. There is substantial diversity with other data previously published in DPts. A mean score of 58 was reported in a study in Iran [23] or 55 in Polish population [24], 67 in USA [25], 68 in Denmark [26], 74 in Japan [27] and in the ADDITION Europe Study (28) an average score of 75-78 was reported. The differences found could be related to different DM duration or prevalence of chronic complications or even due to socioeconomic differences between countries (the mean age of the individuals included in these studies was similar to the one in the present report, so this is not the cause of the disparity between countries). There is no doubt that a low socio - economic level negatively impact on HRQoL, so this could be one of the factors influencing on the difference found between the different populations [29-30]. Unfortunately, we do not have data about educational and economic aspects.

We could deduce from these data that DPts in Spain might have a better HRQoL compared to other countries, and also that the HRQoL is not as bad as expected (70 out of 100 points in EQ-VAS). In fact, when DM has been compared with other chronic illnesses, patients with heart disease and gastrointestinal disorders had a greater impact than DPts [31].

Regarding to the influence of different demographic factors, it is well known that sex is an important one when reporting HRQoL. Women reported a lower HRQoL, which is consistent with previous publications [3,4,9]. In the 4 spheres evaluated in the DQoL, women reported more DM concern than men. This finding is at least partly consistent with the original DQoL evaluation that found two significant associations with sex: women reported DQoL scores reflecting a higher impact of DM and more DM-related worries [19]. The cause for these differences it is not completely elucidated. It could be related to the fact that women with DM are at greater risk of developing coronary artery disease, hypertension and experiencing symptoms of hyperglycaemia compared with men with DM [32]. Another possible explanation could be the presence of higher levels of depression and anxiety among women [33] or perhaps related to the different roles occupied by women in the workplace, at home and in the care of their children [34].

This needs to be researched more carefully to provide recommendations to clinical practice for additional support for women with DM.

In the present study aging was not associated with a negative impact on HRQoL. An age > 65

years old in women remains as a significant factor related to a higher HRQoL in the multivariate analyses. This was an unexpected finding, as the vast majority of studies report lower HRQoL in the elderly [3,4]. However, older age is usually associated with physical problems, but it is not necessarily related to deterioration in mental health. In a study in Spanish population [9] using the SF 12 questionnaire, a stabilization or a slight improvement in mental scales was shown in the elderly. Our current study includes a population with a wide age range, and also displays data in very elderly subjects (>80 years old), indicating a smaller affectation of HRQoL in the spheres of impact, social worry and DM worry.

One possible explanation for this finding could be that the prospect of disease progression can be more stressful for young patients, with older patients having a greater acceptance of their condition and more passive coping strategies [35]. In a Dutch study [26], older age was usually associated with a greater frequency of problems, but younger patients reported problems with anxiety/depression more often than older patients.

However, it is important to highlight that DQoL could be less suitable for evaluating differences in the elderly. In the sphere of social worry, questions about marriage, children, work and education are asked, areas that probably detect stress in younger patients more than in patients of advanced age. A fundamental concern with the use of the DQoL is that the questionnaire does not allow respondents to indicate the applicability or relative importance of domains to the individual [8], although it has been tested and validated for DM2 and it is an instrument widely used [36]. Nevertheless, we should interpret these results with caution.

The effect of obesity in HRQoL is complex. Some suggest that the relationship may differ for physical and mental HRQoL. Previous studies have associated obesity with deteriorated physical function but have been inconclusive as regards mental health [37,38]. Descriptive data from this study show that overweight people and mildly obese patients reported a higher HRQoL with the DQoL questionnaire than the group with normal weight or moderate-severe obesity, thus indicating less impact of the DM and less social worry. In fact, patients reporting the highest quality of life in the DQoL were the ones who were overweight. Nonetheless, the group with obesity II reported lower QoL than any other group. Data from several studies have been published suggesting improved HRQoL in elderly who are overweight and moderately obese especially in the mental domain quality of life [39-41]. A meta-analysis [40] found that mental quality of life was significantly reduced among the class III obese, but was not significantly different among obese (class I and class II) individuals, and was significantly increased among overweight adults. A cross-sectional study of 3,605 individuals conducted in Spain [39] to examine the correlation between body weight and HRQoL in the population aged 60 and over found that, compared with normal weight participants, obesity is correlated with higher HRQoL on the SF-36 mental scales. This has been called the "obesity-HRQoL paradox". It could be explained by early detection of disease or early initiation of treatments in this group of patients, or by lack of a proper definition of obesity in the elderly population [40]. Despite the effect of obesity observed in the descriptive analysis, it did not remain as a significant determinant in HRQoL in the multivariate analysis, after adjusting for different confounders.

