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Quality of life in relation to social and disease factors in patients with type 2 diabetes in Lithuania

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Background: Diabetic patients are more than twice as costly to manage as non-diabetic patients, due mainly to the high costs associated with management of diabetic complications. As in most nations of the world, the number of patients with DM is increasing every year in Lithuania. The aim of this study was to determine relation between quality of the life and disease and social factors of patients with type 2 diabetes in Lithuania.

Material/Methods: Independently prepared questions about the subjects of the survey were: gender; age; weight; education; social and marital status; duration of the disease (in years); treatment method; complications; morbidity with arterial hypertension; change in dietary habits after diagnosis of diabetes (started to eat accordingly to recommendations of the therapist); how often nourishment is taken accordingly to recommendations of the therapist; if beginning to exercise after diagnosis of the diabetes; and if exercising, exercises at least 2–3 times per week. Body mass index was calculated as the relation between body mass in kg and height m square (BMI=kg/m^2). The hospital anxiety and depression (HAD) scale was used for the evaluation of depression and anxiety. Quality of life of patients was evaluated with the SF-36 questionnaire. We surveyed 1022 patients with type 2 diabetes (372 men and 650 women). Association between quality of the life and explanatory parameters (disease and social factors) were analyzed using the logistic regression analysis model.

Results: We found that women had lower scores than men in all fields of quality of life ($p<0.001$). Peroral treatment had a positive impact on the quality of life (QL) fields of the role limitations due to emotional problems (OR_a 0.16. 95% CI 0.07–0.34; $p<0.001$). Treatment with insulin had a positive effect on restriction of activity because of emotional problems (OR_a – 0.23. 95% CI 0.11–0.49; $p<0.001$) and mental health (OR_a – 0.38. 95% CI 0.19–0.78; $p=0.008$), but had a negative impact on bodily pain (OR_a – 3.95. 95% CI 1.41–11.09; $p=0.009$) and physical health (OR_a – 4.14. 95% CI 2.03–8.47; $p<0.001$).

Conclusions: Age and BMI are less important factors that can influence quality of life. Peroral treatment positively acted on the role limitations due to emotional problems, bodily pain, and mental health, but had a strong negative effect on emotional state.

Key words: type 2 diabetes | quality of life | SF-36

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Background

The morbidity rate of diabetes mellitus (DM) is rapidly increasing both in the developed and developing countries of the world. The prevalence of diabetes for all age-groups worldwide was estimated at 2.8% (171 million people) in 2000 and is projected to rise to 4.4% (366 million people) by 2030. The urban population in developing countries is projected to double between 2000 and 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people >65 years of age [1,2]. Diabetes is diagnosed to 7 million people annually and the number of patients has more than doubled during the last 15 years [3]. About 5% of the European population has DM. Diabetic patients are more than twice as costly to manage as non-diabetic patients, due mainly to the high costs associated with management of diabetic complications. Indeed, diabetes care already accounts for about 2–7% of the total national health care budgets of Western European countries [1,2].

As in the rest of the world, the number of patients with DM is increasing every year in Lithuania. According to the Lithuanian Health Information Centre, in 2004 there were 1.97% of people age 18 years and over have DM, and by 2008 this figure had increased to 2.51%, or 67 506 Lithuanians in this age group with DM [4].

The prevalence of DM is related to obesity [5], insufficient physical activity, smoking, and overuse of alcohol [6,7]. Type 2 diabetes is most common in older people. Type 2 diabetes is diagnosed in people 65 years and older 10 times more often than in those under 45 [8], but the average age of patients with DM is decreasing [9].

Diabetes, particularly its complications, impair physical health, but also contribute to psycho-emotional and social problems [10,11]. After diagnosis of DM, patients must change their lifestyles. They experience many negative emotions that cause poorer social adaptation, impair ability to perform activities of daily living, and cause disability.

Studies from around the world have investigated various factors (e.g., disease, its duration, social factors, complications, treatment method, and emotional state) that influence quality of life and emotional state of DM patients. The main goal of this study was to investigate the relationship between quality of the life and social and disease factors of patients with type 2 diabetes.

Material and Methods

Survey participants were selected using these inclusion criteria: age 35 years or older, diagnosed with type 2 diabetes, and without any acute diseases during the survey.

Independently prepared questions about the survey participants were: gender; age; weight; education; social and marital status; duration of the disease (in years); treatment method; complications; morbidity with arterial hypertension; change in dietary habits after diagnosis of diabetes (started to eat accordingly to recommendations of the therapist); how often nourishment is taken accordingly to recommendations of the therapist; if beginning to exercise after diagnosis of the diabetes; if exercising, exercises at least 2-3 times per week; and does the subject smoke. Body mass index was calculated as the relation between body mass in kg and height in meters squared (BMI=kg/m^2).

We used the SF-36 Quality of Life (*Medical Outcomes Study 36-items Short Form*) questionnaire, designed to evaluate well-being during the last 4 weeks. Answers to the questions are "yes/no" and use the Likert scale. This questionnaire consists of 36 questions that reflect 8 fields of life, related into 2 health categories: physical and mental. Four fields were used for the evaluation of physical health (PH): 1) Physical functioning (PF) –ability to perform activities of daily living; 2) role limitations due to physical health problems (RP); 3) bodily pain (BP) (its duration, intensity, and impact on activities of daily living); and 4) general health perceptions (GH) – how patients evaluate their health. Another 4 fields were used for the evaluation of mental health (MH): 1) vitality (VT) – level of energy, freshness and fatigue; 2) social functioning (SF) – how health and emotional problems influence communication with relatives and friends); 3) role limitations due to emotional problems (RE) – influence of emotional factors on work and other activities); and 4) emotional state (ES) – different psychological states, especially anxiety and depression. For the evaluation of each field, questions were assessed in points with sums ranging from 0 to 100 points; higher numbers indicate higher quality of the life. The Hospital Anxiety and Depression (HAD) scale was used to evaluate depression and anxiety.

