

Predictors of quality of life of patients with type 2 diabetes

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Background: Researchers have shown that patients with type 2 diabetes have a lower quality of life than the general population and also somewhat lower than patients with other chronic diseases. Thus one of the most important outcomes of treatment is optimizing the quality of life of the patient. This study examines the factors that most strongly influence the quality of life of patients with type 2 diabetes.

Methods: 200 patients with type 2 diabetes were studied in Estonia in 2004–2005. A patient blood sample, taken during a visit to the family doctor, was collected. The family doctor also provided data on each patient's body mass index (BMI), blood pressure, and medications for treatment of type 2 diabetes. Patients completed a SF-36 during a doctor visit, and also a special questionnaire which we provided to study their awareness about diabetes type 2.

Results: The mean age of the respondents was 64.7 (± 11.1) years and the mean duration of the diabetes was 7.5 (± 1.8) years. Logistic regression analysis showed that quality of life was most significantly affected by awareness of the complications and risk-factors of diabetes, and by the age, duration of the disease, and BMI of the patient. Patients who were less aware had a significantly higher quality of life score ($p < 0.001$ in all cases). The age and BMI of the patients as well as the duration of the diabetes all lowered the score of the quality of life.

Conclusions: The results suggest that the main challenges for physicians in management of diabetes type 2 are modifying patient BMI and patient awareness.

Keywords: diabetes type 2, quality of life, SF-36, awareness of patients, body mass index

Introduction

In 2000, the World Health Organization estimated that more than 177 million people have diabetes. By 2025, this figure will top 300 million. Patients with type 2 diabetes have a high risk of complications such as retinopathy, nephropathy, lower extremity amputations, coronary artery disease, and cardiovascular disease (Turner et al 1988). Researchers have shown that as a result of these complications, the quality of life of patients with type 2 diabetes is remarkably lower than the quality of life of the general population (Rubin and Peyrot 1999) and also somewhat lower than patients with other chronic diseases (U.K. Prospective Diabetes Study Group 1999). Most complications are preventable and a key strategy is metabolic control through a combination of diet, exercise, and medication. The level of hemoglobin A1c (HbA1c) has been found to be related to good diabetic control (Barr et al 2002). However, the relationship between glycemic control and the quality of life of patients with type 2 diabetes is unclear. Some studies have shown that improved HbA1c is associated with short-term improvement in quality of life (Testa and Simonson 1998), while others showed no association (Bagne et al 1995; Aalto et al 1997). Directly quantifiable endpoints, such as microvascular disease, macrovascular disease, and laboratory values, are typically assessed as outcomes of good quality of care. Still, these reflect disease control rather than the patient quality of life (Lau et al 2004). Researchers have found that physician

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ratings of patient health do not necessarily correspond to patient ratings (Nerenz et al 1992). Patients may feel that severe dietary restriction and daily self-administration of oral medication or insulin also negatively affect their quality of life (Redekop et al 2002). Optimizing patient quality of life is a significant treatment outcome. Therefore examining how patients with type 2 diabetes understand the factors that determine their quality of life is important.

The aim of the study was to examine which factors most strongly influence the quality of life of patients with type 2 diabetes.

Methods

The study was conducted in 2004–2005 in Estonia. A random sample of 40 doctors was constituted from the list of 163 family doctors of the Estonian Society of Family Doctors who had participated in our previous study (Rätsep 2006). Twenty-seven of the selected doctors agreed to participate in this study and 21 provided patient data. Every doctor sent a coded list of their patients with type 2 diabetes. From this list, 10 randomly selected patients were allocated to this study. All patients with type 2 diabetes were considered eligible, irrespective of age, duration of diabetes, and treatment. The family doctors were asked to recruit those patients who had been selected for the study. If one patient did not agree, the next patient on the list was selected. During a visit to the family doctor, the patients signed an informed consent document, to confirm their participation in the study. The family doctors then took a blood sample from each patient to measure HbA1c, measured each patient's height, weight, and blood pressure, and listed each patient's medications for treating type 2 diabetes.

