ORIGINAL RESEARCH

Relationship between chronic complications, hypertension, and health-related quality of life in Portuguese patients with type 2 diabetes

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Background: The aim of this study was to assess the relationship between health-related quality of life (HRQoL) and the presence or absence of hypertension and diabetes-related chronic complications in type 2 diabetes, and also the association between HRQoL and the number of chronic complications.

Methods: One hundred patients with type 2 diabetes were interviewed. HRQoL was evaluated using the age-adjusted Short-Form 36 dimensions (physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health).

Results: The mean age of the study population was 62.7±8.7 years; 54.0% were male, and 51.0% were receiving only oral hypoglycemic agents. Chronic complications were related to worse HRQoL in different dimensions: peripheral neuropathy and cardiovascular disease (all, except bodily pain), retinopathy (physical functioning, general health, vitality, and mental health), peripheral arterial disease (physical functioning, role-physical, and general health), and nephropathy (general health and vitality). Hypertension was related to worse general health and vitality. An increased number of chronic complications was associated with worse HRQoL in all dimensions of Short-Form 36 except for the bodily pain dimension.

Conclusion: The presence and increased number of diabetes-related chronic complications, and the presence of hypertension were related to worse age-adjusted HRQoL. Peripheral neuropathy and cardiovascular disease were more strongly related to age-adjusted HRQoL.

Keywords: retinopathy, nephropathy, peripheral neuropathy, cardiovascular disease, peripheral arterial disease

Introduction

Health-related quality of life (HRQoL) is a subjective assessment of the patient[1] that is related to the perception of their health,[1–4] well-being, and functioning,[1] and also to their worries about the future.[4] Although the term HRQoL is not yet precisely defined,[5] it is a useful measure to assess the overall impact of a particular nosological entity in patient,[2] and it complements the clinical information.[3,6] There are several generic tools that can be used to assess HRQoL; they can be used not only in the healthy population but also in specific populations[4] because they allow to assess a wide set of important dimensions that can be used in different diseases.[4,6–8] Wilson and Cleary[9] propose a conceptual model to explain the relationships between clinical variables and measures of HRQoL in order to establish the connection between diagnosis and therapy and, thus, to increase patients' HRQoL. This classification is divided into five levels – biological and physiological factors, symptoms, functioning, general health perceptions, and overall quality of life – and proposes causal relationships between all of them.

With regard to the relationship between HRQoL, the presence of hypertension (HTN), and diabetes-related chronic complications, the literature is not consistent in pointing out that their presence decreases HRQoL and, hence, the importance of evaluating the relationship between these variables and HRQoL. Moreover, as far as we know, the only two researches carried out in Portugal[5,10] that have assessed the relationship between the most frequent chronic complications of diabetes and HRQoL did not make the adjustment of the HRQoL scores for any demographic and/or clinical variables that can mediate some of these relationships. On the other hand, the study sample of these two studies was quite heterogeneous – they evaluated simultaneously type 1 and type 2 diabetic patients – and did not assess chronic complications according to diabetes type. Lastly, the investigations that evaluated the relationship between the number of diabetes-related chronic complications and HRQoL did not make stratified analyses according to sex that can bring important supplemental information to the one achieved for the whole sample.

Concerning microvascular complications of diabetes, while some studies[10–12] have found that the presence of diabetic retinopathy was related to worse HRQoL, Sakamaki et al[13] found no relationship between the two variables. Results of research on the relationship between diabetic nephropathy and HRQoL have found, on one hand, that its presence was related to lower HRQoL[10,11] and, on the other hand, no relationship between both variables.[13] Concerning the relationship between diabetic neuropathy and HRQoL, while Sakamaki et al[13] found no relationship between the two variables, some studies[10,14–17] have found that its presence was related to worse HRQoL.

