CLINICS

CLINICAL SCIENCE

Quality of life of adolescents with type 1 diabetes

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INTRODUCTION: Diabetes mellitus is a highly prevalent chronic disease. Type 1 diabetes mellitus usually develops during infancy and adolescence and may affect the quality of life of adolescents.

OBJECTIVE: To evaluate the quality of life of adolescents with type 1 diabetes mellitus in a metropolitan region of western central Brazil.

METHODS: Adolescents aged 10–19 years who had been diagnosed with type 1 diabetes mellitus at least 1 year previously were included. Patients with verbal communication difficulties, severe disease, and symptomatic hypo- or hyperglycemic crisis as well as those without an adult companion and who were <18 years of age were excluded. The self-administered Diabetes Quality of Life for Youths instrument was applied.

RESULTS: Among 96 adolescents (57% females; 47% white, and 53% nonwhite), 81% had an HbA1c level of >7%. In general, the adolescents consistently reported having a good quality of life. The median scores for the domains of the instrument were as follows: ''satisfaction'': 35; ''impact'': 51; and ''worries'': 26. The total score for all domains was 112. Bivariate analysis showed significant associations among a lower family income, public health assistance, and insulin type in the ''satisfaction'' domain; and a lower family income, public health assistance, public school attendance, and a low parental education level in the ''worries'' domain and for the total score. A longer time since diagnosis was associated with a lower total score. Multivariable analysis confirmed the association of a worse quality of life with public health assistance, time since diagnosis, and sedentary lifestyle in the ''satisfaction'' domain; female gender in the ''worries'' domain; and public health assistance for the total score.

CONCLUSIONS: Overall, the adolescents evaluated in this study viewed their quality of life as good. Specific factors that led to the deterioration of quality of life, including public assistance, time since diagnosis, sedentary lifestyle, and female gender, were identified.

KEYWORDS: Quality of Life; Type 1 Diabetes; Adolescent.

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INTRODUCTION

Diabetes mellitus (DM) is a highly prevalent chronic disease and an important public health problem (1,2). Currently, an estimated 382 million people have diabetes worldwide, and this number is predicted to rise to 592 million by the year 2035. Approximately 80% of diabetics live in developing countries, where rapid lifestyle changes, the aging of the population, and environmental changes have contributed to a significant increase in DM incidence. In 2013, expenditures of $548 billion were associated with this disease, accounting for 11% of total global healthcare costs (1).

In Brazil, epidemiological data on diabetes are scarce. Some studies have indicated a prevalence of 7.6–13.5% (3,4). It has been estimated that by 2030, Brazil will advance from the eighth to the sixth position in terms of the worldwide prevalence of diabetes due to an increase from 4.6 to 11.3% (5).

Type 1 diabetes mellitus (T1DM) usually develops during infancy and adolescence and results from the progressive destruction of pancreatic beta cells and reduced insulin production (6). The prevalence of T1DM varies between 0.05% and 0.3% in children <15 years of age in most European and North American populations (1,7). A prevalence of 0.2% has been estimated for the same age group in Brazil (8), and recent data have demonstrated an increasing incidence that is similar to those of European countries (9). T1DM and its complications may affect adolescents' living conditions over the years and may also influence their quality of life (QOL) (10). Hormonal alterations, immaturity, difficulties in acquiring autonomous control, and a low rate of disease acceptance may hinder the daily control of blood glucose levels. In general, adolescents are more resistant to accepting the disease than

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younger children because they no longer depend on their parents or guardians for care and are responsible for their own health. Psychosocial issues (11) also influence the behavior of adolescents, reflecting their attitudes toward diabetes.

The present study aimed to evaluate the Health-Related Quality of Life (HRQOL) in adolescents with T1DM from the metropolitan region of Cuiabá, Brazil to understand the different aspects associated with the health-disease process and the impact of this condition on daily activities. The HRQOL (12) is evaluated using measuring instruments that transform subjective and individual concepts into objective and measurable data.

The results of this study may contribute to changes in professional practice as well as to health policies. These actions may result in the improvement of service delivery to adolescents with T1DM by taking into account these patients' experiences beyond the biological model.

