



COVID-19-specific worries among people with type 2 diabetes following the continuation of the pandemic and occurrence of multiple waves of COVID-19 in Iran

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Abstract

Purpose To assess COVID-19-specific diabetes worries, and to determine characteristics of people with high levels of these worries among people with type 2 diabetes (T2D) following the continuation of the pandemic and occurrence of multiple waves of COVID-19 in Iran.

Methods An interviewer-based, cross-sectional study was conducted using 500 T2D people in a diabetes specialty clinic. The questionnaire package comprised five parts: sociodemographic and clinical characteristics, COVID-19-specific worries, diabetes-related distress, feelings of isolation and changes in diabetes-specific behaviors. Clinical history and serum measurements were collected from electronic medical records. Descriptive statistics and logistic regressions were performed in the study.

Results Worries related to COVID-19 pandemic were highly prevalent in T2D people. Around 60% were worried about being severely affected due to diabetes if infected with COVID-19 and being described as a high-risk group for COVID-19, and more than half about being possibly faced with lack of diabetes medications. Logistic regressions demonstrated that being female, higher age, diabetes-related complications, duration of diabetes, insulin use, feeling isolation, diabetes-related distress and having changed self-management behaviors were associated with being more worried about diabetes and COVID-19.

Conclusion Diabetes-related worries relating to the COVID-19 were strongly associated with poorer psychosocial status. Findings emphasize the importance of conveying up-to-date information regarding diabetes and COVID-19 that patients want and need to know, also of providing emotional support associated with COVID-19-specific diabetes worries.

Keywords COVID-19 · Type 2 diabetes · COVID-19-specific worries · Diabetes distress · Behavior

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Introduction

The coronavirus disease 2019 (COVID-19) global pandemic has affected billions of people worldwide. While different countries including Iran are struggling against fourth and fifth wave of it, the new strains still emerge and spread fast. Many COVID-19 patients have comorbidities, mostly hypertension, cardiovascular diseases and diabetes mellitus [1]. Patients with diabetes have enhanced risk of severe COVID-19 infection-related complications and poor prognosis including higher risk of hospitalization, intensive care unit admission, and even death [2, 3]. The evidence shows that deaths in people with diabetes in England have more than doubled during the COVID-19 epidemic [4].

Approximately 80% of the estimated 465 million people with diabetes worldwide live in low- and middle-income countries. With nearly 5.4 million people with diabetes, Iran ranked third in the IDF Middle East and North Africa region in 2019

[5]. Nevertheless, to date, there is limited data on the number of and outcomes of diabetes people hospitalized with COVID-19 in Iran. In a retrospective study of a total of 595 hospitalized patients with COVID-19, one quarter had diabetes. Also, at the end of the study, treatment failure and death rate were higher in patients with diabetes compared to those without [6].

Achieving and maintaining good glycemic control is the cornerstone of diabetes care and important method to avoid complications arising from COVID-19 [7]. However, it is known that diabetes management has become more difficult as a result of the pandemic and the nationwide lockdowns imposed by governments around the world [8]. It is likely that patients will struggle with challenges in controlling their diabetes. These could be due to limitation of free space to exercise, limited resources for maintaining a healthy diet, difficulties in obtaining antidiabetic drugs and supplies, and restricted access to health care [9].

Under normal conditions (no pandemic), people with diabetes experience daily worries about diabetes management such as concerns about hypo- and hyperglycemia, fear of diabetes-related complications and so on. Up to 50% of all people with diabetes experience diabetes distress in their lifetime and also are at increased risk of developing anxiety and depression and general stress [10, 11]. These worries and fears can be exacerbated and coupled with fear of COVID-19 infection during this time of crisis that, consequently, can have a more negative effect on the patients' mental health [12]. A recent cross-sectional study in Brazil found a high prevalence of emotional distress (29.2%), eating disorders (75.8%), and moderate to severe sleeping disorders (77.5%) among people with diabetes during the COVID-19 pandemic [13]. Also, results from a cross-national comparative research study in the United States (US), Brazil, and Iran during the COVID-19 pandemic showed that people with type 1 diabetes in Iran experienced higher levels of diabetes distress (57.1%), diabetes burnout (50%), and depressive symptoms (60.9%), followed by Brazil and US [14].