We performed the survey in compliance with the provisions of the professional ethics in sociological-medical research. In total, 1500 forms were distributed during the survey; 1109 (73.93%) forms were collected and 87 of them were filled in incompletely (recognized as unsuitable), which left 1022 that were used in the research. In most cases (about 65%) survey forms were presented by the researcher herself, about 35% of the forms were distributed with the help of care administrators of the health care institutions. Before presenting being presented with the survey form, the subject was acquainted with instructions for filling in the form, and verbal consent to participate was obtained. After agreement to participate in the survey, the subjects filled in the forms by themselves.

We surveyed 1022 patients with type 2 diabetes. The subjects were divided into age groups, by 10-year intervals. The

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subjects were questioned about their weight and height. Respondents who were not sure were weighed and their height was measured in the health care institution where the survey was conducted. Body mass index (BMI) was calculated as recommended by the WHO. Patients were divided into 4 groups according to the duration of their DM: patients with DM for up to 5 years, patients with DM for 6-10 years, patients with DM for 11–15 years, and patients with DM for 16 years and longer.

The subjects were asked to indicate which DM complications were diagnosed for them. We evaluated distribution of the respondents according to the following complications of DM: nephropathy, retinopathy, angiopathy, and polyneuropathy of the legs. Subjects were asked if they have diagnosed arterial hypertension and did they use medicines for the treatment of hypertension. We composed separate groups of the subjects who had arterial hypertension and who were not ill with this disease. Subjects were also divided into groups according to their treatment method: only diet is prescribed, per-oral (ingested) medicines are used, insulin is used, and combination therapy is prescribed – oral medicines and insulin are prescribed for the treatment. We studied changes in nutrition and physical activity after diagnosis of DM. In choosing questions to ask about harmful health behaviors we chose to ask subjects about their smoking behavior because our pilot research had shown that they did not answer a question about use of alcohol. Smoking is the most harmful risk factor that causes pathology of the heart and blood vessels, as well as morbidity with chronic non-infectious diseases, including type 2 DM.

Traditional descriptive statistic methods were used for the statistical analysis. Chi-square test was used for categorical data analysis. Kruskal-Wallis test and Spearman correlation coefficient (r_s) were used because the subscales of SF-36 were not normally distributed. Association between quality of the life and explanatory parameters (disease and social factors) were analyzed using the logistic regression analysis model. Dependent variable (QOL scores) was transformed into dichotomous. Impaired health related QOL was defined as a score that was more than 1 SD below the mean. Independent variables used in logistic regression model were 1) patient and social: gender, age, body mass index, education, social group, marital status, smoking, and 2) disease related factors: duration of the diabetes, complications, treatment method, hypertension, changes of nutritional habits, physical activity after diagnosis diabetes. Bivariate analysis was done for variable selection. P value <0.25 was used as a screening criterion. Hierarchical approach was used for model bilding. Any p-values lower than p<0.05 were considered significant. Statistical analyses were conducted using SPSS statistical software (v. 13.00) and "WinPEPI" (v. 1.55).

Results

A total of 1022 patients with DM were studied. Table 1 shows the distribution of subjects according to: gender, age, education, education, marital status, social position, DM duration, BMI, complications, smoking, and changes in diet and physical activity after diagnosis of DM. The mean age of the respondents was 59.3 years (median – 59.0); of 1022 total subjects, 36.4% were males and 63.6% were females. Overall, 11.4% of respondents had elementary education, 13.6% did not finish secondary school, 26.8% finished secondary school, 29.5% had completed vocational training, and 18.6 percent had completed a bachelor's degree. Most (64.5%) of the participants were married, and 42.9% were pensioners. Mean BMI was 30.8 (Md – 30.0). The majority of respondents (55.2%) were obese (had body mass index more than 30). Bivariate analysis showed an association between self-reported quality of life and socio-demographic and physical characteristics of patients (Table 2). Sex was found to be associated with quality of life; females had statistically significantly lower scores in all subscales of quality of life.

The relationship between age and self-reported quality of life scores was investigated using the Spearman correlation coefficient. There was a small negative (r_s=–0.21 – –0.29, p<0.0005) correlation between age and RE, SF, and MH fields of quality of life. There was a medium (r_s=–0.32 – –0.45, p<0.0005) correlation between age and PF, RP, ES, VT, BP, GH, and PH fields. Thus, older patients reported lower quality of life. Body mass index (BMI) was associated only with PF, RP, and PH. Between BMI and PF, RP, PH subscales of quality of life were found to have a weak negative correlation (r_s=–0.1 – –0.13, p<0.001). In bivariate analysis, higher quality of life (quality of life scores were transformed into ordinal scale) in all subscales (except RE) were associated with higher levels of education (r_s=0.15–0.36, p<0.0005). Statistically significant differences were found between mean rank of quality of life and social group. Disabled subjects and pensioners had the lowest quality of life in all subscales (p<0.001).

