Health status and quality of life in patients with diabetes in Switzerland

Abstract

Aims: We aimed to assess the health status and quality of life (QoL) of patients with diabetes and explore the associated factors in a French-speaking region of Switzerland.

Methods: This cross-sectional study analyzed self-reported data from 585 patients with diabetes. We ran univariate and multivariate regressions analyses on health status (Physical and Mental Component Summary scores (PCS, MCS) of the SF-12) and diabetes-specific QoL (ADDQoL score).

Results: Mean PCS was 43.1 ±10.4 and mean MCS was 46.7 ±11.1. The overall ADDQoL score was -1.6 ±1.6; the life domains of the ADDQoL with the lowest scores were freedom to eat, sex life and freedom to drink. Being older was independently and significantly associated with higher mental health and QoL, while lower income was associated with lower physical health, mental health, and QoL. Having diabetes for over 10 years was associated with lower QoL, while insulin treatment and complications were correlated with lower physical health and QoL.

Conclusions: This study provides key information on the health status and QoL of patients with diabetes in Switzerland and their associated factors, which can help healthcare providers to identify patients at higher risk of lower health and QoL.

Keywords : diabetes, health status, quality of life, SF-12, ADDQoL, Switzerland

Abbreviations[1]

[1] Abbreviations: QoL, quality of life; PCS, physical component summary; MCS, mental component summary; SF-12, 12-Item short form health survey; ADDQoL, audit of diabetes-dependent quality of life; CoDiab-VD, Cohorte des patients diabétiques vaudois; SWIDINEP, Swiss diabetes nephropathy; BMI, body mass index; OAA, oral antidiabetic agents; HbA1c, haemoglobin A1c

1 Introduction

Diabetes is on the rise and one of the major global health burdens worldwide, with about 425 million people suffering from diabetes in 2017, representing an average prevalence of 8.8% among adults [1]. The age-adjusted prevalence of diabetes was 5.6% in Switzerland in 2017 [1], and it was estimated to be 6.6% in the canton of Vaud, a Swiss state of about 720'000 residents [2]. While the overall goal of diabetes care is to prolong life and prevent acute and chronic complications, an important goal is also to preserve patients' perceived health and quality of life (QoL). Quality of life goes beyond disease and health and is defined as an "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns (…)" [3]. Numerous instruments, generic and disease-specific, have been developed to measure both perceived health status and QoL, through questionnaires that collect data directly from patients, in a context of increasing attention towards the consideration of patient-reported outcomes [4, 5]. It is in fact important for healthcare systems to assess the health status and QoL of patients in addition to their disease levels to evaluate how the system is performing, also according to the patients; to our knowledge, this has yet to be done in Switzerland on a large scale.

In addition to the assessment of health status and QoL, information about their associated factors could help providers to identify patients at higher risk of poor health and QoL. In patients with diabetes, previous studies and reviews on factors correlated with health status and QoL have shown mixed and conflicting results on the association between clinical and socio-demographic characteristics and level of health and QoL. While the presence and number of complications is usually associated with lower levels of health status and QoL [6, 7], glycemic control is not always correlated with better QoL scores, especially when QoL is measured with a generic measure [8]. The effect of duration of disease, treatment regimen, and type of diabetes is uncertain and variable [6]. Finally, among the socio-demographic characteristics, older age has been associated with reduced physical functioning but improved mental health, while being a man and of higher socio-economic status has been associated with higher scores of QoL [6, 9].

In this cross-sectional study, the primary objective was thus to assess health status and QoL in patients with diabetes in a French-speaking region of Switzerland, using a generic health status measure and a diabetes-specific QoL measure. The secondary objective was to explore and compare the characteristics independently associated with health status and QoL.

2 Methods

2.1 Study design and study population

This cross-sectional analysis is based on available data for non-institutionalized adults with diabetes in the Canton of Vaud, a French-speaking canton of Switzerland of about 720'000 residents. The data are derived from the baseline data of two cohorts: the "Cohorte des patients diabétiques vaudois" (CoDiab-VD) cohort [10] and the "Swiss Diabetes Nephropathy" (SWIDINEP) cohort. The CoDiab-VD cohort consists of 514 respondents with diabetes (49.2% response rate), recruited in 2011-2012 in community-based pharmacies, while the SWIDINEP cohort consists of 71 respondents with a diabetes kidney disease diagnosis (54.2% response rate), recruited in 2013 in ambulatory nephrology and diabetes clinics. Individuals under dialysis, with a kidney transplant, with another associated kidney diagnosis, with obvious cognitive impairment, not speaking or understanding French well enough, as well as women with gestational diabetes, were excluded.

2.2 Health status and QoL (dependent variables)

Generic health status was assessed with the 12-Item Short Form Health Survey (SF-12), which provides two norm-based scores measuring functional health and well-being from the patient's point of view: the Physical Component Summary (PCS) and the Mental Component Summary (MCS) scores [11]. Scores range from 0 (lowest level of health) to 100 (highest level of health) and were initially calibrated so that 50 is the average score or norm for the US general population, with a standard deviations equalized to 10 [12]. In Switzerland, the PCS and MCS scores were respectively 49.8 (SD 8.6) and 46.7 (SD 10.1) in a sample of Swiss residents in the canton of Vaud from a study performed to establish local population norms for health status questionnaires [13].