This study aimed to assess COVID-19-specific diabetes worries, and to determine characteristics of people with high levels of these worries among people with type 2 diabetes (T2D) following the continuation of the pandemic and occurrence of multiple waves of COVID-19 in Iran.

Methods

Study design and setting

This descriptive, cross-sectional survey was conducted in a diabetes specialty and university clinic affiliated to Tehran University of Medical Sciences in Tehran, Iran, in the

month of April 2021, during which the fourth major wave of COVID-19 driven by the British variant had started. The study adhered to the principles of Declaration of Helsinki. The Medical Research Ethics Committee of the Tehran University of Medical Sciences granted ethical approval for this study.

Study participants

All patients with T2D routinely visiting the clinic in the month of April after lockdown due to COVID-19 constituted the target population and was screened for eligibility. To be eligible, patients had to be: diagnosed with T2D; aged 18 years and older; had been registered and treated at this clinic before the start of COVID-19 pandemic; taking either oral medication or insulin to treat diabetes and providing informed consent to participate in research. Patients under 18 years of age, diagnosed with type 1 diabetes or gestational diabetes, unable to complete questionnaires, and not providing the consent were excluded from the study. All participants were informed of the goals of the study and the confidentiality and anonymity of their responses were guaranteed. All eligible patients were selected till the desired sample size was reached.

Sociodemographic and clinical characteristics

Baseline participant assessments included collection of socio-demographic and clinical measures. Respondents provided information including age, gender, body mass index, level of education, occupation, marital and smoking status. Data relating to T2D clinical history, including diagnosis, diabetes duration, treatment regimen type, diabetes-related complications, and serum measurements for fasting blood sugar (FBS), HbA1c and lipid profile were collected from electronic medical records. All serum values related to before the COVID-19 outbreak were collected and compared to values related to after the outbreak.

Study instruments

The questionnaire package comprised five parts: 1) sociodemographic and clinical characteristics, 2) COVID-19-specific worries, 3) diabetes-related distress, 4) feelings of isolation 5) changes in diabetes-specific behaviors. Data was collected through face-to-face interview using an interviewer-administered method.

Alongside with items on sociodemographic and clinical characteristics, which mentioned above, the questionnaire included items in relation to whether respondents or their family members had experienced COVID-19 symptoms or been diagnosed with COVID-19 with or without hospitalization were included as well.

COVID-19-specific worries part included a total of nine questions with dichotomous responses (yes/no) which were adopted from prior research [15] (Table 2).

Diabetes distress was measured by the brief two-item diabetes distress scale (DDS2) [16]: ‘Feeling overwhelmed by the demands of living with diabetes’ and ‘Feeling that I am often failing with my diabetes routine’. Possible scores on each item range from 1 (not a problem) to 6 (a very serious problem). The DDS2 score is derived as the average of the two items. A score > 2 shows moderate levels of distress, and a score ≥ 3 represents high levels of diabetes distress.

The degree of feeling socially isolated was measured by a 10-point scale from 1 (low) to 10 (high) [17]. People with T2D were asked to rate their feelings of isolation during the pandemic on the scale.

Changes in diabetes-specific behaviors due to the COVID-19 pandemic were measured with a yes/no list of potential behavior changes related to monitoring blood glucose, medication-taking, exercise, and diet (Table 2).

Statistical analyses

We examined descriptive statistics for participants’ baseline characteristics using percent and count for categorical variables, and means and SDs for continuous variables. The Wilcoxon test was used to compare the values of metabolic variables before and during the COVID-19.

Multiple logistic regression models were used to examine the probability of: (1) experiencing diabetes-related worries relating to the COVID-19 pandemic by sociodemographic and diabetes status factors; and (2) experiencing diabetes-related worries relating to the COVID-19 pandemic by sociodemographic and diabetes status factors, and psychosocial and behavioral variables. For each diabetes-related worry, the same base model consisting of age, gender, education level, diabetes duration, diabetes medications and presence of diabetes complications was used. In each regression, a specific explanatory psychosocial variable of interest was included. All coefficients were estimated using maximum likelihood and all coefficients are reported as odds ratios (OR) with 95% confidence intervals (CI). All P-values < 0.05 were considered statistically significant. IBM SPSS, version 24 for Microsoft Windows was used for the performance of all the statistical calculations.