As far as diabetes-related macrovascular complications are concerned, although there is evidence that the presence of cardiovascular disease (CVD) in persons with diabetes was related to lower HRQoL,[5,10,12,14–16,18–22] Wasem et al[17] found no relationship between the two variables. Regarding the relationship between the presence of peripheral arterial disease (PAD) and HRQoL, Silva et al,[5] Neves et al,[10] Javanbakht et al,[11] and Quah et al[16] have shown that patients with this chronic complication had worse HRQoL, whereas Sakamaki et al[13] and Wasem et al[17] found no relationship between the two variables, and Venkataraman et al[22] reported that its presence was related to better HRQoL.

Regarding the relationship between HTN and diabetes, while some studies[5,10,23,24] have found that the presence of HTN was related to lower HRQoL, Wexler et al[20] and Hill-Briggs et al[25] reported no relationship between the two variables.

Finally, some researchers, looking at the relationship between the number of diabetes-related chronic complications and HRQoL, have found that an increased number of complications was related to worse HRQoL.[16,26] However, Caldwell et al[27] did not find a relationship between the two variables.

The aim of this cross-sectional study was to assess the relationship between HRQoL, the presence or absence of HTN, and diabetes-related micro- and macrovascular complications in type 2 diabetes, as well as the association between HRQoL and the number of chronic complications, for the whole sample and by sex. We focused on the assessment of HTN and long-term complications on HRQoL in type 2 diabetic patients for three reasons: first, because HTN is a highly prevalent comorbidity in these individuals; second, because it is highly associated with diabetes-related chronic complications; and third, because it can have a negative association with HRQoL.

Subjects and methods
Study design and participants
A consecutive sample of 100 type 2 diabetic patients from the Outpatient Department of Endocrinology, Diabetes and Metabolism, Centro Hospitalar São João, Porto, Portugal, was recruited. Patients were included in the study if they had a diagnosis of type 2 diabetes, were at least 18 years old, and were not currently pregnant. The protocol for the study was approved by the Ethics Committee for Health of Centro Hospitalar São João, and informed consent was obtained from all participants before participating in the study.

Demographic and clinical data were collected based on medical records. General HRQoL was assessed by the Portuguese version of the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36),[28,29] and it was administered by one of the researchers.

Clinical outcomes
We evaluated the presence of some clinical variables that are reported in the literature to be related to HRQoL among type 2 diabetes;[5,10–12,14–24,26] these factors included microvascular complications, macrovascular complications, and HTN.

Type 2 diabetic patients were classified as on "oral hypoglycemic agents" or "insulin therapy" (the latter including patients only on insulin therapy or on oral hypoglycemic agents plus insulin therapy). Duration of diabetes was categorized as "<10 years", "10–19 years", or "20 years or more".

Microvascular complications considered were diabetic retinopathy, diabetic nephropathy, and diabetic peripheral neuropathy; macrovascular complications were CVD and PAD.

We considered that the patients had retinopathy if they had at least microaneurysms, nephropathy if they had at least albumin excretion rate higher than 30 mg/g creatinine, peripheral neuropathy if they had two or more insensate sites across two feet for the 10 g monofilament or one or more insensate sites for the 128 Hz tuning fork. CVD was defined by the presence of at least one of the following conditions: angina pectoris or acute myocardial infarction or transient ischemic attack or stroke; and PAD was defined as an ankle-brachial index of ≤0.9 or a prior history of lower extremity revascularization.

HTN was defined by one of the following: systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg or current use of antihypertensive agents or documented diagnosis of HTN.

HRQoL measurement tool

The SF-36 Healthy Survey comprises 36 items covering functional health status and general health, currently and over the past 4 weeks, and measures eight dimensions: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health. Raw dimension scores were transformed to scales ranging from 0 to 100, in which higher scores indicate higher HRQoL.