During the family doctor visit, patients completed the Rand 36-item short form health survey (SF-36), and gave the completed form to the doctor, who returned it to the investigators. The SF-36 data were scored according to the methods suggested in the SF-36 Health Survey: Manual and Interpretation Guide (Ware et al 1993). The eight domains used to assess patient health status in this analysis were: Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality, Role-Emotional, Social Functioning, and Mental Health. Raw scale scores were transformed to 0–100 scales, in which higher scores consistently represent better health status in all the dimensions measured.

A special questionnaire for the patients was developed by the research team, which included questions about their personal characteristics, duration of type 2 diabetes, and

other potential determinants of quality of life, for example, smoking status, knowledge about the disease and its risk factors and complications, as well as information sources concerning diabetes. The questionnaire was piloted before being used in the main study, and improved according to the results gained. Patients were asked about their knowledge of risk factors and complications of diabetes. The questions were very simple and had multiple choices, for example, "Do you know which kind of complications diabetes type 2 has?" If the patient had at least 75% of the answers right, he/she was coded as being "aware" of the nature of the disease.

The study was approved by the Ethics Review Committee on Human Research of the Tartu University.

Statistics

The Statistical Package for the Social Sciences (SPSS 10.0) for Windows was used in the analysis. Associations between patient characteristics and the self-reported quality of life of the patients were analyzed using nonparametric tests (Mann-Whitney U test or Kruskal-Wallis test). Nonparametric tests were used because the subscales of SF-36 were not normally distributed. Factors influencing the health of patients with type 2 diabetes were analyzed using logistic regression analysis. Factors used in the logistic regression model were 1) patient related factors: age, gender, body mass index (BMI), smoking status, awareness of disease, and 2) disease related factors: duration of diabetes, treatment regimen (diet, oral medication, or insulin), HbA1c level, and blood pressure level. Any *p*-values lower than 0.05 were considered significant.

Results

Altogether 200 patients with type 2 diabetes were studied; 69% of them were females and 31% were males (Table 1). The mean age of the respondents was 64.7 years (± 11.1) and the mean duration of the diabetes was 7.5 (± 1.8) years. Most of the patients (70%) were receiving only oral treatment; 16% were receiving insulin treatment for diabetes (Table 1). Only one-fourth (24%) of the patients were classified as "being aware" of the complications and the risk factors of their disease.

Analysis showed the existence of several important links between patient characteristics and their perceived health status. The older the patient, the lower the self-reported quality of life (Table 2). Only the emotional well being of patients with type 2 diabetes was not influenced by age. Whether or not the patient was aware of the complications and risk factors of their disease also significantly influenced all sub-scales of quality of life. Patients with higher awareness presented a lower score

Table 1 Characteristics of respondents and distribution of SF-36 scales

Patient characteristics (N = 200)	
Mean (SD) age (years)	64.7 (±11.1)
Mean duration of type 2 diabetes (years)	7.5 (±1.8)
Mean BMI index	33.0 (±6.0)
Mean HbA1c level	7.5 (±6.7)
Treatment type	
Nonpharmacological	14%
Only oral	70%
Insulin	16%
Smoking status	
Yes	16%
No	84%
Mean blood pressure level (mmHg)	
Systolic	149.3 (±18.3)
Diastolic	86.2 (±11.9)
Gender	
Female	61%
Male	39%
Awareness of the disease and its complications	
Yes	24%
No	76%
Mean (SD) SF-36 scores	
Physical functioning	54.0 (±30.1)
Role functioning/physical	38.1 (±42.2)
Role functioning/emotional	41.6 (±44.8)
Energy/fatigue	43.7 (±18.4)
Emotional well being	61.5 (±20.0)
Social functioning	61.3 (±28.2)
Pain	53.4 (±30.9)
General health	35.3 (±18.1)

Abbreviations: BMI, body mass index; HbA1c, hemoglobin A1c; SF-36, Rand 36-item short form health survey.

of quality of life ($p < 0.001$ in all cases) (Table 2). The sex of the patient, duration of diabetes, smoking status, and body mass index also had an important influence on most of the sub-scales of quality of life. The type of treatment received for type 2 diabetes had only a minor effect, and the level of glycosylated hemoglobin had no effect, on the quality of life of patients with type 2 diabetes (Table 2).