Diabetes-specific QoL was assessed with the third version of the Audit of Diabetes-Dependent Quality of Life (ADDQoL) [14, 15], a validated and widely recommended instrument with good psychometric properties [16-18]. The instrument contains two overall items: generic QoL, on a 7-point scale from extremely poor to excellent, and overall impact of diabetes on QoL, on a 4-point scale from maximum negative impact of diabetes to maximum positive impact of diabetes. Impact of diabetes is then measured on 19 life domains: respondents rate the impact of diabetes on the life domain on a 5-point scale, from −3 (maximum negative impact of diabetes) to 1 (positive impact of diabetes), and the importance of the domain for their quality of life on a 4-point scale, from 0 (not all important) to 3 (very important). The two ratings are multiplied to generate the weighted impact score for each domain, which

can be averaged to form a single average-weighted impact score (i.e. overall ADDQoL score throughout the text), ranging from -9 (maximum negative impact of diabetes) to +3 (maximum positive impact of diabetes). Five of the items that may not be relevant for some people have a preliminary question that determines the relevance of the dimension, and are ignored in the overall score if not applicable.

We collected both measures from participants through a self-administered paper questionnaire.

2.3 Independent variables

In the analyses, we included the following independent variables previously reported as potential determinants of health status and/or QoL: i) socio-demographic characteristics: age, gender, living situation (living with someone vs alone), education (primary, secondary, tertiary), employment status,(full-time, part-time, retired/annuitant, unemployed/disabled/at home), and household income; ii) diabetes-specific characteristics: type, duration, type of treatment (oral hypoglycemic agents, insulin, combination, none/unknown), presence of complications (neuropathy, retinopathy, nephropathy, cardiovascular disease, cerebrovascular disease, amputation), and HbA1c level; and iii) risk factors and other clinical characteristics: smoking status (current smoker, former smoker, never), body mass index (BMI), systolic, diastolic, and pulse blood pressure, and cholesterol values. These variables were collected both with self-administered questionnaires (socio/demographic characteristics) and treating physicians (clinical characteristics).

2.4 Data analysis

For the primary objective, we ran univariate analyses on the socio-demographic and clinical characteristics, as well as on the health status measures (MCS and PCS scores) and the diabetes-specific QoL measures (generic QoL, overall impact of diabetes on QoL, overall ADDQoL score, and individual domain scores). For the secondary objective, we performed multivariate linear regressions with backward manual selection to identify independent variables associated with the MCS, PCS, and overall ADDQoL scores, respectively. We included in the initial model all variables associated with the dependent variable (P-value≤0.15) in the univariate analyses. We eliminated variables based on P-value, explained variance (R^2), and number of missing data. We also ran similar multivariate linear regression models to identify the variables independently associated with the three most impacted ADDQoL domains. We performed regression diagnostics on all final models, removing unusual and influential observations in sensitivity analyses based on the Cook's D test. We also performed sensitivity analyses, running the analyses in patients with type 2 diabetes only (n=506) and in patients from the CoDiab-VD cohort only (n=514).

3 Results

3.1 Participant characteristics, health status and QoL

Demographic and clinical characteristics are presented in Table 1. Mean PCS and MCS scores were 43.1 ±10.4 and 46.7 ±11.1, respectively. While 68% of respondents rated their general QoL as good, very good or excellent, 68% also reported that their QoL would be better if they did not have diabetes. The weighted impact scores were negative for all 19 domains of the ADDQoL, with the lowest negative scores observed for 'freedom to eat' (mean = -2.7 ±2.9), 'sex life' (mean = -2.6 ±2.9) and 'freedom to drink' (mean -2.0 ±2.5) and the least negative scores seen for 'reaction of others' (-0.5 ±1.5), 'financial situation' (-1.0 ±2.2) and self-confidence (-1.3 ±2.4) (see Figure 1). In other words, 71%, 60% and 57% of respondents reported that diabetes had a negative impact on their freedom to eat, drink and sex life, respectively, while only 16%, 28% and 32% of respondents reported that diabetes had a negative impact on reaction of others, their financial situation and their self-confidence. The mean overall ADDQoL score was -1.6 ±1.6 and 91% of respondents had a negative overall ADDQoL score.

3.2 Characteristics associated with health status and QoL

The association between each of the measures (PCS, MCS, and overall ADDQoL score) and the socio-demographic, diabetes-specific, and risk factors characteristics are presented in Table 2. Diabetes-related characteristics explained more variance than sociodemographic characteristics for the level of physical functioning and QoL, while sociodemographic characteristics explained more variance for the level of mental well-being.

The PCS regression model included eight variables explaining 28.7% of the variance, while the MCS and the overall ADDQoL regression models included seven variables, explaining 6.6% and 16.6% of the variance respectively. In the multivariate models, lower income was independently associated with lower PCS, MCS and QoL, while being older was independently associated with better MCS and QoL. Whereas type 2 diabetes was associated with lower PCS and better MCS, it was not statistically associated with QoL. A 10-year or more diagnosis of diabetes was correlated with worse QoL only. Insulin treatment, alone or in combination with oral antidiabetic agents, were associated with lower PCS and QoL. The presence of neuropathy was correlated with lower PCS and QoL, while retinopathy and cardiovascular disease were correlated with lower QOL, and cerebrovascular disease was correlated with lower PCS. Finally, employment status and BMI were independently associated with PCS only.