Results

A total of 500 participants provided data for this study. The mean age of the individuals with T2D who participated in the study was 61.44 ± 9.52 years (ranging from 33 to 78 years), and 50% were aged between 55 and 65 years. It

was found that 52.8% were female, 50% were overweight, 83% were married, 37% were educated to diploma level, 36.6% were retired and 12.6% of participants smoked. Also, 48.4% had had a diagnosis of T2D for 11 years or more, 55.8% used oral medication for their diabetes, 55.8% had at least one diabetes complication and 69.8% had not experienced symptoms of COVID-19 since the start of the pandemic (Table 1).

Table 2 presents the descriptive analysis of each item of COVID-19-specific worries questionnaire. Participants were most frequently worried about ‘being severely affected due to diabetes if infected with COVID-19’ (63%), about ‘people with T2D being described as a high-risk group for COVID-19’ (60%), and ‘being possibly faced with lack of diabetes medications’ (56%). In total, 47% were worried about ‘not being able to manage diabetes if infected’, and more than 30% were worried about ‘possible diabetes equipment shortage’, ‘reduced quality of their diabetes care during this crisis’ and ‘insufficient access to health care team if required’.

Levels of different psychosocial and behavioral factors are shown in Table 2. Mean rating of feeling socially isolated was 5.48. Almost three quarters of participants had a mean DDS2 score higher than 2, indicating moderate to high diabetes distress. In response to questions pertaining to behavioral changes, 47.2% maintained diabetes self-management behaviors the same as pre-COVID-19. Exercise and physical activity levels were most impacted by COVID-19 and lockdown; 42.4% reported having less exercise than usual. Regarding taking medication behavior, 38.2% reported being more careful about taking medications than usual. Also, more than 35% reported checking blood glucose more often frequently than usual during the pandemic.

Interesting findings were found when comparing the values before and during the COVID-19 pandemic of HbA1c, fasting blood sugar and lipid profile. There were no significant differences between the values before and during the COVID-19 of HbA1c and fasting blood sugar (FBS). Significant decreases were observed in the values during the COVID-19 of cholesterol, triglyceride and low density lipoprotein (LDL) in compared with the values before the COVID-19 (Table 3).

Table 4 shows associations between COVID-19-specific worries and sociodemographic and diabetes status. In these analyses and later ones, we only focus on the first three prevalent worries. As shown, women more often than men experienced worries about being severely affected due to T2D if infected with COVID-19 (OR= 1.5; 95% CI: 1.10, 2.03). Women were also more worried than men about people with T2D being described as a high-risk group for COVID-19 (OR= 1.65; 95% CI: 1.25, 2.24). People with older age were less likely to worry about being possibly faced with lack of diabetes medications (OR= 0.75; 95% CI: 0.64, 0.84). People with ≥ 2 diabetes complications were more likely to

Table 1 Study population characteristics (N=500)

Characteristics	Mean ± [SD]	
Age	61.44 ± [9.52]	
	n	%
Age		
<55	88	17.6
55–65	250	50
>65	162	32.4
Body Mass Index (kg/m ²)		
<25 (normal)	111	22.2
25–30 (overweight)	250	50
≥30 (obese)	139	27.8
Sex		
Male	236	47.2
Female	264	52.8
Education level		
Primary school	150	30
High school	69	13.8
Diploma	185	37
College	96	19.2
Employment status		
Employed	101	20.2
Retired	183	36.6
Household	216	43.2
Smoking		
Current smoker	63	12.6
Non-smoker/quitted	437	87.4
Diabetes duration	12.86 ± [7.97]	
<5 years	109	21.8
6–10 years	149	29.8
≥11 years	242	48.4
Diabetes complications		
No complication	221	44.2
1 complication	198	39.6
≥ 2 complications	81	16.2
Diabetes medication		
Oral medications only	279	55.8
Insulin and oral medication	151	30.2
Insulin only	70	14
COVID-19 symptoms	151	30.2
COVID-19 tested positive	294	58.8
COVID-19 hospitalization	123	24.6

have worries about being severely affected by COVID-19 (OR= 2.11; 95% CI: 1.10, 4.44), and about being possibly faced with lack of medications (OR= 2.65; 95% CI: 1.56, 4.84) compared with people with no complications. People with diabetes duration ≥ 11 years were more likely to be worried about being severely affected (OR= 1.71; 95% CI: 1.20, 2.72) and about being faced with lack of medications (OR= 2.43; 95% CI: 1.70, 3.98) compared with people with