■ METHODS

A cross-sectional study of adolescents with T1DM assisted from March 2012 to February 2014 was performed at the outpatient endocrinology clinics of the Júlio Müller University Hospital and the General Hospital of the University of Cuiabá, both of which are reference/public services for treating children and adolescents with DM of the Medical Specialties Centers of Cuiabá and Várzea Grande and of private endocrinologists in the metropolitan region of Cuiabá. This case study included patients assisted by the public health system and private health insurance plans.

The adolescents included in the study ranged in age from 10 to 19 years (according to the World Health Organization [WHO] definition) and had been diagnosed with T1DM more than 1 year previously. Patients with verbal communication difficulties, severe disease, and symptomatic hypo- or hyperglycemic crisis as well as those under 18 years of age without an adult companion were excluded.

The required sample size of 95 adolescents was obtained with a confidence interval of 95% and a sampling error of 0.009, taking into account the population of adolescents in the state of Mato Grosso (13) and the T1DM prevalence of 0.2% (8) in the country.

Demographic, socio-economic, and clinical data were obtained by interviews and a standardized questionnaire. The patients' weights, heights, and exam results were collected from their medical records. The body mass indices (BMIs) and classifications of the nutritional states of the participants were obtained using WHO AnthroPlus software (14). The participants reported their race according to the Brazilian Institute of Geographic and Statistics classification system (13) as white, brown, black, indigenous or yellow. For comparative analyses, the different races were divided in two groups (white and nonwhite) because of the small numbers of black and yellow people in this population.

To collect data regarding QOL, we used the instrument Diabetes Quality of Life for Youths (DQOLY), which is a specific instrument to evaluate the QOL of adolescents with diabetes (15). The DQOLY was adapted and validated for the Portuguese language and for Brazilian culture (16). This instrument evaluates the domains of satisfaction (17 items), impact (22 items), and worries (11 items). Responses are given on a Likert scale. Each question is answered using a scale ranging from 1 to 5 (very satisfied to very unsatisfied, respectively, for the satisfaction domain and never to

Table 1 - Sociodemographic, clinical and treatment characteristics of 96 adolescents with type 1 diabetes.

Characteristics	Category	Number	%
Gender	Female	55	57.29
	Male	41	42.71
Age in years	10 — 14	55	57.29
	15 — 19	41	42.71
Race			
	White	45	46.88
	Nonwhite	51	53.12
Family income [a]	1 — 2	30	31.25
	3 — 4	28	29.17
	≥ 5	38	39.58
Years of schooling	≤ 8	58	60.42
	> 8	38	39.58
Occupation	Study + work	10	10.42
	Study only	86	89.58
Type of school	Public	62	64.58
	Private	34	35.42
Maternal education in years	≤ 8	19	19.79
	> 8	77	80.21
Paternal education in years	≤ 8	35	36.46
	> 8	61	63.54
Type of health service	Public	43	44.79
	Private	53	55.21
Time of diagnosis in years	≥ 3	59	61.46
	1 — <3	37	38.54
Insulin injections - times per day	≥ 3	60	63.16
	≤ 2	35	36.84
Type of insulin used[#]	R	2	2.11
	S/S+R	5	5.26
	S+UR	52	54.74
	I/I+R/I+UR	29	30.52
	UR (pump)	7	7.37
Self-monitoring of glycemia	Yes	90	93.75
	No	6	6.25
Hypoglycemia	Yes	71	73.96
	No	25	26.04
Chronic complications of DM	Yes	1	1.04
	No	95	98.96
Hypo- and/or hyperglycemia in the last month	Yes	93	96.88
	No	3	3.13
Hospitalization due to T1DM or complications	Yes	67	30.21
	No	29	69.79
Carbohydrate counting	Yes	27	71.88
	No	69	28.13
Time since the last HbA1c measurement in months	<3	54	56.25
	3 — <6	26	27.08
	6 or more	16	16.67
Value of the last HbA1c measurement	> 7%	78	81.25
	≤ 7%	18	18.75
Physical activities	Yes	86	89.58
	No	10	10.42
Frequency of physical activities per week	None	10	10.42
	1 — 2	20	20.83
	3 or more	66	68.75
Nutritional status	Thin	4	4.17
	Eutrophic	79	82.29
	Overweight	10	10.42
	Obesity	3	3.13

[a] Brazilian minimum monthly wage; [#] R = rapid-acting, S = slow-acting; UR = ultra-rapid-acting; and I = intermediate-acting.

always for the worries and impact domains). The total score is the sum of the domain scores. There is no cutoff score for this instrument; thus, the lowest value corresponds to a better QOL. In addition to the DQOLY items, the participants were asked to self-evaluate the state of their health compared with the states of health of other young people from the same age group. The responses included the following four options: 1 = excellent; 2 = good; 3 = satisfactory; and 4 = bad. This question has been used together with the DQOLY internationally (15,17).