The characteristics associated with the three lowest ADDQoL life domain scores are presented in Table 3. The models for 'freedom to eat' and 'freedom to drink' were similar and included three common variables out of four, explaining 4.9% and 4.3% of the variance, respectively: being older was associated with less negative scores for freedom to eat and drink, while being treated with both insulin and oral agents and reporting cardiovascular complications were associated with greater negative scores. The regression model for 'sex life' included six variables explaining 17.1% of the variance: being a man, having a diagnosis of diabetes for over 10 years, receiving combination therapy, and reporting neuropathy and cerebrovascular disease were associated with greater negative impact of diabetes on sex life, while having higher level of education was associated with less impact.

Removing influential observations increased the adjusted R^2 of all models, while regression coefficients remained comparable. In sensitivity analyses, restricting the analyses to the CoDiab-VD cohort slightly changed the PCS model, with age>75 and cardiovascular disease becoming characteristics significantly associated with PCS scores. Restricting the analyses to patients with type 2 diabetes also slightly changed the ADDQoL model, with higher education becoming a characteristic significantly associated with better QoL. Finally, we also ran the multivariate analyses with HbA1c as an independent variable in patients with HbA1c data (n=414). While higher levels of HbA1c was significantly associated lower PCS, HbA1c was not significantly associated with QoL or MCS.

4 Discussion

Patients with diabetes in the French-speaking Swiss canton of Vaud reported lower physical functioning but similar mental well-being scores compared to the population-based scores established in the region in a previous study [13]. According to the respondents, diabetes had an overall negative impact on their QoL, as measured with the diabetes-specific QoL measure (overall ADDQoL score). More specifically, the respondents reported that diabetes had the most negative impacts on freedom to eat as wished, sex life, and freedom to drink as wished. The factors independently associated with health status and QoL in our Swiss population with diabetes were multiple and related to socio-demographic and diabetes-specific characteristics, these latter characteristics explaining more variance in physical functioning (PCS) and QoL (ADDQoL) than socio-demographic characteristics. Three common factors associated with lower PCS and QoL emerged from our regression analyses: lower income, receiving insulin (alone or in combination with oral antidiabetic agents), and the presence of neuropathy.

Dietary freedom was reported as the most impacted life domain in our study, as well as in many studies using the ADDQoL in a range of countries in Europe [19-25], Asia [26-28], and Australia [29]. Diabetes requires dietary restrictions as well as constant monitoring of food intake, exercise and glucose levels to decrease the risk of developing complications and thus increase the likelihood of better health and QoL in the future. Self-management interventions need to balance the immediate negative impacts of dietary restrictions on patients with the future positive impacts of self-management in preventing the deterioration of health. In our population, younger individuals, treated with insulin and oral antidiabetic agents, and suffering from cardiovascular complications tended to report worse scores regarding the impact of diabetes on their freedom to eat and drink, suggesting that treating physicians should particularly pay attention to patients with these characteristics when implementing self-management plans and discussing dietary restrictions.

The low QoL score for sex life reported in our population has also been reported in other studies using the ADDQoL [23, 29]. Lower sex life scores were correlated with by being a man, diagnosed for more than 10 years, and suffering from cerebrovascular complications and neuropathy. This is not surprising as the pathophysiology for erectile dysfunction in men with diabetes is well known and includes vascular and nerve system dysfunctions to diabetes [30]. Diabetes has also been associated with lower scores for sexual desire, activity, arousal and satisfaction in men [30]. This is an important issue that should be tackled by treating physicians as it may be corrected by treatments, such as phosphodiesterase type 5 inhibitors and prostaglandin-E1 injections, and thus improved patients' sex life.

Regarding the global diabetes-related QoL as expressed by the overall ADDQoL score, the mean score in our population was among the least negative in the published literature using the same instrument (e.g. [19, 29, 31]) with most studies reporting worse scores (e.g. [8, 32, 33]). These differences are likely due to multiple factors, among which we can cite the healthcare system and context: Switzerland is a privileged country with universal health insurance, relatively easy access to care and good reimbursement policies, as further evidenced by the fact that the impact of diabetes on patient's financial situation was the second least impacted domain in our population.

The socio-demographic and diabetes-specific characteristics collected in our survey did not explain much of the variance in mental well-being. Other factors that we did not measure in our study, such as personality trait and coping style, may be stronger determinants of mental health than diabetes-related clinical characteristics.

Regarding characteristics associated with physical functioning (PCS) and QoL, the finding that the lowest income was associated with both lower PCS and QoL is consistent with other studies [29, 34], while our finding that gender was not a significant factor is in contrast to previous studies [9]. Older individuals were more likely to report higher QoL scores than younger individuals, although older individuals tended to report lower PCS. It appears that although physical health decreases with age, older patients reported less negative impact of diabetes on their quality of life. It may be explained by expectations that decline with age: older respondents expecting lower QoL rate their QoL higher than younger respondents expecting higher QoL [29]. While patients with type 2 diabetes reported lower PCS than patients with type 1 diabetes, they tended to report less negative impact of diabetes on their QoL, although the association was not statistically significant in multivariate analyses. Respondents diagnosed for more than ten years reported lower QoL scores than patients diagnosed for a shorter period. In the literature, the association between duration of diabetes and QoL is mixed, with studies finding that increased duration of diabetes was associated with decreased QoL [9, 28, 35], while others found no association [36]. As previously shown [29], the presence of complications was associated with lower PCS and QoL, but neuropathy, retinopathy and cardiovascular disease were the three complications that remained in the final multivariate model for QoL, suggesting that they are the strongest factors associated with poor QoL. These characteristics can inform treating physicians and intervention planners about patients who are more at risk for deterioration of quality of life and therefore require more attention and careful self-management planning.