Table 2 Descriptive analysis of COVID-19-specific diabetes worries items, and psychosocial and behavioral factors (N=500)

Variable	N (%) or mean ± [SD]
COVID-19 specific diabetes worries	
Being severely affected due to diabetes if infected	315 (63)
People with T2D being described as a high-risk group	300 (60)
Diabetes medications shortage	280 (56)
Unable to manage diabetes if infected	235 (47)
Diabetes equipment shortage	195 (39)
Reduced quality of care of diabetes	190 (38)
Insufficient access to health care team if required	155 (31)
Unable to manage how changes in everyday life influence blood glucose	135 (27)
Food shortage	100 (20)
Isolation, scale from 1 (low) to 10 (high)	5.48 ± [3.11]
Diabetes Distress Scale (range 1–6) 2.49 ± [1.05]	
Moderate to high diabetes distress (DDS >2)	381 (76.2)
None/low diabetes distress (DDS ≤ 2)	119 (23.8)
Behavior change	
Check blood glucose more often than usual	178 (35.6)
More careful about taking medications than usual	191 (38.2)
More exercise than usual	96 (19.2)
Less exercise than usual	212 (42.4)
Eating more than usual	60 (12)
Eating less than usual	101 (20.2)
I do the same as I have always done	236 (47.2)

shorter duration of diabetes. People on both insulin and oral medication (OR= 2.88; 95% CI: 1.99, 4.88) and insulin only groups (OR= 2.70; 95% CI: 1.90, 4.72) were more likely to worry about being possibly faced with lack of medications compared with people on oral medication only group.

Table 5 shows associations between COVID-19-specific worries and psychosocial and behavioral variables. People who reported moderate to high levels of diabetes distress were more likely to have worries about being severely affected (OR= 4.76; 95% CI: 2.95, 6.95), about people with T2D being as a high-risk group (OR= 2.80; 95% CI: 1.88, 3.33) and about being possibly faced with lack of medications (OR= 4.14; 95% CI: 3.11, 7.05) compared with people with no/low distress. Likewise, participants who felt a stronger sense of isolation were more likely to experience worries (OR= 1.2 to 1.7; 95% CI: 1.2 to 1.7).

Participants who were more likely to have COVID-19-specific diabetes worries were more likely to check blood glucose more often (OR= 1.5 to 1.7; 95% CI: 1.0 to 3.0), were more careful about taking medications (OR= 2.4 to 3.1; 95% CI: 1.4 to 5.0) and did exercise more than usual (OR= 1.5 to 1.7; 95% CI: 1.2 to 2.2). Eating more or less than usual were both associated with having worry about

Table 3 Metabolic variables of people with T2D before and after the COVID-19

Variables	Pre-COVID Median (min-max)	Post-COVID Median (min-max)	Z(p)
HbA1c (%)	7.6 (5.9–14.9)	7.7 (5.7–11.8)	–1.49 (0.14)
Fasting Blood Sugar (mg/dl)	134 (72–421)	138.5 (70–356)	–0.51 (0.61)
Cholesterol (mg/dl)	136.5 (86–240)	130 (67–280)	–1.97 (0.04)
Triglyceride (mg/dl)	117 (45–492)	115 (45–369)	–2.29 (0.02)
Low Density Lipoprotein (mg/dl)	71.5 (26–156)	61 (22–163)	–2.78 (0.005)
High Density Lipoprotein (mg/dl)	43 (26–86)	42 (19–104)	–0.63 (0.52)

Z: Wilcoxon test

Table 4 Logistic regression estimates of experiencing COVID-19 worries by sociodemographic and diabetes status variables