All data were collected by the author LMFCC. Interviews were performed to present the DQOLY for its self-administration. The adolescents were interviewed as outpatients and in private medical offices during routine health-care visits. The interviews were pre-scheduled by telephone and were conducted at home. The adolescents were instructed to respond to the instrument autonomously. The researcher was available to read and clarify questions for those adolescents $\leq$ 14 years of age because of their potential difficulties with understanding some of them.

The collected data were entered twice to minimize processing mistakes. Statistical analysis was performed using the Stata V13.0 software (StataCorp, College Station, TX) (18). The prevalence ratios and their 95% confidence intervals were calculated using Pearson's chi square test to analyze the association between the scores above and below the median and between the demographic and clinical variables. This test was also used for bivariate analysis of the association between health status and the studied variables. A 5% significance level was adopted. Multivariate analysis was performed using the Poisson multiple regression model. This model included the variables with a significance level of greater than 20% ($p > 0.20$), as shown by bivariate analysis. A significance level of 5% and a 95% confidence interval were adopted for the final regression model.

ETHICS

All included patients or their guardians for those under 18 years of age were sufficiently informed about this study. The patients and guardians signed informed consent forms. The Research Ethics Committee of the Faculty of Medicine of the University of São Paulo approved this study.

RESULTS

Ninety-nine adolescents were included in this study. Three adolescents were excluded because they refused to participate. The socio-demographic and clinical characteristics of the 96 analyzed adolescents are shown in Table 1. Before being divided into two large groups (white and nonwhite), 45 adolescents reported being of white color, 46 of brown color, 4 of black color, and 1 of yellow color.

Table 2A - Bivariate analysis of associations between sociodemographic characteristics and the domains ''Satisfaction'' and ''Impact''.

Characteristics	Satisfaction							Impact						
	Above the median		Below the median					Above the median		Below the median				
	n	%	n	%	PR	CI 95%	p	n	%	n	%	PR	CI 95%	p
Gender														
Female	29	52.73	26	47.27	1.44	[0.90; 2.32]	0.116	26	47.27	29	57.73	1.02	[0.66; 1.57]	0.928
Male	15	36.59	26	63.41	1.00			19	46.34	22	53.66	1.00		
Age														
10 – 14 years	23	41.82	32	58.18	0.82	[0.53; 1.26]	0.360	24	43.64	31	56.36	0.85	[0.56; 1.30]	0.461
15 – 19 years	21	51.22	20	48.78	1.00			21	51.22	20	48.78	1.00		
Race														
Nonwhite	23	50.00	23	50.00	1.32	[0.82; 2.16]	0.240	21	45.65	25	54.35	0.98	[0.63; 1.52]	0.923
White	17	37.78	28	62.22	1.00			21	46.67	24	53.33	1.00		
Family income#														
1 — 2	**18**	**60.00**	**12**	**40.00**	**1.90**	**[1.09; 3.30]**	**0.019**	18	60.00	12	40.00	1.42	[0.89; 2.29]	0.143
3 — 4	14	50.00	14	50.00	1.58	[0.87; 2.88]	0.130	11	39.29	17	60.71	0.93	[0.52; 1.69]	0.818
≥ 5	12	31.58	26	68.42	1.00			16	42.10	22	57.90	1.00		
Schooling														
≤ 8 years	25	43.10	33	56.90	0.86	[0.56; 1.33]	0.507	26	44.83	32	55.17	0.90	[0.59; 1.38]	0.619
> 8 years	19	50.00	19	50.00	1.00			19	50.00	19	50.00	1.00		
Occupation														
Study + work	7	70.00	3	30.00	1.63	[0.97; 2.61]	0.178	5	50.00	5	50.00	1.08	[0.56; 2.08]	1.00*
Study only	37	43.02	49	56.98	1.00			40	46.51	46	53.49	1.00		
Type of school														
Public	32	51.61	30	48.39	1.46	[0.87; 2.45]	0.125	31	50.00	31	50.00	1.21	[0.76; 1.95]	0.407
Private	12	35.29	22	64.71	1.00			14	41.18	20	58.82	1.00		
Maternal education														
≤ 8 years	11	57.90	8	42.10	1.35	[0.85; 2.14]	0.239	10	52.63	9	47.37	1.16	[0.71; 1.89]	0.574
> 8 years	33	42.86	44	57.14	1.00			35	45.45	42	54.55	1.00		
Paternal education														
≤ 8 years	19	54.29	16	45.71	1.32	[0.86; 2.03]	0.208	20	57.14	15	42.86	1.39	[0.92; 2.11]	0.127
> 8 years	25	40.98	36	59.02	1.00			25	40.98	36	59.02	1.00		
Type of health service														
Public	**27**	**62.79**	**16**	**37.21**	**1.96**	**[1.24; 3.08]**	**0.003**	22	51.16	21	48.84	1.18	[0.77; 1.80]	0.448
Private	17	32.08	36	67.92	1.00			23	43.40	30	56.60	1.00		