In addition to the evaluation of general demographic and clinical factors, an assessment of the influence of specific aspects of DM was made.

Previous studies examining the relationship between glycemic control and HRQoL have reported inconsistent findings. According to our data, a worse metabolic control of the DM remained as a significant factor related with a lower HRQoL in both sexes, associated with a higher impact, a higher social concern and less satisfaction. In an extensive review, Rubin and Peyrot [3] reported that a better glycemic control was associated with a higher HRQoL. However, conflicting data have been published, as such relationship was not found i.e. by Redekop et al, when they controlled for other factors in multivariate analysis [26]. Among DCCT/EDIC participants, worsening metabolic control decreased HRQoL [42]. It seems logical that a better metabolic control produces greater satisfaction and a decrease in anxiety resulting in a higher HRQoL. Rubin and Peyrot [3] suggested that there was more likely to find an association if questionnaires used specific for DM, whereas generic instruments were less sensitive for this purpose.

Regarding the effects of treatment, we found that insulin therapy increased the probability of presenting a lower HRQoL when using DQoL, showing a higher impact in men and women, and also more social worry in women. No differences in the generic EQ-VAS were found between both groups, probably due to a lower sensitivity of this questionnaire for detecting differences in specific treatments for diseases. However, after adjusting for several confounders, insulin treatment was not one of the principal modifiers of the illness. Previous studies have not been able to show clear results regarding the relationship between type of therapy for DM and QoL [43-44]. A study previously published in the Spanish population found a lower HRQoL in the insulin-treated group [9]. Jacobson [36] reported the lowest levels of satisfaction and greatest impact for patients with insulin when compared with those on oral antidiabetic drugs or on diet alone. The association of insulin therapy with a lower HRQoL, rather than a consequence of its subcutaneous administration, could be related to greater self-care demands. This could be related to increased anxiety generated by a perception in the patient of a more serious disease and a worse prognosis when treated with insulin. Insulin therapy could be particularly stressful for patients inadequately trained in diet and exercise-related skills. Some studies have shown that patient satisfaction with treatment usually improves upon switching to insulin [45]. There are many other perceived benefits of insulin treatment that can lead to improvements in satisfaction with treatment (i.e. increased flexibility) [44]. Thus, education, self-management programs and support may benefit the HRQoL in patients with DM. Patients with higher baseline levels of anxiety, higher levels of DM-related distress and higher baseline levels of HbA_{1c} are most likely to experience HRQoL gain from participation in self-management programs such as DAFNE [46] or the Saint Carlos Study [47].

Regarding to the type of DM and HRQoL, no differences were found with the generic instrument EQoL-VAS between DM 1 and DM 2. However, patients with DM 2 reported higher HRQoL than patients with DM 1, showing less impact of DM and fewer social worries, when DQoL was used. This finding could be related to the age difference between both groups (65 vs 40 years old, DM 2 vs DM 1 respectively) and the lack of applicability of some items of the DQoL for older people, as it has been previously discussed (i.e if a 65 years old patient is questioned about his worry related to having children or getting a job, probably he is going to get a better punctuation on that item than a 40 years old patient, because he is probably not worried about that issue at all).