The strength of our study reside in the use of validated measures of both health status and QoL measures capturing a more complete picture of our population and the use of both a generic and disease-specific instrument, as suggest by Rubin and Peyrot [6] who advocate the use of both generic and disease-specific instruments. This is also the first study to our knowledge to assess health status and QoL among patients with diabetes in a large French-speaking region of Switzerland. Interpretation of our findings are however limited by several factors. First, most data were self-reported, possibly resulting in under- or over-reporting of medical conditions, complications and comorbidities, included as covariates in our analyses. For instance, the rate of self-reported nephropathy (15.8%) was lower than the creatinine-based rate reported in another Swiss study (22.4%) among patients with type 2 diabetes seen in primary care settings [37]. The effect of such under- or over-reporting remains unknown, however. Second, we did not adjust for HbA1c values in our multivariate models because data were missing for many participants. The additional analyses run to explore the role of HbA1c in the subset of patients with data showed that higher HbA1c was a factor associated with lower physical

health, but not with QoL, as previously shown in other studies [8, 38, 39]. Third, the explained variances (adjusted R^2) we achieved in our models were relatively small, although comparable to other studies (e.g. [8, 38]). The addition of other explanatory factors, such as attitudinal factors (e.g. personality trait and coping style) and other psychosocial factors (e.g. depression and stress), which have been previously associated with QoL [40-42], would probably improve the explained variance but they were not measured in our population. In sensitivity analyses including patients from the CoDiab-VD cohort only, for whom a measure of depression was available [43], depression was significantly associated with lower QoL and increased the total explained variance to 25%. Fourth, the cross-sectional nature of our study prevents us from drawing conclusions on causality between associated factors and health status and QoL. Lastly, it is difficult to assess whether we can generalize these results to other countries or even Swiss cantons speaking a different language. Cross-national and cross-cultural generalizations are strongly limited by the fact that cultural norms and language likely influence the way individuals rate their QoL.

In conclusion, this study provides key information on the perceived health status and quality of life of patients with diabetes in Switzerland. While the health status measures tell us that patients with diabetes perceive their physical functioning as lower compared to the Swiss population-based norm, the QoL measure tells us which life domains are particularly affected by diabetes, namely the freedom to eat and drink as wished, and sex life. The factors independently associated with health status and QoL can help healthcare providers to identify patients at higher risk of lower physical functioning, mental well-being and QoL.

5 Conflict of interest

The authors declare that they have no conflict of interest.

6 Acknowledgments

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

[1] International Diabetes Federation, IDF Diabetes Atlas, in, International Diabetes Federation, Brussels, Belgium, 2017.

[2] M. Firmann, V. Mayor, P.M. Vidal, M. Bochud, A. Pecoud, D. Hayoz, F. Paccaud, M. Preisig, K.S. Song, X. Yuan, T.M. Danoff, H.A. Stirnadel, D. Waterworth, V. Mooser, G. Waeber, P. Vollenweider, The CoLaus study: a population-based study to investigate the epidemiology and genetic determinants of cardiovascular risk factors and metabolic syndrome, BMC cardiovascular disorders, 8 (2008) 6.

[3] The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization, Soc Sci Med, 41 (1995) 1403-1409.

[4] E.C. Nelson, E. Eftimovska, C. Lind, A. Hager, J.H. Wasson, S. Lindblad, Patient reported outcome measures in practice, BMJ, 350 (2015) g7818.

[5] C.F. Snyder, R.E. Jensen, J.B. Segal, A.W. Wu, Patient-reported outcomes (PROs): putting the patient perspective in patient-centered outcomes research, Med Care, 51 (2013) S73-79.

[6] R.R. Rubin, M. Peyrot, Quality of Life and Diabetes, Diabetes Metab Res Rev 15 (1999) 205-218.

[7] F.A. Luscombe, Health-related quality of life measurement in type 2 diabetes, Value in health : the journal of the International Society for Pharmacoeconomics and Outcomes Research, 3 Suppl 1 (2000) 15-28.

[8] M. Sundaram, J. Kavookjian, J.H. Patrick, L.A. Miller, S.S. Madhavan, V.G. Scott, Quality of life, health status and clinical outcomes in Type 2 diabetes patients, Qual Life Res, 16 (2007) 165-177.

[9] R.E. Glasgow, L. Ruggiero, E.G. Eakin, J. Dryfoos, L. Chobanian, Quality of life and associated characteristics in a large national sample of adults with diabetes, Diabetes Care, 20 (1997) 562-567.

[10] E. Zuercher, J. Bordet, B. Burnand, I. Peytremann-Bridevaux, CoDiab-VD: protocol of a prospective population-based cohort study on diabetes care in Switzerland, BMC Health Services Research, 15 (2015) 329.

[11] J. Ware, Jr., M. Kosinski, S.D. Keller, A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity, Medical care, 34 (1996) 220-233.