The relationship between marital status and self-reported quality of life in all subscales were estimated. According to Kruskal-Wallis test results, the mean rank of scores in different marital status groups was statistically significant (p<0.001). Lowest quality of life was reported by widowers.

Multiple logistic regression analysis (Table 3) using patient and social variables (gender, age, body mass index, education, social group, and marital status) indicated a preventive relation between gender (male) and impaired self-reported quality of life in almost all sub-scales (adjusted odds ratio (OR_a) 0.07–0.42). BMI showed a small inverse relationship in SF, ES, PH, and MH sub-scales of self-reported quality of life

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Table 1. General characteristics of patients with type 2 diabetes (N=1022).

Variables		Absolute number (%)	
Gender	Male	372	(36.4)
	Female	650	(63.6)
Age (years): mean – 59.3; median – 59.0			
Age	35–44 y.o.	16	(1.6)
	45–54 y.o.	287	(28.1)
	55–64 y.o.	390	(38.1)
	65–74 y.o.	329	(32.2)
Education	Elementary	117	(11.4)
	Incomplete secondary	139	(13.6)
	Secondary	274	(26.8)
	Vocational	**302**	**(29.5)**
	Higher	190	(18.6)
Marital status	Single	27	(2.6)
	Married	**659**	**(64.5)**
	Divorced	148	(14.5)
	Widow (-er)	188	(18.4)
Social status	Blue-collar workers	254	(24.9)
	White-collar workers	223	(21.8)
	Pensioners	**438**	**(42.9)**
	Disabled	107	(10.5)
Duration of DM in years	Up to 5 years	**366**	**(35.8)**
	6–10 years	**346**	**(33.9)**
	11–15 years	184	(18.0)
	16 years and >	126	(12.3)
Duration of DM in years: mean – 8.8; median – 7.0			
BMI (kg/m^2)	Up to18.4 kg/m^2	0	(0.0)
	18.5-24.9 kg/m^2	20	(2.0)
	25-29.9 kg/m^2	437	(42.8)
	30 and > kg/m^2	**565**	**(55.2)**
BMI (kg/m2): mean – 30.8; median – 30.0			
Had DM complications		**738**	**(72.2)**
of them:	Nephropathy	343	(33.6)
	Retinopathy	588	(57.5)
	Angioplasty	558	(54.6)
	Polyneuropathy of legs	329	(32.2)
Patients with arterial hypertension		**760**	**(74.4)**
Treatment method	Diet	99	(9.7)
	Oral medicines	**452**	**(44.2)**
	Insulin	**432**	**(42.3)**
	Combinative therapy	39	(3.8)
Changed nutrition habits after DM diagnosis		894	(87.5)
Began take more exercises after DM diagnosis		346	(33.9)

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Table 2. Patient and social related characteristics and SF-36 subscales (median (Md) and mean (m) scores of the sub-scales).