= Brazilian minimum monthly wage.

Table 2B - Bivariate analysis of associations between sociodemographic characteristics and the domains ''Concerns'' and ''Total score''.

Characteristics	CONCERNS							TOTAL IQVJD						
	Above the median		Below the median					Above the median		Below the median				
	n	%	n	%	PR$_b$	CI 95%	p	n	%	n	%	PR	CI 95%	p
Gender														
Female	31	56.36	24	43.64	1.54	[0.97; 2.45]	0.05	29	52.73	26	47.27	1.20	[0.78; 1.84]	0.392
Male	15	36.59	26	63.41	1.00			18	43.90	23	56.10	1.00		
Age														
10 − 14 years	29	52.73	26	47.27	1.27	[0.82; 1.98]	0.27	25	45.45	30	54.55	0.85	[0.57; 1.27]	0.436
15 – 19 years	17	41.46	24	58.54	1.00			22	53.66	19	46.34	1.00		
Race														
Nonwhite	23	50.00	23	50.00	1.12	[0.73; 1.74]	0.60	22	47.83	24	52.17	1.02	[0.66; 1.58]	0.912
White	20	44.44	25	55.56	1.00			21	46.67	24	53.33	1.00		
Family income[#]														
1 — 2	**21**	**70.00**	**9**	**30.00**	**2.42**	**[1.40;4.19]**	**0.001**	**20**	**66.67**	**10**	**33.33**	**1.81**	**[1.11; 2.94]**	**0.015**
3 — 4	14	50.00	14	50.00	1.73	[0.93; 3.21]	0.08	13	46.43	15	53.57	1.26	[0.71; 2.24]	0.434
≥ 5	11	28.95	27	71.05	1.00			14	36.84	24	63.16	1.00		
Schooling														
≤ 8 years	30	51.72	28	48.28	1.23	[0.79; 1.92]	0.36	27	46.55	31	53.45	0.88	[0.59; 1.33]	0.560
> 8 years	16	42.10	22	57.89	1.00			20	52.63	18	47.37	1.00		
Occupation														
Study + work	2	20.00	8	80.00	0.39	[0.11; 1.37]	0.09*	6	60.00	4	40.00	1.26	[0.72; 2.19]	0.520*
Study only	44	51.16	42	48.83	1.00			41	47.67	45	52.33	1.00		
School														
Public	**35**	**56.45**	**27**	**43.55**	**1.74**	**[1.02;2.97]**	**0.024**	**35**	**56.45**	**27**	**43.55**	**1.60**	**[1.01; 2.65]**	**0.047**
Private	11	32.35	23	67.65	1.00			12	35.29	22	64.71	1.00		
Maternal education														
≤ 8 years	11	57.90	8	42.10	1.27	[0.81; 2.01]	0.331	11	57.90	8	42.10	1.24	[0.79; 1.94]	0.384
> 8 years	35	45.45	42	54.55	1.00			36	46.75	41	53.25	1.00		
Paternal education														
≤ 8	**24**	**68.57**	**11**	**31.43**	**1.90**	**[1.27;2.84]**	**0.002**	**23**	**65.71**	**12**	**34.29**	**1.67**	**[1.13; 2.47]**	**0.013**
> 8	22	36.07	39	63.93	1.00			24	39.34	37	60.66	1.00		
Health service														
Public	27	62.79	16	37.21	1.75	[1.14;2.69]	0.009	27	62.79	16	37.21	1.66	[1.10; 2.52]	0.015
Private	19	35.85	34	64.15	1.00			20	37.74	33	62.26	1.00		

[#] = Brazilian minimum monthly wage.