When accounting for all the variables listed in Table 1, logistic regression analysis showed that quality of life was most significantly affected by the extent of the patient's awareness of the complications and risk factors of diabetes, and by age, duration of disease, and BMI (Table 3). Patients who were not well informed had a significantly higher quality of life score. Patients' age, BMI, and duration of diabetes all lowered the quality of life score (Table 3).

Discussion

This Estonian study aimed to establish the most significant factors that influence the quality of life of patients with

type 2 diabetes. So far this is the first study on the quality of health of diabetes patients in Estonia.

Patient-perceived health status was measured using the SF-36 health survey instrument, which is approved as appropriate for examining relationships between patient experience with diabetes, quality of life and other chronic diseases, and is reliable and valid in assessing of diabetic health status (Jacobson et al 1994; Woodcock 2001). The average values of SF-36 in different domains demonstrated, as expected, lower values when compared with population averages (Lai et al 2001).

Several studies are being and have been conducted to find out which factors influence the quality of life of patients with type 2 diabetes. The results have been contradictory, however, especially concerning the effect of the metabolic control of diabetes on quality of life (Weinberger et al 1994; Larsson et al 1999), the treatment regimen (Ware et al 1993; U.K. Prospective Diabetes Study Group 1999; Redekop et al 2002; Saito et al 2006), and the duration of the disease (Aalto et al 1997; Redekop et al 2002; Saito et al 2006). Although by using univariate analysis we found that the sex of the patient, smoking status, and treatment type had some effect on the health-related quality of life, these factors were not significant after adjustment for other variables. Only the age and body mass index of the patient, as well as the duration of diabetes and whether the patient was aware of the complications and risk factors of the disease, had an independent effect on the quality of health and life. Older patients with type 2 diabetes assessed their quality of life as being significantly lower than younger patients, especially concerning physical functioning, role limitations due to physical functioning, emotional functioning, and social functioning. These findings are consistent with other studies conducted on diabetes patients (Caruso et al 2000; Redekop et al 2002) and also with studies on the general population (McHorney et al 1994). The effect of obesity in lowering the health-related quality of life of patients with type 2 diabetes, and the general population, was found to be similar in all studies (Redekop et al 2002; Jia and Lubetkin 2005; Huang et al 2006). In our study obese patients had especially low ratings in the emotional and physical role scales. It seems that the main challenge for doctors, and patients with type 2 diabetes, is promoting regular exercise and weight loss, which are shown to improve the functional as well as emotional status of patients (Glasgow et al 1997; Caruso et al 2000; Maddigan et al 2005). Moreover, researchers have found that the level of self-reported exercise was the only significant self-management behavior to predict quality of life and body mass index (Glasgow et al 1997; Maddigan

Table 2 Patient and disease-related characteristics and SF-36 sub-scales (mean scores of the sub-scales and SD)