Data analysis

Statistical Package for the Social Sciences version 20.0 for Windows software (IBM Corporation, Armonk, NY, USA) was used for the analysis. Descriptive statistical analysis included calculation of means and standard deviations for cardinal variables, and frequencies for ordinal and nominal variables. Independent samples t-tests were used to compare means of independent samples. The degree of association between pairs of variables was measured by Pearson's (r) or Spearman's (r_s) correlation coefficients. Relationships were considered to be statistically significant at $P<0.05$.

As there were age-discrepancies within the sample (minimum age of 44 years old, and maximum age of 80 years old), we adjusted SF-36 results to the age of the participants; therefore, all other variables were related to the residuals of simple linear regression models having each dimension as a dependent variable and age as the independent variable.

Results

Demographic and diabetes-related data are presented in Table 1. We interviewed 100 patients with type 2 diabetes aged 44–80 years. Most patients were male, were receiving only oral hypoglycemic agents, and had the disease for <10 years. Only 21.0% of the patients did not have chronic complications related to diabetes. Among the chronic

Table 1 Demographic and clinical characteristics of type 2 diabetic patients

Sex, n (%)	
Male	54 (54.0)
Female	46 (46.0)
Age (years), mean (SD)	62.7 (8.7)
Treatment groups of type 2 diabetes, n (%)	
Without insulin therapy	51 (51.0)
With insulin therapy	49 (49.0)
Duration of diabetes (years), n (%)	
<10	42 (42.0)
10–19	32 (32.0)
≥20	26 (26.0)
Microvascular complications, n (%)	
Retinopathy	51 (51.0)
Nephropathy	27 (27.0)
Peripheral neuropathy	39 (39.0)
Macrovascular complications, n (%)	
Cardiovascular disease	47 (47.0)
Peripheral arterial disease	32 (32.0)
Hypertension, n (%)	52 (52.0)

Abbreviation: SD, standard deviation.

complications considered, the most prevalent was diabetic retinopathy, followed by CVD.

The average values obtained by patients in the eight dimensions of the SF-36, as well as the association between these scores and age are shown in Table 2. There was no association between age and any of the eight dimensions of the SF-36.

The age-adjusted scores of HRQoL by the presence or absence of each of the microvascular complications of diabetes are shown in Table 3, macrovascular complications of diabetes in Table 4, and HTN in Table 5. There was an overall tendency for the presence of each of the chronic complications and HTN to be related to worse HRQoL in all dimensions of SF-36, regardless of age; the only exception was the dimension role-physical in diabetic nephropathy.

The complications related to larger number of dimensions were peripheral neuropathy and CVD (all dimensions except

Table 2 Health-related quality of life in patients with type 2 diabetes and its association with age

SF-36 dimensions	Percent Mean (SD)	Association with age r (P-value)
Physical functioning	30.0 (32.6)	−0.170 (0.092)
Role-physical	31.3 (46.0)	−0.127 (0.208)
Bodily pain	38.1 (32.5)	0.093 (0.358)
General health	44.0 (17.9)	0.080 (0.428)
Vitality	42.2 (26.1)	−0.078 (0.440)
Social functioning	51.4 (26.8)	−0.006 (0.952)
Role-emotional	52.7 (49.3)	−0.061 (0.544)
Mental health	47.9 (24.5)	0.012 (0.909)

Note: r, Pearson's correlation coefficient.
Abbreviations: SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey; SD, standard deviation.

Table 3 Health-related quality of life in patients with type 2 diabetes and microvascular complications