The mean value of the last glycated hemoglobin (HbA$_{1c}$) level was 9.59% ± 2.82%. The mean BMI was 20.01 ± 3.09 kg/m^2.

Analysis of the DQOLY scores showed a normal distribution (Shapiro test $p > 0.10$), which allowed for a comparison of the percentages of scores above/equal to the median with those below the median for each domain. The median (minimum-maximum) total DQOLY score and domain scores were as follows: total DQOLY value, 111 (59–165); satisfaction, 35 (17–62); impact, 50 (26–73); and worries, 26 (11–44). The distribution of percentages of scores above and below the median according to the domain and bivariate analyses are shown in Tables 2A, 2B, 3A and 3B. The variables with a $p < 0.20$ were selected for analyses using logistic regression models, as shown in Table 4.

In response to the specific question regarding their perception of their own health, 29% reported it as excellent, 48% as good, 17% as satisfactory, and 6% as bad. Participants who were only students and those who frequently participated in physical activities were more likely to declare their health state as excellent or good compared with those who were students with sedentary habits (prevalence ratio [PR] = 2.53; $p = 0.046$). The association between the best declared health state and being a student who exercised regularly remained significant after adjusting for family income, type of insulin, the self-monitoring of blood glucose, the time since the last HbA$_{1c}$ measurement, the frequency of exercise, and the nutritional status (PR = 2.54; $p = 0.011$).

DISCUSSION

The assisted adolescents with T1DM from the metropolitan region of Cuiabá were mostly female and reported similar proportions of white and nonwhite races, corresponding with the demographic characteristics of the region (13). The active search for cases included regional hospitals and private practices to ensure for the inclusion of a representative sample of adolescents that was independent of socioeconomic class and that allowed for a comparison of the HRQOL according to this specific parameter.

Only adolescents with chronic disease were included in the study (i.e., with a diagnosis given more than 1 year ago) to avoid possible fluctuations in the evaluation during the adaptation and remission periods, which are common during the first year of the disease. Most of the studied adolescents had been diagnosed >3 years previously and received more than three daily injections of insulin. The evaluation of treatment parameters and disease control revealed that although the patients were under clinical supervision (with the self-monitoring of blood glucose and

Table 3A - Bivariate analysis of associations between clinical characteristics and the domains ''Satisfaction'' and ''Impact''.