[12] J.E. Ware, M. Kosinski, S.D. Keller, SF-36 Physical and Mental Health Summary Scales: A Users' Manual,, 2nd Ed ed., The Health Institute, New England Medical Center, Boston, 1994.

[13] T.V. Perneger, B. Burnand, A simple imputation algorithm reduced missing data in SF-12 health surveys, J Clin Epidemiol, 58 (2005) 142-149.

[14] C. Bradley, C. Todd, T. Gorton, E. Symonds, A. Martin, R. Plowright, The development of an individualized questionnaire measure of perceived impact of diabetes on quality of life: the ADDQoL, Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation, 8 (1999) 79-91.

[15] C. Bradley, J. Speight, Patient perceptions of diabetes and diabetes therapy: assessing quality of life, Diabetes Metab Res Rev, 18 Suppl 3 (2002) S64-69.

[16] Y. El Achhab, C. Nejjari, M. Chikri, B. Lyoussi, Disease-specific health-related quality of life instruments among adults diabetic: A systematic review, Diabetes research and clinical practice, 80 (2008) 171-184.

[17] E. Gibbons, R. Fitzpatrick, A structured review of patient-reported outcome measures for people with diabetes: an update 2009., in, Oxford, 2009.

[18] B.A. Levterova, D.D. Dimitrova, G.E. Levterov, E.A. Dragova, Instruments for disease-specific quality-of-life measurement in patients with type 2 diabetes mellitus--a systematic review, Folia medica, 55 (2013) 83-92.

[19] A.M. Abbatecola, L. Spazzafumo, P. Fabbietti, R. Testa, R.A. Rabini, A.R. Bonfigli, A. Corsonello, F. Lattanzio, G. Paolisso, Diabetes-related quality of life is enhanced by glycaemic improvement in older people, Diabetic medicine : a journal of the British Diabetic Association, 32 (2015) 243-249.

[20] N. Alcubierre, E. Rubinat, A. Traveset, M. Martinez-Alonso, M. Hernandez, C. Jurjo, D. Mauricio, A prospective cross-sectional study on quality of life and treatment satisfaction in type 2 diabetic patients with retinopathy without other major late diabetic complications, Health Qual Life Outcomes, 12 (2014) 131.

[21] I. Avramopoulos, A. Moulis, N. Nikas, Glycaemic control, treatment satisfaction and quality of life in type 2 diabetes patients in Greece: The PANORAMA study Greek results, World J Diabetes, 6 (2015) 208-216.

[22] P. Depablos-Velasco, E. Salguero-Chaves, J. Mata-Poyo, B. Derivas-Otero, R. Garcia-Sanchez, P. Viguera-Ester, Quality of life and satisfaction with treatment in subjects with type 2 diabetes: results in Spain of the PANORAMA study, Endocrinologia y nutricion : organo de la Sociedad Espanola de Endocrinologia y Nutricion, 61 (2014) 18-26.

[23] E. Jodar-Gimeno, F. Alvarez-Guisasola, L. Avila-Lachica, R. Palomares-Ortega, C. Roldan-Suarez, L. Lizan-Tudela, Quality of life and fear for hypoglycaemia in patients with type 2 diabetes mellitus, Revista clinica espanola, 215 (2015) 91-97.

[24] A.K. Papazafiropoulou, F. Bakomitrou, A. Trikallinou, A. Ganotopoulou, C. Verras, G. Christofilidis, S. Bousboulas, A. Muelidonis, Diabetes-dependent quality of life (ADDQOL) and affecting factors in patients with diabetes mellitus type 2 in Greece, BMC research notes, 8 (2015) 786.

[25] E. Turk, V. Prevolnik Rupel, A. Tapajner, S. Leyshon, A. Isola, An Audit of Diabetes-Dependent Quality of Life (ADDQOL) in Older Patients with Diabetes Mellitus Type 2 in Slovenia, Value in Health Regional Issues, 2 (2013) 248-253.

[26] C.S. Fung, E.Y. Wan, C.L. Yu, C.K. Wong, Validity and reliability of the 19-item Audit of Diabetes-Dependent Quality of Life (ADDQoL-19) questionnaire in Chinese patients with type 2 diabetes mellitus in primary care, Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation, 25 (2016) 2373-2378.

[27] J.O. Chung, D.H. Cho, D.J. Chung, M.Y. Chung, An assessment of the impact of type 2 diabetes on the quality of life based on age at diabetes diagnosis, Acta diabetologica, 51 (2014) 1065-1072.

[28] Y.T. Shim, J. Lee, M.P. Toh, W.E. Tang, Y. Ko, Health-related quality of life and glycaemic control in patients with Type 2 diabetes mellitus in Singapore, Diabetic medicine : a journal of the British Diabetic Association, 29 (2012) e241-248.

[29] M. Donald, J. Dower, J.R. Coll, P. Baker, B. Mukandi, S.A. Doi, Mental health issues decrease diabetes-specific quality of life independent of glycaemic control and complications: findings from Australia's living with diabetes cohort study, Health Qual Life Outcomes, 11 (2013) 170.

[30] S. Bhasin, P. Enzlin, A. Coviello, R. Basson, Sexual dysfunction in men and women with endocrine disorders, The Lancet, 369 (2007) 597-611.