	PF Md (m)	RP Md (m)	RE Md (m)	SF Md (m)	ES Md (m)	VT Md (m)	BP Md (m)	GH Md (m)	PH Md (m)	MH Md (m)
Gender										
Male	85.0* (74.1)	75.0* (62.8)	100.0* (78.5)	77.8* (73.4)	68.0* (66.6)	65.0* (64.6)	77.8* (72.1)	45.0* (49.6)	52.0* (50.9)	51.0* (49.5)
Female	65.0 (62.8)	25.0 (43.8)	66.7 (56.8)	55.6 (57.1)	60.0 (59.5)	55.0 (51.6)	55.6 (59.9)	35.0 (33.9)	43.0 (43.9)	43.5 (43.0)
Age (years)										
35–44	85.0* (88.1)	100.0* (90.6)	100.0* (95.8)	100.0* (91.7)	76.0* (76.0)	75.0* (76.3)	88.9* (85.4)	60.0* (58.1)	58.4* (57.6)	57.0* (56.4)
45–54	90.0 (79.4)	100.0 (73.6)	100.0 (79.8)	88.9 (74.5)	72.0 (68.5)	70.0 (66.4)	88.9 (76.0)	45.0 (50.6)	56.0 (52.8)	53.0 (50.5)
55–64	70.0 (67.8)	50.0 (47.9)	66.7 (59.8)	55.5 (60.0)	62.0 (60.6)	57.5 (55.0)	66.7 (64.4)	40.0 (37.5)	47.0 (75.8)	47.0 (44.4)
65+	55.0 (54.0)	25.0 (37.3)	66.7 (55.7)	55.6 (55.3)	60.0 (57.5)	45.0 (48.3)	44.4 (53.2)	30.0 (31.7)	40.0 (41.3)	42.0 (41.7)
BMI										
18.5–24.9 kg/m^2	50.0** (50.3)	25.0* (31.3)	66.7 (43.3)	44.4 (53.89)	52.0 (50.8)	45.0 (42.5)	66.7 (57.8)	25.0 (27.5)	39.0** (39.0)	37.0 (38.4)
25–29.9 kg/m^2	80.0 (69.9)	50.0 (58.7)	100.0 (69.0)	66.7 (64.0)	64.0 (62.8)	60.0 (57.8)	66.7 (66.8)	45.0 (40.9)	51.4 (48.7)	47.0 (46.1)
30 and > kg/m^2	70.00 (65.2)	50.0 (48.2)	100.0 (62.1)	66.7 (62.6)	64.0 (61.9)	60.0 (55.7)	66.7 (62.6)	40.0 (39.0)	45.0 (45.7)	48.0 (45.1)
Education										
Elementary	40.0* (42.3)	0.0* (17.7)	33.3* (50.7)	44.4* (46.2)	44.0* (50.5)	30.0* (39.8)	44.0* (44.0)	20.0* (19.1)	31.0* (35.4)	33.0* (37.3)
Incomplete secondary	60.00 (61.80)	25.0 (39.4)	66.7 (55.6)	55.6 (53.4)	60.0 (60.7)	55.0 (51.1)	55.6 (66.2)	40.0 (36.3)	42.0 (45.0)	49.0 (42.9)
Secondary	65.0 (66.1)	50.0 (54.7)	100.0 (66.6)	66.7 (66.4)	64.0 (62.9)	60.0 (57.6)	55.6 (64.4)	45.0 (39.2)	46.5 (45.1)	48.0 (46.2)
Vocational	85.0 (75.9)	75.0 (62.5)	100.0 (74.5)	77.8 (69.6)	68.0 (64.0)	65.0 (63.2)	88.9 (71.2)	45.0 (47.3)	55.0 (50.5)	51.0 (48.2)
Higher	85.0 (72.7)	75.0 (63.7)	66.7 (61.6)	66.8 (65.3)	68.0 (65.9)	55.0 (57.6)	66.7 (64.6)	45.0 (43.1)	52.0 (48.5)	45.0 (46.7)
Social group										
Blue-collar workers	85.0 (78.5)	100.0 (78.9)	100.0 (87.4)	77.8 (77.1)	76.0 (70.3)	70.0 (67.4)	89.0 (82.6)	50.0 (50.0)	53.0 (53.3)	53.0 (51.6)
White-collar workers	85.0 (81.1)	75.0 (65.6)	100.0 (73.4)	88.9 (72.9)	68.0 (66.6)	70.0 (64.9)	77.8 (71.2)	45.0 (47.4)	56.0 (51.7)	53.0 (49.4)
Pensioners	60.00 (58.5)	25.0 (38.3)	66.7 (53.3)	55.6 (55.1)	56.0 (57.6)	50.0 (49.5)	44.4 (55.0)	30.0 (32.4)	41.0 (42.3)	43.0 (41.9)
Disabled	40.0* (44.2)	25.0* (19.4)	33.3* (39.3)	55.6* (41.9)	48.0* (51.6)	35.0* (40.1)	44.4* (45.0)	30.0* (28.3)	37.0* (36.4)	34.0* (36.9)
Marital status										
Single	70.0 (69.4)	50.0 (45.4)	100.0 (74.1)	66.7 (60.1)	64.0 (61.3)	50.0 (49.4)	66.00 (53.5)	25.0 (26.1)	40.0 (42.8)	49.0 (43.8)
Married	80.0 (69.3)	75.0 (58.4)	100.0 (68.8)	66.7 (66.1)	64.0 (63.7)	60.0 (59.3)	77.8 (69.0)	45.0 (44.1)	51.0 (48.2)	49.0 (46.8)
Divorced	70.0 (69.7)	50.0 (48.5)	33.3 (54.5)	55.6 (56.6)	60.0 (53.6)	55.0 (50.4)	50.0 (59.7)	30.0 (30.9)	43.0 (46.3)	45.5 (41.2)
Widow (-er)	55.0* (56.1)	25.0* (35.2)	66.7* (56.9)	55.6* (57.9)	72.0* (63.1)	55.0* (51.6)	44.4* (53.1)	30.0* (32.7)	40.5* (41.0)	46.0* (44.0)

* $p \leq 0.001$. PF – physical functioning; RP – role limitations due to physical health problems; RE – role limitations due to emotional problems; SF – social functioning; ES – emotional state; VT – vitality; BP – bodily pain; GH – general health perceptions; PH – physical health; MH– mental health.

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Table 3. Patient and social related characteristics and SF-36 sub-scales (multivariate regression analysis).