Characteristics	Worries							Total Score						
	Above median		Below median		PR	CI 95%	p	Above median		Below median		PR	CI 95%	p
	n	%	n	%				n	%	n	%			
Time with DM														
≥ 3 years	29	49.15	30	50.85	1.07	[0.69; 1.65]	0.760	**34**	**57.63**	**25**	**42.37**	**1.64**	**[1.01; 2.68]**	**0.032**
> 1 — <3 years	17	45.95	20	54.05	1.00			13	35.14	24	64.86	1.00		
Insulin/day														
≥ 3 injections	29	48.33	31	51.67	1.00	[0.65; 1.53]	0.982	31	51.66	29	48.33	1.13	[0.73; 1.75]	0.576
≤ 2 injections	17	48.57	18	51.43	1.00			16	45.71	19	54.29	1.00		
Type of insulin														
UR	1	14.29	6	85.71	0.29	[0.05; 1.82]	0.116*	1	14.29	6	85.71	0.27	[0.04; 1.69]	0.105
I/I+R/I+UR	17	58.62	12	41.38	1.19	[0.80; 1.79]	0.404	16	55.17	13	44.83	1.05	[0.70; 1.58]	0.823
S+R/S+UR	28	49.12	29	50.88	1.00			30	52.63	27	47.37	1.00		
Self-monitoring of glycemia														
No	45	50.00	45	50.00	1.00			44	48.89	46	51.11	1.00		
Yes	1	16.67	5	83.33	0.33	[0.06; 2.02]	0.206*	3	50.00	3	50.00	1.02	[0.45; 2.34]	1.00
Hypoglycemia														
Yes	31	43.66	40	56.34	0.73	[0.48; 1.10]	0.160	36	50.70	35	49.30	1.15	[0.70; 1.90]	0.564
No	15	60.00	10	40.00	1.00			11	44.00	14	56.00	1.00		
Hypo- or hyperglycemia														
Yes	44	47.31	49	52.69	0.71	[0.31; 1.62]	0.606	45	48.39	48	51.61	0.73	[0.32; 1.66]	0.613
No	2	66.67	1	33.33	1.00			2	66.67	1	33.33	1.00		
Last HbA1c measurement														
≥ 6 months	9	56.25	7	43.75	1.27	[0.75; 2.14]	0.406	10	62.50	6	37.50	1.41	[0.87; 2.28]	0.204
> 3 and <6 months	13	50.00	13	50.00	1.12	[0.69; 1.83]	0.641	13	50.00	13	50.00	1.12	[0.69; 1.83]	0.641
<3 months	24	44.44	30	55.56	1.00			24	44.44	30	55.56	1.00		
Physical activity														
Yes	40	46.51	46	53.49	1.00			43	50.00	43	50.00	1.00		
No	6	60.00	4	40.00	1.29	[0.74; 2.25]	0.513	4	40.00	6	60.00	0.80	[0.36; 1.76]	0.741*
Physical activity														
Never	6	60.00	4	40.00	1.47	[0.82; 2.63]	0.315*	4	40.00	6	60.00	0.80	[0.36; 1.77]	0.737*
≤ 2 times/week	13	65.00	7	35.00	1.59	[0.99; 2.45]	0.058	10	50.00	10	50.00	1.00	[0.61; 1.65]	1.000
≥ 3 times/week	27	40.91	39	59.09	1.00			33	50.00	33	50.00	1.00		
Nutritional status														
Thin	0	0.00	4	100.00	0.00	-	0.017	2	50.00	2	50.00	1.01	[0.37; 2.77]	1.000*
Eutrophic	41	51.90	38	48.10	1.00			39	49.37	40	50.63	1.00		
Overweight	5	38.46	8	61.54	0.74	[0.36; 1.52]	0.369	6	46.15	7	53.85	0.94	[0.50; 1.75]	0.830
Value of last Hb1Ac measurement								43	55.14	35	44.87	2.48	[1.02; 6.02]	0.012
> 7%	41	52.56	37	47.44	1.89	[0.87; 4.10]	0.058	**43**	**55.14**	**35**	**44.87**	**2.48**	**[1.02; 6.02]**	**0.012**
≤ 7%	5	27.78	13	72.22	1.00			4	22.22	14	77.78	1.00		

controlling of HbA_{1c} in the past months), they did not have ideal control of their DM. Most had at least one episode of hypo- or hyperglycemia in the past month (93%), and more than one half (67%) reported a previous hospitalization due to DM. In addition, the mean value for metabolic control, as evaluated by HbA_{1c} measurements, was 9.6%, confirming the absence of good control of the disease in these patients.

Despite signs of uncontrolled chronic disease, most of the evaluation results were consistent with a good perception of the health state by the adolescents. A likely explanation is that these patients were still in the initial phase of this chronic disease, which does not yet involve any irreversible repercussions, and they were young (mean age of 14 years), which contributed to more favorable evaluations of their health. A recent systematic (19) review has also noted the similarities in the QOL reported by young people with and without diabetes; however, the affected individuals observed specific impacts of the disease in their daily lives.

Metabolic control has been a target of the treatment DM to ensure for not only the improved organic evolution of the disease but also a better QOL. A trend of the deterioration of metabolic control in adolescents is due to hormonal alterations in addition to psychological and behavioral aspects (20) that are characteristic of this phase of life. A recent cohort study (21) of 2,602 diabetic patients with a mean age of 13 years has found that poor metabolic control, as assessed by HbA_{1c} measurements, is associated with worse QOL. However, other studies (15,17) either have not found an association between HbA_{1c} and QOL or have detected a negative association.