[31] D.J. Ostini R, Donald M, The Audit of Diabetes-Dependent Quality of Life 19 (ADDQoL): feasibility, reliability and validity in apopulation-based sample of Australian adults, Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation, 21 (2012) 1471-1477.

[32] D.M. Bowser, S. Utz, D. Glick, R. Harmon, V. Rovnyak, The relationship between diabetes mellitus, depression, and missed appointments in a low-income uninsured population, The Diabetes educator, 35 (2009) 966-977.

[33] J.O. Chung, D.H. Cho, D.J. Chung, M.Y. Chung, Assessment of factors associated with the quality of life in Korean type 2 diabetic patients, Internal medicine (Tokyo, Japan), 52 (2013) 179-185.

[34] I. Imayama, R.C. Plotnikoff, K.S. Courneya, J.A. Johnson, Determinants of quality of life in adults with type 1 and type 2 diabetes, Health Qual Life Outcomes, 9 (2011) 115.

[35] E. Gurkova, J. Cap, K. Ziakova, Quality of life and treatment satisfaction in the context of diabetes self-management education, International journal of nursing practice, 15 (2009) 91-98.

[36] H.L. Wee, C.E. Tan, S.Y. Goh, S.C. Li, Usefulness of the Audit of Diabetes-Dependent Quality-of-Life (ADDQoL) questionnaire in patients with diabetes in a multi-ethnic Asian country, PharmacoEconomics, 24 (2006) 673-682.

[37] F. Lamine, F. Lalubin, N. Pitteloud, M. Burnier, A. Zanchi, Chronic kidney disease in type 2 diabetic patients followed-up by primary care physicians in Switzerland: prevalence and prescription of antidiabetic drugs, Swiss Med Wkly, 146 (2016) w14282.

[38] J.H. Quah, N. Luo, W.Y. Ng, C.H. How, E.G. Tay, Health-related quality of life is associated with diabetic complications, but not with short-term diabetic control in primary care, Ann Acad Med Singapore, 40 (2011) 276-286.

[39] W. Redekop, Health-related quality of life and treatment satisfaction in Dutch patients with type 2 diabetes., Diabetes Care, 25 (2002) 458-463.

[40] I. Imayama, R.C. Plotnikoff, K.S. Courneya, J.A. Johnson, Determinants of quality of life in type 2 diabetes population: the inclusion of personality, Quality of Life Research, 20 (2011) 551-558.

[41] M. Rose, H. Fliege, M. Hildebrandt, T. Schirop, B.F. Klapp, The network of psychological variables in patients with diabetes and their importance for quality of life and metabolic control, Diabetes Care, 25 (2002) 35-42.

[42] M.A. Co, L.S. Tan, E.S. Tai, K. Griva, M. Amir, K.J. Chong, Y.S. Lee, J. Lee, E.Y. Khoo, H.L. Wee, Factors associated with psychological distress, behavioral impact and health-related quality of life among patients with type 2 diabetes mellitus, Journal of diabetes and its complications, 29 (2015) 378-383.

[43] M.A. Whooley, A.L. Avins, J. Miranda, W.S. Browner, Case-finding instruments for depression. Two questions are as good as many, Journal of general internal medicine, 12 (1997) 439-445.

Table 1: Participant characteristics

	N	% or mean (SD)
Socio-demographic characteristics		
Age	585	64.3 (11.4)
>65 years old		55.1%
Women	585	38.3%
Living with someone (vs alone)	580	72.4%
Swiss nationality (vs non-Swiss)	580	86.6%
Education	566	
Primary		19.1%
Secondary		55.5%
Tertiary		25.4%
Employment status	565	
Full-time		23.7%
Part-time		8.7%
Retired/annuitant		57.0%
Unemployed/disabled/at-home		10.6%
Household income, CHF/month	507	
≤3499		23.3%
3500-5499		29.8%
550-9499		29.2%
≥9500		17.8%
Diabetes-specific characteristics		
Type 2 Diabetes	585	86.5%
Diagnosis >10 years	569	49.6%
Treatment	583	
Oral antidiabetic agents		48.9%
Insulin		21.4%
Combination		29.2%
None / unknown	(3)	0.5%
Complications		
Neuropathy	564	27.3%
Retinopathy	499	18.6%
Nephropathy	570	15.8%
Cardiovascular disease	570	13.7%
Cerebrovascular disease	569	4.0%
Amputation	563	2.8%
≥1 complication	570	45.6%
HbA1c	414	7.3 (1.2)
<7.0%		42.8%
Risk factors and other clinical characteristics		
Smoking status	575	
Current smoker		18.3%
Former smoker		45.4%
Never		36.4%
BMI	547	30.2 (5.7)
Obese (BMI≥30)		47.9%
Blood pressure, mmHg		
Systolic	458	133.9 (15.0)
Diastolic	445	78.0 (9.5)
Pulse	445	57.5 (14.6)
Cholesterol total, mmol/l	321	4.6 (1.0)
LDL-C, mmol/l	295	2.5 (0.9)
HDL-C, mmol/l	314	1.3 (0.6)
Triglycerides, mmol/l	318	1.9 (1.4)

CHF, Swiss francs; HbA1c, haemoglobin A1c; BMI, body mass index; LDL-C, LDL-cholesterol; HDL-C, HDL cholesterol