	PF OR_a (95% CI)	RP OR_a (95% CI)	RE OR_a (95% CI)	SF OR_a (95% CI)	ES OR_a (95% CI)	VT OR_a (95% CI)	BP OR_a (95% CI)	GH OR_a (95% CI)	PH OR_a (95% CI)	MH OR_a (95% CI)
Gender	0.85 (0.55–1.31)	0.18 (0.12–0.28)*	0.27 (0.17–0.42)*	0.18 (0.11–0.29)*	0.42 (0.25–0.71)*	0.25 (0.16–0.40)*	0.07 (0.04–0.14)*	0.12 (0.06–0.21)*	0.22 (0.13–0.37)*	0.42 (0.27–0.64)*
Age	1.02 (0.98–1.06)	0.98 (0.95–1.02)	0.98 (0.95–1.01)	0.98 (0.94–1.01)	1.02 (0.98–1.07)	**1.05 (1.01–1.09)****	1.03 (0.99–1.07)	1.04 (1.00–1.08)	**1.05 (1.01–1.09)****	0.99 (0.96–1.03)
BMI	0.98 (0.94–1.03)	1.00 (0.96–1.04)	1.02 (0.98–1.06)	**0.96 (0.92–0.99)****	**0.91 (0.86–0.96)***	0.97 (0.92–1.01)	0.96 (0.92–1.01)	0.97 (0.93–1.01)	**0.94 (0.90–0.98)***	**0.95 (0.91–1.00)****
Education										
Incomplete secondary	**0.1 (0.05–0.18)***	**0.52 (0.30–0.93)****	1.20 (0.68–2.13)	1.35 (0.75–2.40)	**0.18 (0.09–0.36)***	**0.21 (0.11–0.39)***	**0.37 (0.20–0.68)****	0.74 (0.40–1.40)	**0.07 (0.03–0.15)***	0.55 (0.31–0.96)
Secondary	**0.19 (0.10–0.35)***	0.59 (0.32–1.10)	0.82 (0.44–1.53)	**0.25 (0.13–0.51)***	**0.22 (0.11–0.45)***	**0.20 (0.10–0.39)***	0.64 (0.33–1.24)	0.73 (0.38–1.42)	**0.49 (0.26–0.91)****	**0.23 0.12–0.43***
Vocational	**0.09 (0.04–0.16)***	**0.44 (0.23–0.83)****	**0.37 (0.20–0.71)****	**0.38 (0.20–0.74)****	0.52 (0.26–1.05)	**0.18 (0.09–0.35)***	0.86 (0.43–1.70)	0.65 (0.32–1.30)	**0.25 (0.13–0.49)***	**0.20 (0.10–0.38)***
Higher	**0.24 (0.12–0.43)***	**0.19 (0.10–0.35)***	**0.51 (0.28–0.93)****	**0.40 (0.21–0.77)****	**0.08 (0.03–0.19)***	**0.10 (0.05–0.20)***	**0.16 (0.08–0.34)***	**0.16 (0.08–0.34)***	**0.11 (0.06–0.22)***	**0.12 (0.06–0.23)***
Social group										
Blue-collar workers	Ref.									
White-collar workers	0.56 (0.23–1.37)	**13.85 (5.00–38.36)***	**11.62 (4.99–27.03)***	**5.56 (2.34–13.21)***	**1.06 (0.48–2.35)**	**2.68 (1.27–5.64)****	**6.29 (2.64–14.98)***	**5.06 (2.26–11.32)***	**9.81 (3.97–24.22*)**	**2.62 (1.23–5.58)****
Pensioners	2.09 (1.00–4.38)**	39.75 (14.40–109.68)*	12.80 (5.65–29.02)*	9.86 (4.08–23.80)*	4.03 (1.79–9.07)*	2.89 (1.39–6.04)**	10.68 (4.47–25.51)*	3.53 (1.61–7.77)**	9.44 (3.83–23.24)*	5.77 (2.81–11.87)*
Disabled	20.56 (10.31–39.80)*	71.70 (26.11–196.90)*	17.15 (7.72–38.11)*	41.23 (17.25–98.58)*	2.61 (1.16–5.87)**	8.00 (4.00–16.08)*	28.25 (11.70–68.22)*	13.39 (6.19–28.96)*	19.05 (7.90–45.95)*	15.13 (7.68–29.82)*
Marital status										
Single	Ref.									
Married	0.76 (0.23–2.55)	0.45 (0.16–1.29)	1.63 (0.54–4.90)	0.39 (0.14–1.04)	0.45 (0.13–1.57)	**0.28 (0.10–0.78)****	**0.14 (0.05–0.43)***	**0.12 (0.04–0.36)***	0.62 (0.19–2.07)	1.49 (0.48–4.68)
Divorced	**0.21 (0.06–0.77)****	0.35 (0.11–1.07)	**3.45 (1.09–10.93)****	0.70 (0.24–2.00)	2.54 (0.72–9.02)	0.70 (0.24–2.07)	**0.30 (0.10–0.93)****	**0.21 (0.07–0.64)***	0.79 (0.22–2.80)	3.10 (0.95–0.14)
Widow (-er)	0.57 (0.17–1.94)	0.36 (0.12–1.08)	1.42 (0.47–4.33)	**0.36 (0.13–0.98)****	0.35 (0.10–1.26)	**0.13 (0.04–0.39)***	**0.22 (0.07–0.67)****	**0.12 (0.04–0.37)***	0.67 (0.20–2.36)	0.98 (0.31–3.13)

* p≤0.001; **p≤0.05. OR_a – adjusted odds ratio; 95% CI – 95% confidence interval. Only those variables are shown which were entered into model.

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(OR_a 0.91–0.95). Education levels (elementary education was set as the reference category) had a preventive effect on impaired self-reported quality of life in almost all sub-scales (OR_a 0.07–0.51). All sub-scales of impaired self-reported quality of life had strong direct relations with social group of pensioners and disabled subjects (blue-collar workers were set as the reference group). In these groups, OR_a ranged from 2.09 to 71.7. When the single subjects group was set as the reference group, an inverse relation was found between marital status and self-reported quality of life among married subjects in VT, BP, and GH sub-scales (OR_a 0.12–0.28), among divorced in PF, BP, GH (OR_a 0.21–0.30), and in widowed subjects in SF, VT, BP, GH (OR_a 0.12–0.36). A direct, strong association (OR_a 3.45) was found only in sub-scale RE for divorced subjects.