In the present study, the adolescents with longer-established DM diagnoses had a worse HRQOL. The correlation of the lower satisfaction of the adolescents with a longer time since diagnosis suggests that the course of the disease is an important factor in the deterioration of QOL. Multivariable-adjusted analysis of select treatment characteristics, such as the type of insulin used and the time since the last laboratory evaluation, showed that the lower satisfaction of these adolescents was independent of these variables, suggesting a more global influence of the evolution of the disease on daily activities. The higher awareness of the adolescents about the chronicity of DM as well as of their real daily needs

Table 3B - Bivariate analysis of associations between clinical characteristics and the domain ''Worries'' and the total score.

Characteristics	Worries							Total Score						
	Above median		Below median		PR	CI 95%	p	Above median		Below median		PR	CI 95%	p
	n	%	n	%				n	%	n	%			
Time with DM														
≥ 3 years	29	49.15	30	50.85	1.07	[0.69; 1.65]	0.760	34	57.63	25	42.37	1.64	[1.01; 2.68]	0.032
> 1 — <3 years	17	45.95	20	54.05	1.00			13	35.14	24	64.86	1.00		
Insulin/day														
≥ 3 injections	29	48.33	31	51.67	1.00	[0.65; 1.53]	0.982	31	51.66	29	48.33	1.13	[0.73; 1.75]	0.576
≤ 2 injections	17	48.57	18	51.43	1.00			16	45.71	19	54.29	1.00		
Type of insulin														
UR	1	14.29	6	85.71	0.29	[0.05; 1.82]	0.116*	1	14.29	6	85.71	0.27	[0.04; 1.69]	0.105
I/I+R/I+UR	17	58.62	12	41.38	1.19	[0.80; 1.79]	0.404	16	55.17	13	44.83	1.05	[0.70; 1.58]	0.823
S+R/S+UR	28	49.12	29	50.88	1.00			30	52.63	27	47.37	1.00		
Self-monitoring of glycemia														
No	45	50.00	45	50.00	1.00			44	48.89	46	51.11	1.00		
Yes	1	16.67	5	83.33	0.33	[0.06; 2.02]	0.206*	3	50.00	3	50.00	1.02	[0.45; 2.34]	1.00
Hypoglycemia														
Yes	31	43.66	40	56.34	0.73	[0.48; 1.10]	0.160	36	50.70	35	49.30	1.15	[0.70; 1.90]	0.564
No	15	60.00	10	40.00	1.00			11	44.00	14	56.00	1.00		
Hypo- or hyperglycemia														
Yes	44	47.31	49	52.69	0.71	[0.31; 1.62]	0.606	45	48.39	48	51.61	0.73	[0.32; 1.66]	0.613
No	2	66.67	1	33.33	1.00			2	66.67	1	33.33	1.00		
Last HbA1c measurement														
≥ 6 months	9	56.25	7	43.75	1.27	[0.75; 2.14]	0.406	10	62.50	6	37.50	1.41	[0.87; 2.28]	0.204
> 3 and <6 months	13	50.00	13	50.00	1.12	[0.69; 1.83]	0.641	13	50.00	13	50.00	1.12	[0.69; 1.83]	0.641
<3 months	24	44.44	30	55.56	1.00			24	44.44	30	55.56	1.00		
Physical activity														
Yes	40	46.51	46	53.49	1.00			43	50.00	43	50.00	1.00		
No	6	60.00	4	40.00	1.29	[0.74; 2.25]	0.513	4	40.00	6	60.00	0.80	[0.36; 1.76]	0.741*
Physical activity														
Never	6	60.00	4	40.00	1.47	[0.82; 2.63]	0.315*	4	40.00	6	60.00	0.80	[0.36; 1.77]	0.737*
≤ 2 times/week	13	65.00	7	35.00	1.59	[0.99; 2.45]	0.058	10	50.00	10	50.00	1.00	[0.61; 1.65]	1.000
≥ 3 times/week	27	40.91	39	59.09	1.00			33	50.00	33	50.00	1.00		
Nutritional status														
Thin	0	0.00	4	100.00	0.00	-	**0.017**	2	50.00	2	50.00	1.01	[0.37; 2.77]	1.000*
Eutrophic	41	51.90	38	48.10	1.00			39	49.37	40	50.63	1.00		
Overweight	5	38.46	8	61.54	0.74	[0.36; 1.52]	0.369	6	46.15	7	53.85	0.94	[0.50; 1.75]	0.830
Value of last Hb1Ac measurement								43	55.14	35	44.87	2.48	[1.02; 6.02]	0.012
> 7%	41	52.56	37	47.44	1.89	[0.87; 4.10]	0.058	**43**	**55.14**	**35**	**44.87**	**2.48**	**[1.02; 6.02]**	**0.012**
≤ 7%	5	27.78	13	72.22	1.00			4	22.22	14	77.78	1.00		