Figure 1: ADDQoL average weighted impact (AWI) and individual weighted impact scores by domain (lower score=worse QoL, classified by decreasing order, with 95% confidence intervals)

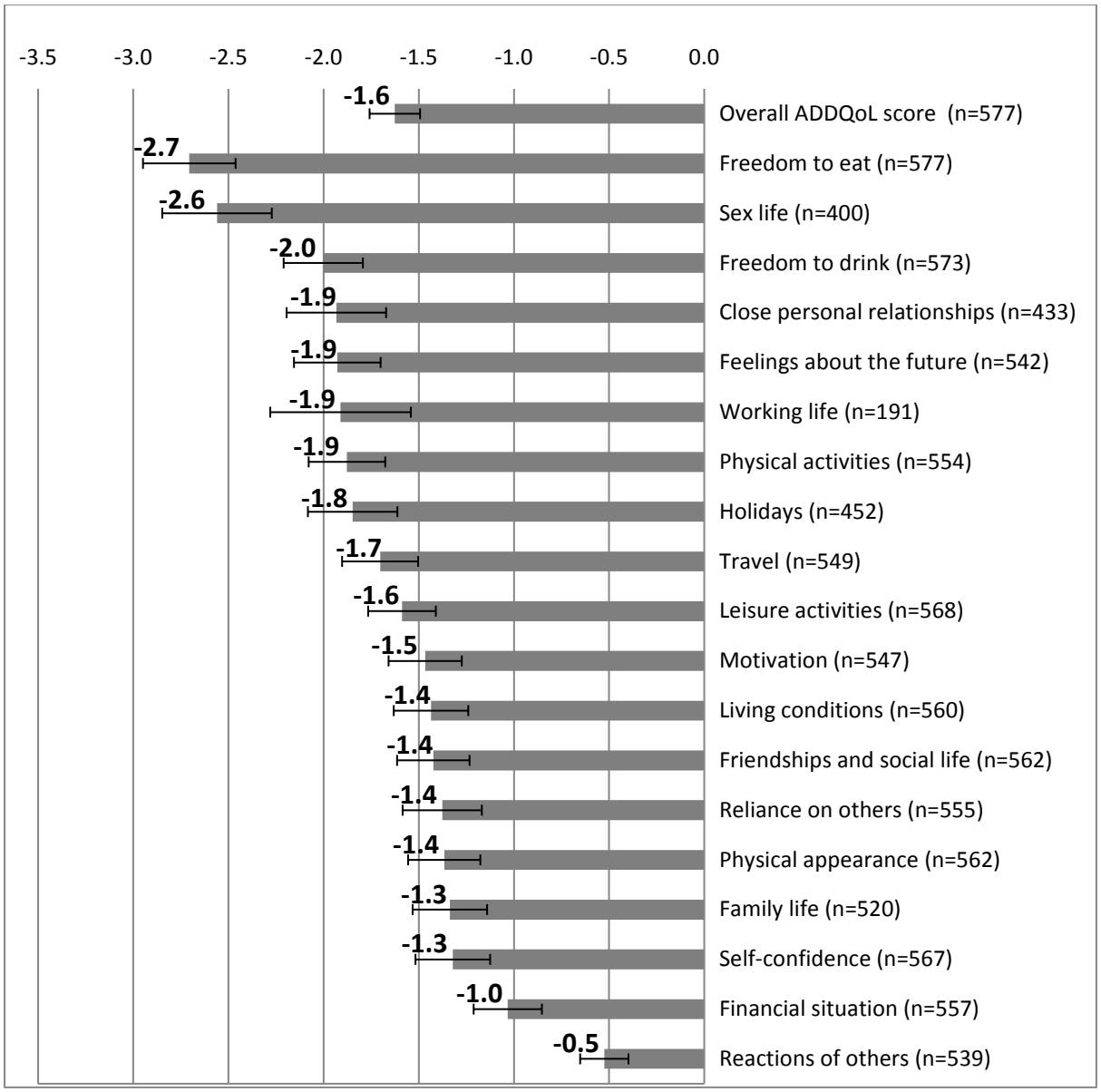

Table 2 Univariate and multivariate linear regression coefficients in SF-12 PCS, SF-12 MCS and overall ADDQoL models