The mean duration of DM was 8.8 years (Md 7.0). Overall, 72.2% of patients had DM complications, and 74.4% reported arterial hypertension. Most patients (44.2%) were receiving oral treatment, 42.3% were receiving insulin treatment, 9.7% were being treated by diet, and 3.8% were receiving combined therapy. After DM diagnosis, 87.5% of patients reported they had changed eating habits, and 33.9% had begun to exercise more (Table 1). Bivariate analysis showed an association between self-reported quality of life and disease-related characteristics (Table 4). A moderate negative correlation between disease duration and self-reported quality of life scores was found. Spearman correlation coefficient in subscales of quality of life ranged from –0.30 to –0.47 ($p<0.0005$). Higher levels of mean rank scores were found among subjects without DM complications in all sub-scales. There was a statistically significant difference ($p<0.001$) in the scores of subjects without complications and those with complications. The same relation was found between arterial hypertension and self-reported quality of life. Statistically significantly ($p<0.001$) higher scores were found among subjects without arterial hypertension in all subscales. According to Kruskal-Wallis test results, the mean rank of scores in different treatment groups was statistically significant ($p<0.001$). Higher scores were estimated in all sub-scales among subjects treated by diet or oral medicines. Respondents who had changed their diet and begun follow recommendations provided by the therapist after DM diagnosis had statistically significantly higher scores in all sub-scales of self-reported quality of life ($p<0.001$). Increasing physical activity (exercising at least 2–3 times per week) after diagnosis DM had a weak positive association with higher scores in sub-scales PF ($r_s=0.07$, $p=0.002$) and RP ($r_s=0.125$, $p<0.0005$) and weak negative association in sub-scale BP ($r_s=–0.114$, $p<0.0005$).

Multiple logistic regression analysis (Table 5) using disease-related variables (duration of the DM, complications, arterial hypertension, treatment method, nutrition habit, and physical activity) indicated a strong association between duration of DM and impaired self-reported quality of life in PF, RP, SF, VT, BP, GH, and PH sub-scales. DM complications were strongly associated with lower self-reported quality of life in RE, SF, ES, VT, PH, and MH sub-scales. Arterial hypertension was directly associated in 8 out of 10 sub-scales of quality of life. In these 8 subscales (PF, RP, RE, SF, ES, BP, GH, PH), OR_a ranged from 1.78 to 2.99. When accounting for all variables listed in Table 5, logistic regression showed diverse effects of treatment method on self-reported quality of life. Oral and insulin treatment had a protective effect in RE and MH sub-scales (OR_a ranges from 0.16 to 0.38), and a strong direct association with impaired quality of life in the ES sub-scale (OR_a ranges from14.39 to 19.36). Oral treatment has a positively influence on BP ($OR_a=0.60$), but insulin treatment had a negative impact on BP ($OR_a=3.95$). Changing nutrition habits after DM diagnosis was not positively associated with self-reported quality of life. Changed exercise habits (increased physical activity) had a positively influence on ES ($OR_a=0.50$), BP ($OR_a=0.49$) and MH ($OR_a=0.44$).

Discussion

Numerous studies have been conducted on quality of life in patients with type 2 diabetes. In agreement with the findings of most of these studies, we demonstrated that diabetes has a negative impact on quality of life. Similar data has been presented by studies of quality of life of patients with type 2 diabetes performed in the USA [12,13], Holland [14], Estonia [15], and other countries, showing that patients with DM evaluate their physical health as poorer than persons without DM. The research carried out in Lithuania showed that that pensioners rated all fields of QL lower than blue-collar workers and white-collar workers ($p<0.001$).

People with DM have a lower quality of life than the general population [11,16]. In the present study, health-related quality of life was associated with diabetic complications [14,17–21]. A German study showed that diabetic neuropathy significantly reduced patient quality of life and a created substantial economic burdens, both for society and health insurance [22].

Our results suggest that complications had a negative impact on the following fields of QL: role limitations due to emotional problems, social functioning, emotional state, vitality, physical health, and mental health.

Lack of exercise, a poor diet, current smoking, and abstinence from alcohol were all associated with a significantly increased risk of diabetes. There was a negative correlation between BMI and the following fields of QL: physical functioning ($r_s=–0.075$; $p=0.016$), role limitations due to physical health problems ($r_s=–0.106$; $p=0.001$), and physical health ($r_s=–0.066$;

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Table 4. Disease related characteristics and SF-36 sub-scales (median (Md) and mean (m) scores of the sub-scales).