SF-36 dimensions (adjusted for age)	Microvascular complications								
	Retinopathy			Nephropathy			Peripheral neuropathy		
	No Mean (SD)	Yes Mean (SD)	P-value	No Mean (SD)	Yes Mean (SD)	P-value	No Mean (SD)	Yes Mean (SD)	P-value
Physical functioning	10.9 (33.8)	−10.5 (26.9)	<0.001	3.2 (33.8)	−8.7 (25.8)	0.064	8.3 (34.0)	−13.0 (24.2)	<0.001
Role-physical	7.8 (48.3)	−7.5 (42.0)	0.094	−2.3 (44.3)	6.2 (49.3)	0.409	10.0 (48.6)	−15.6 (35.7)	0.003
Bodily pain	0.1 (30.5)	−0.1 (34.3)	0.968	1.4 (32.4)	−3.7 (32.6)	0.495	4.7 (32.8)	−7.4 (30.6)	0.068
General health	7.4 (14.3)	−7.1 (18.2)	<0.001	2.4 (17.9)	−6.6 (16.4)	0.024	3.1 (17.4)	−4.9 (17.8)	0.028
Vitality	9.1 (24.5)	−8.7 (24.5)	<0.001	3.5 (25.2)	−9.4 (26.3)	0.028	6.4 (24.5)	−10.1 (25.4)	0.002
Social functioning	5.3 (26.4)	−5.1 (26.4)	0.053	1.4 (26.7)	−3.7 (27.1)	0.403	5.8 (25.0)	−9.1 (27.1)	0.006
Role-emotional	9.4 (47.4)	−9.0 (49.7)	0.061	1.3 (48.9)	−3.5 (50.8)	0.664	9.4 (48.6)	−14.7 (47.1)	0.016
Mental health	7.7 (22.0)	−7.4 (24.8)	0.002	0.7 (22.2)	−1.8 (30.3)	0.698	5.6 (23.2)	−8.8 (24.2)	0.004

Abbreviations: SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey; SD, standard deviation.

bodily pain). In type 2 diabetic patients with retinopathy, PAD, and nephropathy, the HRQoL only differed on four, three, and two dimensions, respectively – retinopathy (physical functioning, general health, vitality, and mental health), PAD (physical functioning, role-physical, and general health), and nephropathy (general health and vitality). HTN was related to worse HRQoL in terms of general health and vitality. The most related dimensions to worse HRQoL were general health and vitality; the general health dimension was lower in patients with any of the long-term complications and HTN, whereas the vitality dimension was lower in HTN and all diabetes-related complications with the exception of PAD. On the other hand, the bodily pain was the dimension least related to HRQoL because it was not related to any of these variables.

The association between HRQoL and the number of chronic complications for the whole sample and by sex are shown in Table 6. An increased number of long-term complications tended to be associated with worse HRQoL in all dimensions of SF-36, regardless of age; the only exceptions were the bodily pain dimension in males and the

role-emotional dimension in females. This association reached statistical significance in all dimensions with the exception of bodily pain in the total sample, all except bodily pain and social functioning in men, and only in general health, vitality, and mental health dimensions in women. In men, the most associated dimension of HRQoL with the number of chronic complications was physical functioning, followed by general health, and then by role-physical. In women, the most associated dimensions with the number of complications were general health, followed by vitality. The dimensions physical functioning, role-physical, and role-emotional were only associated with the number of complications in males.

Discussion

The presence of diabetes-related chronic complications and HTN, as well as the number of complications were related to worse HRQoL regardless of age, with the different conditions being related to different dimensions of HRQoL. The adjustment of SF-36 scores for age may obscure relationships between diabetes-related complications, HTN, and

Table 4 Health-related quality of life in patients with type 2 diabetes and macrovascular complications

SF-36 dimensions (adjusted for age)	Macrovascular complications					
	Cardiovascular disease			Peripheral arterial disease		
	No Mean (SD)	Yes Mean (SD)	P-value	No Mean (SD)	Yes Mean (SD)	P-value
Physical functioning	8.9 (35.1)	−10.0 (25.4)	0.003	5.5 (33.7)	−11.7 (25.3)	0.006
Role-physical	11.5 (48.4)	−13.0 (38.7)	0.006	8.3 (48.1)	−17.7 (34.1)	0.003
Bodily pain	3.6 (36.4)	−4.0 (26.9)	0.235	1.6 (35.1)	−3.5 (25.7)	0.412
General health	5.7 (16.8)	−6.5 (17.0)	<0.001	2.5 (17.8)	−5.3 (17.1)	0.040
Vitality	5.2 (26.5)	−5.8 (24.4)	0.034	1.7 (25.8)	−3.6 (26.5)	0.343
Social functioning	6.2 (24.7)	−6.9 (27.6)	0.014	2.7 (26.3)	−5.7 (27.3)	0.147
Role-emotional	9.3 (47.7)	−10.4 (49.2)	0.045	1.7 (49.2)	−3.6 (49.7)	0.622
Mental health	5.8 (25.1)	−6.5 (22.4)	0.012	3.0 (25.6)	−6.3 (21.1)	0.078