	SF-12 PCS model		SF-12 MCS model		Overall ADDQoL model	
	Univar coeff	Multivar coeff (R^2)	Univar coeff	Multivar coeff (R^2)	Univar coeff	Multivar coeff (R^2)
Socio-demographic characteristics		(12.2%)		(7.0%)		(6.7%)
Age (ref: <65)						
65-74	-2.81***	0.25	4.25***	3.32**	0.45***	0.58***
>=75	-4.82***	-2.83*	2.77**	1.40	0.49**	0.65***
Men	1.06		1.10		-0.06	
Living with someone (ref: alone)	2.72***		1.85*		0.02	
Swiss nationality (ref: non-Swiss)	1.02		4.58***	2.62*	0.61***	
Education (ref: primary)						
Secondary	2.23*		2.48*		0.58***	
Tertiary	3.72***		3.69**		0.45**	
Employment (ref: full-time)						
Part-time	-2.81*	-2.00	0.09	-0.52	-0.42	
Retired/ annuitant	-7.02***	-3.97***	1.27	-0.14	0.08	
Unemployed/disabled	-8.99***	-6.15***	-5.29***	-3.71*	-0.39	
Income (ref: ≤3499)						
3500-5499	3.89***	2.69**	3.47**	3.56**	0.48**	0.41**
5500-9499	5.04***	1.41	1.67	1.33	0.21	0.07
≥9500	7.75***	2.44*	4.30***	3.87**	0.47**	0.39*
Diabetes-specific characteristics		(22.6%)		(4.1%)		(17.6%)
Type 2 diabetes (ref: type 1)	-6.46***	-4.73**	4.35***	3.68**	0.75***	
Diagnosis >10 years (ref: <10 years)	-1.94**		-2.03**	-1.98*	-0.68***	-0.39***
Treatment (ref: OAA)						
Insulin	-2.84**	-5.42***	-2.65**		-0.99***	-0.53***
Combination	-3.73***	-3.70***	-1.81*		-0.93***	-0.63***
Complications						
Neuropathy	-7.31***	-5.10***	-1.17		-0.63***	-0.37**
Retinopathy	-3.80***		-1.41		-0.74***	-0.37**
Nephropathy	-3.49***		-2.08	-2.55*	-0.65***	
Cardiovascular disease	-3.74**		0.79		-0.81***	-0.54***
Cerebrovascular disease	-9.57***	-7.92***	-0.57		-0.65*	
Amputation	-8.67***		0.16		-0.66	
HbA1c†	-1.38***		-0.74*		-0.38***	
Risk factors		(8.0%)		(1.0%)		(0.6%)
Smoking (ref: never)						
Former smoker	-1.67*		1.96*		0.16	
Current smoker	-0.75		-1.81		0.08	
BMI (ref: underw/normal)						
Overweight	-4.66***	-4.18***	0.32		0.03	
Obese	-8.06***	-7.53***	0.36		-0.21	
Adjusted R^2 (full model)		28.7%		6.6%		16.6%

*<0.10; **<0.05; ***<0.01; †HbA1c omitted in the multivariate model because of missing data; univar coeff, coefficients in univariate analyses; multivar coeff, coefficients of variables remaining in the multivariate model after backward elimination; BMI, body mass index; OAA, oral antidiabetic agents; ref, reference; underw, underweight; HbA1c, haemoglobin A1c

Table 3 Univariate and multivariate linear regression coefficients in the freedom to eat, freedom to drink, and sex life models

	Freedom to eat		Freedom to drink		Sex life	
	Univar coeff	Multivar coeff (R^2)	Univar coeff	Multivar coeff (R^2)	Univar coeff	Multivar coeff (R^2)
Socio-demographic characteristics		(4.9%)		(5.2%)		(8.3%)
Age (ref: <65)						
65-74	0.79***	0.77***	0.74***	0.77***	0.43	
>=75	0.10**	0.76**	0.66**	0.71**	0.00	
Men	-0.01		-0.08		-1.55***	-1.52***
Living with someone (ref: alone)	0.26		0.28		-0.03	
Swiss nationality (ref: non-Swiss)	0.12		-0.06		0.03	
Education (ref: primary)						
Secondary	0.90***	0.92***	0.12		0.87**	0.89**
Tertiary	0.59	0.57	-0.36		0.58	0.87**
Employment (ref: full-time)						
Part-time	0.01		0.40		0.21	
Retired/ annuitant	0.59*		0.46*		0.10	
Unemployed/disabled	-0.30		-0.32		-0.21	
Income (ref: ≤3499)						
3500-5499	0.22		-0.17		0.09	
5500-9499	-0.002		-0.33		0.27	
≥9500	0.11		-0.56		0.20	
Diabetes-specific characteristics		(6.3%)		(7.3%)		(13.0%)
Type 2 diabetes	-0.14		0.20		0.29	
Diagnosis >10 years	-0.29		-0.25		-1.24***	-0.78**
Treatment (ref: OAA)						
Insulin	-0.32	0.01	-0.64**	-0.43	-1.06***	-0.57
Combination	-1.05***	-0.95***	-0.76***	-0.59**	-1.24***	-0.77**
Complications						
Neuropathy	-0.32		-0.55**	-0.53**	-1.48***	-1.12***
Retinopathy	-0.11		0.06		-1.09***	
Nephropathy	-0.11		-0.06		-1.47***	
Cardiovascular disease	-0.79**	-0.66*	-0.74**	-0.73**	-1.26***	
Cerebrovascular disease	0.45		-0.59		-3.29***	-2.76***
Amputation	-0.46		0.83		-0.97	
HbA1c†	-0.44***		-0.38***		-0.28**	
Risk factors		(1.1%)		(0.1%)		(1.5%)
Smoking (ref: never)						
Former smoker	0.19		0.16		-0.53	
Current smoker	0.50		0.13		-0.39	
BMI (ref: underw/normal)						
Overweight	-0.06		-0.14		-0.33	
Obese	-0.60		-0.22		0.37	
Adjusted R^2		4.9%		4.3%		17.1%

*<0.10; **<0.05; ***<0.01; †HbA1c omitted in the multivariate model because of missing data; univar coeff, coefficients in univariate analyses; multivar coeff, coefficients of variables remaining in the multivariate model after backward elimination; BMI, body mass index; OAA, oral antidiabetic agents; ref, reference; underw, underweight; HbA1c, haemoglobin A1c