	PF Md (m)	RP Md (m)	RE Md (m)	SF Md (m)	ES Md (m)	VT Md (m)	BP Md (m)	GH Md (m)	PH Md (m)	MH Md (m)
Duration of the disease (in years)										
Up to 5 years	80. 0 (75.3)	75.0 (68.2)	100.0 (77.1)	77.8 (72.5)	72.0 (67.8)	70.0 (65.9)	77.8 (72.0)	50.0 (48.4)	54.0 (51.0)	53.5 (50.0)
6–10 years	70.0 (69.4)	62.5 (57.4)	100.0 (65.0)	66.7 (65.6)	72.0 (63.9)	60.0 (58.2)	77.8 (69.2)	45.0 (44.2)	48.5 (48.3)	49.0 (46.5)
11–15 years	60.0 (60.6)	25.0 (34.7)	33.3 (52.4)	55.6 (52.5)	52.0 (52.9)	50.0 (46.8)	44.4 (52.5)	30.0 (26.4)	42.0 (41.1)	41.0 (39.9)
16 years and >	45.0 (44.9)*	0.0 (18.5)*	33.3 (45.5)*	44.4 (44.2)*	56.0 (53.8)*	35.0 (37.4)*	33.3 (45.9)*	20.0 (20.8)*	34.0 (36.3)*	36.5 (37.2)*
DM Complications										
Without complications	90.0 (80.3)	100.0 (76.8)	100.0 (85.2)	88.9 (80.6)	76.0 (71.7)	75.0 (70.6)	88.9 (78.1)	55.0 (54.7)	57.0 (54.1)	56.0 (52.9)
With complications	60.0 (61.8)*	25.0 (42.9)*	66.7 (56.8)*	55.6 (56.3)*	56.0 (58.4)*	55.0 (50.9)*	55.6 (59.0)*	35.0 (33.8)*	42.0 (43.5)*	43.0 (42.5)*
Arterial hypertension										
Without Arterial hypertension	85.0 (77.4)	100.0 (69.23)	100.0 (78.6)	77.8 (76.1)	72.0 (68.5)	75.0 (67.6)	88.9 (80.8)	55.0 (54.0)	57.0 (53.3)	53.0 (50.8)
With Arterial hypertension	65. 0 (63.3)*	50.0 (46.6)*	66.7 (59.9)*	55.6 (58.6)*	60.0 (59.9)*	55.0 (52.5)*	44.4 (58.7)*	35.0 (34.7)*	43.0 (44.1)*	45.0 (43.5)*
Treatment										
Diet	95.0 (87.9)*	100.0 (83.6)*	100.0 (84.2)*	100.0 (82.7)*	68.0 (68.0)*	70.0 (69.4)*	66.7 (70.6)*	45.0 (51.5)*	55.0 (54.6)*	55.0 (51.8)*
Oral medicines	80.0 (72.4)	75.0 (63.8)	100.0 (73.3)	77.8 (71.1)	68.0 (64.0)	65.0 (61.4)	77.8 (71.8)	45.0 (47.0)	52.0 (49.9)	50.0 (47.9)
Insulin	55.0 (56.9)	25.0 (34.7)	66.7 (54.1)	55.6 (51.8)	56.0 (58.9)	50.0 (49.5)	44.4 (55.9)	25.0 (29.7)	40.0 (41.1)	42.0 (41.9)
Combinative therapy	55.0 (60.9)	50.0 (36.5)	0.0 (32.5)	44.4 (44.7)	60.0 (60.6)	35.0 (40.6)	44.4 (56.4)	20.0 (33.6)	35.0 (45.3)	42.0 (39.3)
Nutrition										
Modified nutrition habits after DM diagnosis	75.0 (68.4)	50.0 (55.5)	100.0 (65.7)	66.67 (64.7)	64.0 (62.9)	60.0 (57.34)	66.7 (65.4)	45.0 (41.5)	48.0 (47.2)	48.0 (46.0)
Unmodified nutrition habits after DM diagnosis	60.0 (56.9)*	25.0 (30.8)*	100.0 (57.8)*	55.6 (51.8)*	60.0 (56.0)*	55.0 (49.1)*	44.4 (57.2)*	20.0 (26.8)*	40.0 (41.4)*	45.0 (41.2)*
With exercise after DM diagnosis	75.0** (69.9	75.0* (60.5)	100.0 (62.7)	66.7 (63.3)	56.0 (61.3)	60.0 (57.2)	55.6** (61.0)	45.0 (40.3)	48.0 (47.0)	45.0 (45.3)
Without exercise after DM diagnosis	70.0 (65.3)	50.0 (48.0)	100.0 (65.7)	66.7 (62.9)	68.0 (42.5)	60.0 (55.9)	66.7 (66.1)	40.0 (39.3)	47.0 (46.2)	49.0 (45.4)

* p≤0.001; ** p≤0.05 (Kruskall_Wallis test). PF – physical functioning; RP – role limitations due to physical health problems; RE – role limitations due to emotional problems; SF – social functioning; ES – emotional state; VT – vitality; BP – bodily pain; GH – general health perceptions; PH – physical health; MH – mental health.

p=0.034). Recent increases in DM and obesity in many countries, including the USA and Australia, have been partly attributed to declines in physical activity. Randomized controlled trials have shown that interventions involving physical activity reduce body mass index and the progression to insulin resistance, but most were done in selected groups, such as people

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Table 5. Disease related characteristics and SF-36 sub-scales (multivariate regression analysis).