	Worries about being severely affected if infected with COVID-19 due to T2D	Worries about people with T2D being described as a high-risk group	Worries about being possibly faced with lack of diabetes medications
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Sex, female vs. male	1.50** (1.10–2.03)	1.65*** (1.25–2.24)	1.05 (0.78–1.27)
Age, years	1 (0.89–1.01)	1 (0.90–1.01)	0.75** (0.64–0.84)
Education (reference: primary school)			
High school	0.95 (0.53–1.56)	0.91 (0.53–1.09)	0.97 (0.64–1.39)
Diploma	1.17 (0.72–1.81)	1.05 (0.52–1.65)	0.81 (0.45–1.45)
College	1.15 (0.54–2.32)	1.32 (0.44–2.46)	1 (0.99–1.01)
Current smoker vs. non-smoker/ quitted	0.90 (0.7–1.43)	0.88 (0.67–1.39)	1 (0.88–1.08)
Diabetes complications (reference: no complication)			
1 complication	1.83** (1.51–2.10)	1.11 (0.69–1.77)	1.49** (1.03–1.78)
≥ 2 complications	2.11*** (1.10–4.44)	1.31 (0.88–1.91)	2.65*** (1.56–4.84)
Diabetes duration (reference: <5 years)			
6–10 years	1.23** (1.02–1.52)	1.08 (0.88–1.78)	1.12 (0.75–1.90)
≥11 years	1.71** (1.20–2.72)	1.31 (0.65–1.71)	2.43*** (1.70–3.98)
Diabetes medication (reference: oral medication only)			
Insulin and oral medication	1.23 (0.95–1.60)	1.30 (0.98–1.72)	2.88*** (1.99–4.88)
Insulin only	1.37 (0.87–2.10)	1.10 (0.85–2.05)	2.70*** (1.90–4.72)

OR: odds ratio, CI: confidence interval

** $P < 0.05$, *** $P < 0.01$

being severely affected by COVID-19 compared with people eating as usual (OR= 2.11; 95% CI: 1.39, 3.25 and 2.89; 1.88, 4.30) (Table 5). Participants who reported maintaining diabetes self-management behaviors the same as always (OR= 0.61 to 0.69; 95% CI: 0.48 to 0.88) were less likely to be worried than those participants who reported changing their behaviors.

Discussion

The present study assesses psychosocial consequences of the COVID-19 pandemic and changes in self-management behaviors and clinical outcomes in people with T2D. Our study of 500 outpatients with T2D indicated that worries

relating to the COVID-19 pandemic were highly prevalent. Logistic regression analysis showed that COVID-19-specific diabetes worries were significantly associated with being female, higher age, presence of diabetes-related complications, longer duration of diabetes, feelings of isolation, higher levels of diabetes-related distress and changes in self-management behaviors.

In this study, participants most frequently worried about being severely affected due to T2D if infected with COVID-19 (63%) and that people with T2D are described as a high-risk group (60%). This is consistent with previous studies which showed that a large percentage of patients with diabetes were worried about COVID-19 [15, 18]. Research suggests that T2D is associated with increased risk of hospitalization, admission to intensive care units and death for

Table 5 Logistic regression estimates of experiencing COVID-19 worries by psychosocial and behavioral variables

	Worries about being severely affected if infected with COVID-19 due to T2D	Worries about people with T2D being described as a high-risk group	Worries about being possibly faced with lack of diabetes medications
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Moderate/high vs. none/low diabetes distress	4.76*** (2.95–6.95)	2.80*** (1.88–3.33)	4.14*** (3.11–7.05)
Isolation, scale from 1 (low) to 10 (high)	1.70*** (1.65–1.71)	1.23*** (1.19–1.29)	1.55*** (1.49–1.59)
Diabetes-related behavioral changes			
Check blood glucose more often than usual	1.66** (1.03–3.01)	1.54** (1.05–2.95)	1.52** (1.02–2.65)
More careful about taking medications than usual	2.44*** (1.44–3.98)	2.47*** (1.57–3.94)	3.10*** (1.94–5.02)
More exercise than usual	1.59** (1.22–1.90)	1.48** (1.17–2.09)	1.70*** (1.30–2.20)
Less exercise than usual	1.11 (0.65–1.80)	0.89 (0.60–1.41)	0.99 (0.45–1.52)
Eating more than usual	2.11*** (1.39–3.25)	1.30 (0.83–2.34)	1.20 (0.86–1.70)
Eating less than usual	2.89*** (1.88–4.30)	1.35 (0.93–1.90)	1.69** (1.09–2.85)
I do the same as I have always done	0.65*** (0.48–0.85)	0.69*** (0.56–0.88)	0.61*** (0.48–0.76)