Patient characteristics/SF-36 sub-scales	Physical function	Role functioning/ Physical	Role functioning/ Emotional	Energy/ Fatigue	Emotional well being	Social functioning	Pain	General health
Age								
<55	77.8 (21.8)**	71.8 (38.0)**	73.3 (37.5)**	50.3 (16.6)**	63.5 (24.8)	76.9 (24.8)**	65.6 (30.5)*	42.6 (17.6)**
55–69	57.4 (28.1)	37.8 (41.3)	40.5 (44.7)	45.1 (18.8)	61.2 (27.1)	61.3 (27.1)	53.2 (30.5)	35.5 (17.9)
≥70	35.9 (26.3)	20.8 (34.6)	26.8 (40.6)	37.9 (17.6)	60.9 (28.3)	52.8 (28.3)	46.9 (30.5)	31.0 (17.7)
Sex								
Male	60.8 (28.9)**	42.5 (42.6)	47.6 (44.7)	45.8 (18.6)	62.0 (20.3)	65.8 (29.4)*	56.2 (31.8)	37.4 (19.2)
Female	49.6(30.2)	35.3 (35.3)	37.6 (44.7)	42.3 (18.3)	61.2 (19.9)	58.4 (27.2)	51.6 (30.5)	33.9 (17.2)
Duration of diabetes (years)								
<5	59.8 (30.5)*	42.4 (42.4)	44.9 (46.3)	46.1 (16.7)	64.4 (20.7)	65.9 (25.9)*	61.2 (29.6)*	38.2 (17.1)*
5–10	54.5 (28.3)	40.8 (42.9)	44.4 (46.1)	44.2 (20.4)	60.2 (18.1)	60.9 (30.9)	49.1 (31.9)	33.3 (20.8)
>10	45.9 (30.1)	28.3 (34.9)	32.5 (42.2)	39.5 (18.8)	56.7 (20.7)	52.5 (29.9)	47.6 (34.2)	30.9 (30.9)
Smoking status								
Yes	70.8 (25.4)**	52.0 (40.8)*	63.9 (42.8)**	48.7 (16.8)	67.7 (19.2)	72.1 (25.8)*	64.1 (27.8)	45.5 (21.5)**
No	52.2 (30.7)	36.6 (42.5)	38.3 (45.3)	43.1 (18.5)	60.3 (20.4)	59.6 (28.1)	53.5 (32.1)	33.6 (17.2)
BMI								
<27	57.0 (33.3)*	51.1 (43.6)**	50.7 (47.0)*	47.4 (19.1)	66.3 (17.5)	64.6(22.9)	64.6 (23.8)	40.6 (19.0)
27–33	59.5 (29.5)	43.9 (43.5)	47.2 (45.1)	45.5 (20.1)	62.4 (19.4)	64.8 (29.4)	54.7 (31.0)	35.7 (17.3)
>33	46.6 (28.6)	27.5 (38.1)	32.0 (42.7)	40.4 (15.7)	59.1 (821.1)	56.1 (27.8)	48.4 (32.1)	33.2 (18.5)
Treatment type								
Nonpharmacological	48.8 (35.8)	36.7 (39.6)	29.2 (29.2)	42.8 (18.5)	59.8 (23.6)	63.9 (22.0)	48.4 (25.9)	33.7 (16.9)*
Oral	58.3 (30.1)	42.9 (44.0)	49.0 (47.1)	46.0 (17.6)	64.6 (18.5)	62.9 (29.0)	58.6 (32.6)	37.9 (18.3)
Insulin	48.5 (28.8)	35.3 (42.2)	35.6 (43.6)	40.0 (20.9)	54.3 (23.5)	56.9 (26.6)	51.5 (31.8)	28.9 (19.5)
HbA1c level								
<7.5	56.5 (30.0)	39.2 (41.1)	42.4 (45.4)	44.3 (17.6)	62.5 (20.2)	61.5 (29.9)	53.4 (31.2)	36.0 (17.1)
>7.5	51.5 (31.0)	37.5 (43.0)	42.3 (44.9)	42.8 (19.8)	60.7 (20.6)	61.6 (29.8)	54.8 (31.6)	34.3 (18.9)
Disease awareness								
Yes	41.9 (29.7)**	24.5 (24.5)**	28.0 (41.4)**	36.8 (41.4)**	53.8 (17.3)*	51.3 (18.9)**	38.2 (27.7)**	25.9 (18.5)**
No	57.8 (29.4)	42.5 (43.4)	45.9 (45.2)	45.9 (45.2)	63.9 (18.3)	64.5 (19.8)	58.2 (27.8)	38.2 (18.1)

Notes: * $p < 0.05$; ** $p < 0.01$.

Abbreviations: BMI, body mass index; HbA1c, hemoglobin A1c; SF-36, Rand 36-item short form health survey.

et al 2005). However, the level of exercise should be optimal, because beyond that, the effect of exercise on quality of life becomes more negative (Watkins et al 2000).