	PF OR_a (95% CI)	RP OR_a (95% CI)	RE OR_a (95% CI)	SF OR_a (95% CI)	ES OR_a (95% CI)	VT OR_a (95% CI)	BP OR_a (95% CI)	GH OR_a (95% CI)	PH OR_a (95% CI)	MH OR_a (95% CI)
Duration of the disease: Up to 5 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
6–10 years	1.18 (0.75–2.23)	**1.87 (1.18–2.97)***	0.70 (0.46–1.08)	1.13 (0.70–1.82)	0.69 (0.42–1.15)	1.41 (0.87–2.29)	0.86 (0.52–1.42)	1.22 (0.74–2.01)	1.13 (0.70–1.82)	1.53 (0.98–2.20)
11–15 years	**2.01 (1.27–3.41)***	**4.20 (2.56–6.90)***	0.98 (0.60–1.62)	**2.35 (1.42–3.89)***	**2.63 (1.59–4.43)***	**2.87 (1.67–4.86)***	**1.74 (1.02–2.97)***	**3.39 (2.03–5.63)***	**2.35 (1.42–3.89)***	**2.59 (1.56–4.30)**
16 years and >	**4.22 (2.43–7.35)***	**6.61 (3.76–11.58)***	0.99 (0.58–1.68)	**5.01 (2.91–8.63)***	1.68 (0.92–3.06)	**4.23 (2.39–7.48)***	**4.19 (2.38–7.40)***	**4.82 (2.74–8.47)***	**5.01 (2.91–8.63)***	1.14 (0.64–2.04)
DM Complications	1.32 (0.81–2.15)	1.61 (0.98–2.64)	**5.45 (2.86–10.37)***	**1.79 (1.04–3.08)***	**2.73 (1.54–4.82)***	**5.10 (2.65–9.82)***	1.24 (0.72–2.13)	1.35 (0.80–2.26)	**1.79 (1.04–3.08)***	**3.41 (1.96–5.91)***
Arterial hypertension	**1.90 (1.17–3.08)***	**2.23 (1.38–3.58)***	**2.37 (1.43–3.93)***	**2.57 (1.46–4.53)***	**2.45 (1.38–4.35)***	0.73 (0.46–1.14)	**2.99 (1.66–5.38)***	**1.78 (1.06–2.99)***	**2.57 (1.45–4.53)***	1.25 (0.81–1.95)
Oral treatment	1.02 (0.45–2.30)	0.88 (0.40–1.94)	**0.16 (0.07–0.34)***	0.49 (0.23–1.07)	**19.36 (2.12–126.43)***	1.07 (0.57–2.00)	**0.60 (0.39–0.92)***	1.15 (0.63–2.13)	0.77 (0.52–1.14)	**0.27 (0.13–0.57)***
Insulin treatment	1.09 (0.50–2.39)	1.48 (0.69–3.17)	**0.23 (0.11–0.49)***	0.88 (0.43–1.83)	**14.39 (1.90–109.05)***	1.28 (0.70–2.32)	**3.95 (1.41–11.09)***	1.44 (0.79–2.61)	**4.14 (2.03–8.47)***	**0.38 (0.19–0.78)***
Changed nutrition habits after DM diagnosis	0.66 (0.41–1.07)	1.02 (0.63–1.64)	0.70 (0.45–1.11)	0.74 (0.46–1.20)	**1.72 (1.01–2.93)***	0.69 (0.44–1.10)	0.71 (0.44–1.14)	0.71 (0.44–1.14)	0.74 (0.46–1.20)	0.73 (0.46–1.14)
Changed habits of the physical activity	1.40 (0.97–2.02)	0.83 (0.58–1.19)	1.09 (0.76–1.56)	0.98 (0.67–1.44)	**0.50 (0.32–0.76)***	0.72 (0.49–1.07)	**0.49 (0.32–0.75)***	0.79 (0.53–1.17)	0.98 (0.67–1.44)	**0.44 (0.30–0.65)***

* p≤0.001; *** p≤0.05. OR_a – adjusted odds ratio; 95% CI – 95% confidence interval. Only those variables are shown which were entered into model.

with impaired glucose tolerance, or had composite interventions including diet as well as physical activity [23]. Our study showed that only one-third of all participating patients (33.9%) had changed their habits of physical activity by beginning to engage in sports after DM diagnosis.

A low-fiber diet with a high glycemic index has been associated with an increased risk of diabetes, and specific dietary fatty acids may differentially affect insulin resistance and the risk of diabetes [6]. Most (87.5%) of the patients changed their nutritional habits and began to eat according to therapist recommendations after diagnosis of DM. Our study results indicate that having DM is associated with lower health-related quality of life scores. Duration of diabetes, insulin use, and diabetes-related complications are all factors associated with health-related quality of life scores.

With respect to diabetes, this means that health care professionals should not just focus on objective vital signs (e.g., blood pressure), physical examination findings (e.g., retinopathy, nephropathy, and heart disease), and laboratory tests (e.g., glycosylated hemoglobin values) associated with treatment. Health care professionals should also strive to understand the subjective impact diabetes and its management has on DM patients' physical and mental functioning – that is, their health-related quality of life.

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Conclusions

This study showed that male gender and higher education led to better evaluation of all fields of quality of the life. Age and body mass index are less important factors that can influence quality of life because weak positive relation was determined only with 4 of 10 fields of quality of life (social functioning, emotional state, physical health, and mental health). Smoking is associated with a worse estimate of exuberance/vitality. Duration of the disease was relevant to lower rating of all fields of quality of the life, except to evaluation of role limitations due to emotional problems, emotional state, and mental health. Per oral treatment positively acted on the role limitations due to emotional problems, bodily pain, and mental health, but had a strong negative effect on evaluation of emotional state. Treatment with insulin positively influenced evaluations of the role limitations due to emotional problems, and mental health, but negatively influenced evaluation of emotional state, bodily pain, and physical state. Change in diet was not a very important influence on quality of life, and it had a negative impact only on emotional state. Physical activity is an important influence on emotional state, bodily pain, and mental health (OR_a=0.44–0.50) fields in higher points.

Our results suggest that the main challenges for physicians in management of diabetes type 2 are changing patient BMI and patient awareness. Public health education about diabetes is needed, with a particular focus on the promotion of healthy lifestyles and explaining DM risk factors. Particularly, attention must be given to those who are in high-risk groups, as well as the emotional state of DM patients. The Hospital Anxiety and Depression (HAD) scale is a convenient and fast way to evaluate anxiety and depression; therefore, therapists and health care experts would be able to use it not only for emotional state evaluation of DM patients, but also for patients with other chronic diseases. When designing diabetes programs it is important to consider the influence that age, social factors, duration of disease, complications, nutrition, and physical activity have on quality of life and emotional state of people with DM.

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