Abbreviations: SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey; SD, standard deviation.

Table 5 Health-related quality of life in patients with type 2 diabetes and hypertension

SF-36 dimensions (adjusted for age)	Hypertension		
	No Mean (SD)	**Yes** Mean (SD)	**P-value**
Physical functioning	5.4 (34.0)	−5.0 (29.8)	0.111
Role-physical	0.5 (46.1)	−0.4 (45.6)	0.920
Bodily pain	4.2 (33.6)	−3.9 (31.0)	0.209
General health	6.3 (17.9)	−5.8 (15.9)	<0.001
Vitality	8.3 (28.5)	−7.7 (20.9)	0.002
Social functioning	3.5 (28.6)	−3.3 (24.8)	0.205
Role-emotional	3.0 (49.8)	−2.8 (49.0)	0.558
Mental health	4.0 (27.2)	−3.7 (21.4)	0.125

Abbreviations: SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey; SD, standard deviation.

HRQoL dimensions that strongly depend on a concomitant relationship with age. Thereby, absolute scores on the SF-36 and their relationship with long-term complications and HTN may have clinical usefulness, but to analyze their association with HRQoL, which was our intention, it is recommended that values are adjusted for age if there are significant age-discrepancies within the sample.

Regarding the relationship between the presence of retinopathy and HRQoL, we found that having retinopathy was related to lower HRQoL in terms of physical functioning, general health, vitality, and mental health. Our results partially overlap with the findings of Neves et al[10] for three reasons: first, these Portuguese researchers have found that the diabetic patients with retinopathy had worse HRQoL than those without retinopathy in all SF-36 dimensions; second, because in that study the authors included in their analysis

Table 6 Health-related quality of life and association with number of diabetes-related chronic complications

SF-36 dimensions (adjusted for age)	Association with number of chronic complications		
	Total r_s (**P-value**)	**Male** r_s (**P-value**)	**Female** r_s (**P-value**)
Physical functioning	−0.428 (<0.001)	−0.542 (<0.001)	−0.190 (0.206)
Role-physical	−0.277 (0.005)	−0.427 (0.001)	−0.054 (0.722)
Bodily pain	−0.124 (0.221)	0.043 (0.759)	−0.262 (0.079)
General health	−0.470 (<0.001)	−0.465 (<0.001)	−0.431 (0.003)
Vitality	−0.421 (<0.001)	−0.353 (0.009)	−0.424 (0.003)
Social functioning	−0.254 (0.011)	−0.222 (0.107)	−0.217 (0.148)
Role-emotional	−0.231 (0.021)	−0.332 (0.014)	0.077 (0.611)
Mental health	−0.374 (<0.001)	−0.375 (0.005)	−0.352 (0.017)

Note: r_s, Spearman's correlation coefficient.
Abbreviation: SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey.

a quite heterogeneous sample (ie, type 1 and type 2 diabetic patients), whereas we included a less heterogeneous one; and third, because they did not make the adjustment of the HRQoL scores for age. Conversely, a cross-sectional study[13] and a longitudinal study[30] have found no relationship between the two variables. Contrary to what we expected, which was a reduced HRQoL in both physical and mental component scores of the SF-36, we found that diabetic retinopathy appears to have a greater relationship with the physical component than the mental one.