In addition, the different type of DM did not remain as a significant variable influencing on HRQoL in the multiple analysis. In the literature, differences between HRQoL and the two types of DM have not been thoroughly studied and the results are conflicting. Jacobson [36] reported higher HRQL in DM 2 patients after adjusting for several factors. Another study compared levels of three HRQL measures comparing DPts with DM 1 and DM 2 and found no differences in EQ-5D and QoL-DN scores between the two samples, but a higher SF 36 score in the DM 2 group [48].

Finally, the presence of diabetic complications was one of the factors with the highest adverse impact on HRQoL, showing women with kidney disease and men with retinopathy a lower QoL (OR 1.6 for both complications). Consistent data with these findings have been published previously [26,49]. In the prospective study DCCT/EDIC, retinopathy, neuropathy, and nephropathy, and their associated symptoms led to decrease HRQoL, exerting a stronger effect on HRQoL than DM management approaches [42].

Regarding to treatment adherence, a greater degree of adhesion was seen in women, especially those ones with a longer duration of DM (> 15 years).

The DIABASIS study evidenced clear sex differences in the perception and self-management of disease. Women took the disease more seriously, reported a higher impact on daily life and were more involved in self-management, while men relied more on family support [50]. These differences in attitudes should be taken into account when counseling and treating patients.

In accordance with previous studies, middle age men showed a worse adherence compared to older patients. These might be mediated by a perceived lower seriousness of the DM or a lower susceptibility to complications in the younger DPts [51]. This may lead many individuals to a lack of understanding about the importance of DM self-care [52].

A lesser degree of adherence to treatment was seen in obese men in the multivariate analysis. Worse adherence was observed for questions of the SCI-r related to diet and exercise (data not shown in descriptive analysis). However, it is noteworthy that obese patients had a good self-care management in the rest of items that are not related to weight. These results are consistent with data previously published [53].

Higher adherence has been previously reported in patients with a prolonged evolution of the DM [54]. It may be related to the fact that these individuals have had more time to adapt positively to life with DM and have had a greater number of contacts with the professional health care system, with more opportunities for DM education.

It is noteworthy that insulin treatment was consistently associated with a higher adherence in both sexes, probably related with a higher severity of the DM perceived. In addition, DPts treated with insulin are more likely to suffer from symptomatology of hyper o hypoglycemia in case of a poor compliance of recommended self-care behaviors.

In a similar way, patients suffering from diabetic retinopathy reported a higher adherence, presumably related to a greater realism about health status and fear of developing more serious DM complications and comorbidities.

5. LIMITATIONS AND STRENGTHS

Several limitations of this study should be considered when these results are interpreted. First of all, the data are cross-sectional, so causal associations between DM characteristics and HRQoL in DPts cannot be assured.

Unfortunately, we did not assess other complications of DM, such as heart disease or stroke that could exert an important influence on HRQoL, and consequently modify the results.

Another problem could be that we have used self-report measures for the evaluation of self-care behaviors that may be subject to some social desirability bias, so it is possible that adherence to treatment might have been overestimated.

Despite these limitations, this study provides valuable information and several important implications to clinical practice. The principal strength of this study includes its real-world setting and the large and unselected study sample with a wide range of ages represented. Identifying sub groups of individuals with the lowest HRQoL and adherence to treatment it may be useful for designing appropriate intervention programs.

6. CONCLUSION AND IMPLICATIONS FOR RESEARCH AND PRACTICE

In conclusion, DM is one of the most demanding long-term conditions and the preservation of HRQoL represents an important therapeutic goal. Evaluating HRQoL is complex as there are many factors that influence and might bias the results. An accurate selection of the questionnaire is of crucial importance, as the results will vary depending on the use of a generic questionnaire or a specific one for the illness.

In the future, women, younger DPts with chronic complications and a worse metabolic control would need additional support to improve their wellbeing, as they are the ones with a lower HRQoL.

In addition, middle age obese men without insulin treatment should be targeted to improve DM self-care behaviours through educational and informational materials.

This study has important implications for current policies and programs that are designed to enhance the quality of chronic diseases management.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/16054