Models are controlled for age, sex, education, diabetes complications, diabetes duration and diabetes medication

OR: odds ratio, CI: confidence interval

P < 0.05, *P < 0.01

COVID-19 [2, 19]. Results from a recent meta-analysis suggest that the likelihood of death is higher in diabetes patients hospitalized with COVID-19 compared with non-diabetes patients [20].

In our study, more than half of participants were worried about being possibly faced with lack of diabetes medications. Also, our results found that those participants who were on insulin alone or insulin with oral medications were more likely to be worried about being faced with shortages of diabetes medications compared with participants who were on oral medications only. One possible reason for this could be the severe insulin shortage that the country has been facing since before the pandemic [21] and has intensified during this crisis as well.

Diabetes related psychological distress (negative emotions and burden of self-management) could aggravate during the psychological stress in the wake of COVID-19 [12] and also some factors such as gender, time since diabetes diagnosis and presence of complications moderate the levels at which distress are experienced [22]. In our study, 76.2% experienced moderate to high levels of diabetes distress after more than one year of the onset of the pandemic. Our results also showed that experiencing higher levels of diabetes distress were related to experiencing COVID-19 specific worries. Women, people with a longer duration of diabetes and people with diabetes complications were more likely to show COVID-19 worries than men, people with a shorter duration of diabetes and people without complications, respectively.

This is in line with earlier findings of predictors for diabetes distress [22, 23].

Our results also revealed that people who felt a stronger sense of isolation were more likely to be worried. One longitudinal mediation analysis of 3005 adults aged 57–85 years in the USA found that higher amounts of perceived isolation predicted higher amounts of depression and worry symptoms, and also in the reverse direction, depression and worry symptoms predicted higher amounts of perceived isolation [24].

Our study demonstrated that people who reported having more worries were more likely to check their blood glucose, were more careful about taking their medications and exercised more. This behavior may reduce feelings of worry as exercise is associated with lower levels of stress and anxiety [25]. In our study, people eating more or less than usual were more than twice as likely to worry about being severely affected by COVID-19. This could kind of be considered as an adaptive reaction to the current situation. When people are stressed they tend to find irregular eating habits, which in turn can make the management of blood sugar more difficult [26]. Our findings emphasize the importance of conveying up-to-date information regarding diabetes and COVID-19 that people with T2D want and need to know, also of providing emotional support associated with specific worries related to diabetes and COVID-19.

Our study showed no significant differences between the values before and during the COVID-19 of HbA1c and FBS. Moreover, significant decreases were observed in the values during the COVID-19 of cholesterol, triglyceride and LDL when compared to the values before the COVID-19. This could be indicative of an increase in the degree of personal responsibility the people with T2D participating in our study are willing to assume towards their self-care management during this crisis and thus, subsequent improvements in the self-management levels and clinical outcomes [27, 28].

Convenience sample of participants who may generally be healthier than the average individual with T2D is one of limitations in this study. Another limitation is that our study focuses on patient self-reported measures and is subject to social desirability biases. However, disease and clinical values were obtained from electronic medical records. Our cross-sectional study design is the third limitation that can be mentioned, so we cannot draw any conclusions regarding the causality.

Conclusion

It was found as a result of the research that worry related to being severely affected by COVID-19 among people with T2D was prevalent. Also, after more than one year from the onset of the crisis, people with T2D were highly worried about being faced with lack of diabetes medications. This study showed the significant changes in diabetes self-management behaviors among our participants during the pandemic. This may also explain in part why glycemic control has not been impacted by the pandemic.

Our findings could be helpful in the efforts to provide better emotional and educational support for people with T2D to cope with their distress and anxiety during the pandemic. Finally, our study suggests that certain groups of people with T2D including people with diabetes complications, people with longer duration of diabetes and people on insulin may require additional emotional support.

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Conflict of interest All of the authors declare no known conflict of interest.

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