Our results showed that the presence of nephropathy was related to worse HRQoL in terms of general health and vitality. These results are partially in agreement with the findings of Neves et al,[10] because these authors reported that its presence was related to lower HRQoL in all dimensions of SF-36. However, as mentioned earlier, the study of Neves et al[10] has methodological limitations that might have compromised the results. In contrast, two studies[13,30] reported no relationship between the presence of nephropathy and HRQoL. Surprisingly, we did not find differences between the two groups in the other dimensions of the SF-36, particularly in terms of mental component.

We found that the presence of peripheral neuropathy was related to worse HRQoL in all dimensions of SF-36 with the exception of the bodily pain dimension. These results are different from those obtained in another study,[13] which did not find a relationship between peripheral neuropathy and HRQoL. Our results are consistent with the findings of Neves et al,[10] given that in that study it was found that the presence of neuropathy was related to lower HRQoL in all dimensions of SF-36, and partially overlapping with the results of other investigations.[15,16] In the first study it was reported that having neuropathy was related to worse HRQoL in terms of physical functioning and bodily pain dimensions of SF-36, while in the latter one it was found that the presence of peripheral neuropathy was related to lower HRQoL in terms of physical and mental components of the aforementioned tool.

Concerning the relationship between the presence of CVD and HRQoL, Wasem et al[17] reported no relationship between the two variables, whereas we found worse HRQoL in patients with CVD in all dimensions of SF-36 with the exception of bodily pain dimension when comparing with those that did not have the disease. These findings are partially in agreement with the results of four cross-sectional studies[5,10,15,22] because in those studies, the presence of CVD was related to lower HRQoL in terms of physical functioning, general health,[5,10,15,22] role-physical,[5,10,22] bodily pain, vitality,[5,10,15] social functioning,[15] and physical component.[15,22] On the other hand, our findings

are also partially in accordance with the results of two longitudinal studies,[30,31] which found that the presence of CVD was related to worse physical functioning, general health, vitality, mental component,[30] and physical component.[30,31] Our results and those obtained in those studies suggest that CVD causes physical and emotional constraints in patients with diabetes. With regard to physical impairments, it appears that HRQoL and life expectancy of these patients are more reduced, given that CVD is the major cause of death in both diabetic males and females.[32] Thereby, it is not surprising that these patients become physically more limited, and, consequently, end up becoming psychologically more vulnerable.

Regarding PAD and its relationship with HRQoL, Sakamaki et al[13] and Wasem et al[17] found no relation between the two variables, and surprisingly, Venkataraman et al[22] reported that patients with PAD had better HRQoL in terms of physical functioning, role-physical, and physical component than those without PAD. Conversely, we found that PAD was related to worse HRQoL in terms of physical functioning, role-physical, and general health. Our results are partially in agreement with the findings of Silva et al[5] and Neves et al,[10] because it was found that its presence was related to worse HRQoL in terms of physical functioning, bodily pain, vitality,[5,10] role-physical, general health, social functioning, role-emotional, and mental health.[10] However, it is worth noting that these studies[5,10] have methodological limitations that might have jeopardized the results, namely, the inclusion of type 1 and type 2 diabetes, and the non-adjustment of the HRQoL scores for age. As with diabetic retinopathy and nephropathy, PAD had a greater relationship with the physical component than with the mental one.

Although Wexler et al[20] and Hill-Briggs et al[25] have found no relationship between the presence of HTN and HRQoL, in this study HTN was related to worse HRQoL in terms of general health and vitality. These findings are partially in agreement with the results of prior studies[5,10,23,24] – the presence of HTN was related to lower HRQoL in terms of physical functioning, role-physical, bodily pain,[5,10] general health,[5,10,23] vitality, social functioning, mental health,[10,24] role-emotional,[10] and mental component.[24] These differences between the two groups may possibly be explained by its frequent association with cardiac, cerebrovascular, renal, and ocular complications. Isolated HTN (except hypertensive crisis) is usually asymptomatic, and it is through predisposition to associated diseases that eventually may help to explain the worse HRQoL of the hypertensive patients. On the other hand, various items of the SF-36 are somewhat similar to some symptoms of hypotension and hypoglycemia and, thus, may have contributed to this worse HRQoL in the hypertensive patients.