Previous studies have shown controversial results on the effect of the duration of diabetes on quality of life. Most studies have found no effect (Aalto et al 1997; Rubin and Peyrot 1999; Redekop et al 2002), but some have shown a negative effect (Wubben and Porterfield 2005; Saito et al 2006). Our study confirms the negative effect of duration of diabetes on

the energy and general health of the patient, as well as on emotional well-being and social functioning. There could be different reasons for this finding. Development of complications in the later stage of the disease, decreases quality of life. In the years of its duration, diabetes clearly has a tendency to worsen. As complications develop, new symptoms emerge and the treatment regimen tends to become more complex.

The key question is how patients manage their disease. A positive connection has been found between active,

Table 3 Patient characteristics and patient health (multivariate regression analysis)**

Subscales of patient health/ Patient characteristics	B-coefficient	p-value
Physical functioning		
Age	-0.538	<0.000
BMI	-0.286	<0.000
Awareness*	0.182	<0.000
Role functioning/Physical		
Age	-0.416	<0.000
BMI	-0.286	<0.000
Awareness*	0.195	0.008
Role functioning/Emotional		
Age	-0.395	<0.000
BMI	-0.211	0.004
Awareness*	0.217	0.005
Energy/Fatigue		
Duration of diabetes	-0.190	0.021
Awareness*	0.190	0.021
Emotional well being		
Duration of diabetes	-0.203	0.012
Awareness*	0.244	0.003
Social functioning		
Age	-0.252	0.002
Duration of diabetes	-0.223	0.005
Awareness*	0.180	0.02
Pain		
Age	-0.229	<0.000
Awareness*	0.259	0.004
General health		
Duration of diabetes	-0.185	<0.000
Awareness*	0.300	0.020

Notes: *higher score, less aware; **only statistically important data are listed.

Abbreviation: BMI, body mass index.

problem-oriented management behavior and an improved quality of life (Anderson et al 2000). If patients believe they are able to perform disease-specific behavior, which will be relevant to the outcome of the disease, they can positively influence health-related quality of life (Aalto et al 1997). But if the patient persists with emotion-oriented management, this may have a negative impact on psychosocial well being, causing an increased sense of burden which in turn will affect interactions with others (Watkins et al 2000). The longer patients have the illness, the worse they feel. They may lose energy, feel fatigue, and their social functioning may sharply decrease, as demonstrated in our study. Furthermore, we found that being aware of the disease and its possible complications negatively affects the patient's quality of life. Our results conflict with studies on the psychosocial aspects of diabetes, which found that those with extensive knowledge and understanding of their disease have a more positive quality of life (Anderson et al 2000; Watkins et al 2000). However, similar results to our study were demonstrated among

patients with hypertension (Li et al 2005). Researchers found that subjects aware of having high blood pressure had a lower health-related quality of life score than subjects with high blood pressure, who were unaware of the diagnosis (Li et al 2005). The barriers most frequently reported by patients in previous studies were helplessness and frustration as a result of lack of glycemic control, and continued progression of the disease despite adherence (Nagelkerk et al 2006). Therefore knowledge about the disease is not enough to guarantee improved quality of life. However, the results of a US study demonstrated that well-informed and motivated patients were more successful in obtaining and maintaining good control of their risk factors (Rachmani et al 2005). The negative effect on patients' quality of life as a result of their greater awareness of the disease, might be influenced by differences in information delivery. Whilst patients can be educated toward greater autonomy, not all health professionals are ready to work in partnership with them. The study highlighted the importance of clinical staff not only gaining a better understanding of diabetes management, but also of the theoretical principles underlying patient empowerment (Cooper et al 2003).

Conclusions

Our study demonstrated that the most important factors affecting the quality of life of patients with type 2 diabetes are age, duration of diabetes, BMI, and the extent of their understanding and awareness of their disease. BMI and patient awareness and understanding of disease are modifiable risk factors, but are extremely challenging issues for physicians. Family doctors should work in closer partnership with patients in order to enhance their abilities to be more autonomous in controlling their own risk factors, and learning and maintaining problem-oriented behavior.

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