may have impacted their satisfaction regarding their HRQOL. However, other studies (22) using different methods of monitoring have indicated that the time since diagnosis may have a lesser impact. Stahl et al. did not identify alterations in QOL in diabetic adolescents with at least 7 years since diagnosis compared with non-diabetic controls. A cohort study (21) also did not detect an influence of the time since diagnosis on the QOL of adolescents.

A predominant factor influencing the deterioration of QOL identified in the present study was public service assistance. Although most of the adolescents, even those being monitored by private clinics, obtained their medication through public service assistance, the results suggested that the quality of this assistance was unsatisfactory. These findings may have been due to factors that were not evaluated in this study, such as the time required to schedule medical appointments, the emergency services available, and the individualization and broadening of mental health services and services integrated with the sociocultural characteristics of the communities where these adolescents live. Therefore, services to diabetic adolescents are improved if they are organized in a multidisciplinary manner. Lawrence et al. have also reported that the type of service used by patients influences QOL. American adolescents receiving Medicare and Medicaid services have reported a worse QOL compared with those assisted through private services (21).

The lower education levels of parents as well as female gender directly reflected a worse QOL as measured by the DQOLY worries domain. This domain addresses the concerns of adolescents regarding not only their health and appearance but also their future and expectations from affective relationships. The lower education levels of parents, which indicate a lower socioeconomic status, may be associated with the insecurity of adolescents due to a lack of information and the anticipation of socioeconomic difficulties in the future. The association between the lower education levels of parents and the deterioration of the QOL of diabetic children has been a recurrent theme in the literature (21,23).

Physical activity is an important factor in the evaluation of QOL along with the health state of adolescents. A clinical trial (24) evaluating young patients with diabetes randomized

Table 4 - Sociodemographic and clinical characteristics associated with scores above the medians in the ''Satisfaction'' and ''Worries'' domains and the total score.

Characteristics	Satisfaction domain		
	PR	CI 95%	p
Type of health service			
Public	1.84	1.19 - 2.85	**0.006**
Private	1.00		
Time since diagnosis			
> 3 years	1.71	1.03 - 2.86	**0.039**
1 - 3 years	1.00		
Physical activity			
No	2.02	1.06 - 3.84	**0.032**
Yes	1.00		
Worries domain			
Gender			
Female	1.56	1.01 - 2.42	**0.048**
Male	1.00		
Total score			
Type of health service			
Public	**1.57**	**1.05 - 2.34**	**0.029**
Private	1.00		

PR = Adjusted prevalence ratio in the Poisson regression model with variable selection; and CI = confidence interval.

these subjects into either physical activity or no physical activity groups and found an improvement in the clinical control of disease and QOL in the physical activity group.

To the best of our knowledge, the present study is the first to evaluate HRQOL in diabetic adolescents living in the metropolitan region of Cuiabá. By applying the DQOLY, it was possible to identify the influences of social aspects, such as the type of medical services used and the education levels of parents, on the self-evaluation of QOL. The impacts of characteristic factors of the disease, such as evolution time and exercise, on QOL were also identified. A limitation of this study is its cross-sectional design, which made it impossible to establish causal links. Another limitation is the absence of a control group. However, the results may contribute to new treatment evaluation and monitoring procedures for adolescents with diabetes and possibly to the broadening of multidisciplinary approaches in the face of this complex and chronic disease, which originates during infancy and adolescence.

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■ AUTHOR CONTRIBUTIONS

Costa LM planned the study, conducted the survey and contributed to the interpretation of the results. Vieira SE planned the study, contributed to the interpretation of the results, wrote the paper and submitted the study.

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