With regard to the relationship between the number of diabetes-related chronic complications and HRQoL, while Caldwell et al[27] reported no relationship between the two variables, we found that an increased number of complications was associated with worse HRQoL in all dimensions of SF-36 with the exception of bodily pain dimension. These findings are partially in agreement with the results of two cross-sectional studies.[16,26] In the first study, it was found that a higher number of chronic complications was related to worse HRQoL in terms of physical and mental component, whereas in the latter investigation, an increased number of long-term complications was related to worse HRQoL in terms of physical functioning, role-physical, role-emotional, social functioning, and mental health. On the other hand, our results are partially consistent with the findings of a longitudinal study[33] that have found that an increased number of complications predicted lower HRQoL in terms of physical and mental components. In the present study, the existence of higher number of diabetes-related complications suggests a set of physical, emotional, and social constraints, which result from the emergence of new symptoms, the intensification of the treatment regimen, and a feeling of frustration, anger, and failure after the worsening of diabetes. We also found relevant differences between sexes. Different HRQoL dimensions were more strongly associated with the number of chronic complications in male and female patients.

Some differences in the results between this study and others may be explained by the different generic tools used to assess HRQoL that do not measure exactly the same dimensions.

Several limitations of this study should be considered when interpreting its results. The results would be more robust with a larger sample. This would also allow multivariate analysis, thus decreasing the confounder effect of the remaining variables. Multiple testing also must be considered, as it increases the occurrence of statistically significant results; however, the comparison of our results with prior studies enhances their adequate interpretation despite this limitation. Furthermore, most of the patients interviewed were of low sociocultural status, which may have limited their understanding of the questions in the instrument used to assess HRQoL. Generalization of our findings may be limited because our sample was collected in a central public hospital and might not be representative of the population with type 2 diabetes in other care centers or in primary care. Further studies are warranted to adjust the dimensions of HRQoL to other variables (eg, sex, body mass index, type of diabetes and treatment regimens, and duration of the disease) to explore the relationships

between HRQoL and the presence of diabetes-related chronic complications and HTN, which we think may explain some of these relationships. Further investigations on stratifying the severity of diabetes-related chronic complications are required because they may bring important complementary information. More studies are needed to explore sex differences with regard to the association between the number of long-term complications and HRQoL and considering different groups of complications. Lastly, the use of qualitative methodology could be useful to obtain information complementary to that achieved by quantitative studies, allowing more accurate interpretation of some results.

The current study has various strengths. First, we included a more homogeneous sample (ie, only type 2 diabetic patients) in comparison to the two previous researches carried out in Portugal[5,10] which have included both type 1 and type 2 diabetic patients when assessing the relationship between diabetes-related chronic complications, HTN and HRQoL without making stratified analyses according to type of diabetes. Second, the age-adjustment of the SF-36 values to evaluate the relationship between chronic complications, HTN and HRQoL, given the age-discrepancies within the sample, which was not made in the two mentioned Portuguese investigations. Third, we evaluated the association between HRQoL and number of chronic complications by sex, which was not made previously,[16,26,27] and we think may provide important supplemental information.

Conclusion

In summary, our findings suggest that the presence and increased number of diabetes-related chronic complications, as well as the presence of HTN were related to worse age-adjusted HRQoL. It is worth noting that among diabetes-related long-term complications, peripheral neuropathy and CVD were more strongly related to patients' age-adjusted HRQoL. In males, there was a strong association between the number of chronic complications and HRQoL than in their counterparts.

Disclosure

The authors report no conflicts of interest in this work.

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