ORIGINAL RESEARCH

Association of the Coronavirus Disease 2019 Outbreak on the Diabetes Self-Management in Chinese Patients: An Analytical Cross-Sectional Study

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Background: The coronavirus disease 2019 (COVID-19) outbreak has seriously affected people's lives, especially those with chronic diseases. Diabetes self-management, which plays an important role in glycaemic control and reducing the risk of acute and long-term complications, may be discouraged by social distancing.

Purpose: To evaluate the level of self-management activities in Chinese patients with type 2 diabetes mellitus (T2DM) during the COVID-19 pandemic.

Patients and Methods: A survey of with 872 patients with T2DM in the inpatient and outpatient departments through face-to-face interviews was conducted from 1 July, 2020 to 30 September, 2020. The main outcome measures were glycaemic control status and level of self-management activities during the pandemic.

Results: In terms of glycaemic control, the data showed that patients with fasting plasma glucose (FPG) < 7.0 mmol/L (36.4%), postprandial plasma glucose (PPG) < 10.0 mmol/L (26.3%), or glycosylated haemoglobin (HbA1c) < 7.0% (18.6%) in our investigation has well-controlled blood glucose level, and 11.9% of patients experienced blood glucose <3.9 mmol/L during the outbreak. The diabetes self-management of Chinese patients decreased and the final diabetes self-management score of the Chinese patients was 3.4 ± 1.45. Patients with higher education, diabetes education, comorbidities, and online consultations had higher diabetes self-management scores ($P <0.05$). Adherence to diabetes self-management in the normal glycaemic control group was higher than that in the substandard glycaemic control group ($P<0.05$). Among all participants, 72.1% of the patients reduced the frequency of hospital visits, and 44.8% considered that they had diabetes-related stress during the pandemic. The mean anxiety level score rated by 286 patients was 5.3±2.8.

Conclusion: The COVID-19 pandemic has affected diabetes self-management, including substandard glycemic control, increased diabetes-related stress, limited exercise range and medical visits. Therefore, future interventions should focus on the online management of chronic diseases and support online consultation' development and promotion, which can overcome physical distance and provide personalized services conveniently.

Keywords: coronavirus disease 2019, diabetes self-management, online consultation, type 2 diabetes mellitus

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has affected countries across the globe and taken tens of thousands of lives, caused by a contagious coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection.

In the early stage of the outbreak, COVID-19 spread rapidly in all parts of China, causing different degrees of illness.[1] A retrospective cohort study suggested that nearly half of the patients who suffered from the COVID-19 have comorbidity at the same time, including diabetes.[2]

Diabetes is a chronic disease, resulting from an impairment in insulin action or insulin secretion, and its prevalence is going up. Diagnosed according to the American Diabetes Association (ADA) criteria, the prevalence of diabetes among Chinese adults has risen to 12.8%.[3] It has been reported that people with diabetes are more likely to be infected[4] and reach the composite end-points[5,6] because patients with diabetes have the problem of immunity decline,[7] acting on phagocytosis, chemotaxis, the bactericidal activity of neutrophils and macrophages.[8] However well-controlled blood glucose can improve the prognosis.[6] According to the latest diabetes prevention and treatment guidelines issued by the National Diabetes Association, self-management education for patients with diabetes is the key to reducing the risk of acute and long-term complications.[9] Self-management consists of adherence behaviors such as dietary changes, exercise, self-monitoring of blood glucose, regular self-medication and follow-up. Diabetes self-management in Chinese patients with T2DM is suboptimal. Studies have shown that the average score of diabetes self-management in Chinese people with T2DM was nearly half of the total possible score.[10] With the spread of novel coronavirus continuously and rapidly, China has instituted some measures to achieve social distancing, which may lead to more unsatisfactory diabetes self-management. A study from Spain found that consumption of sugary foods and snacks increased and physical activity dropped significantly during the COVID-19 lockdown.[11] But nearly half of all respondents from a Polish study stated that their diabetes self-management had significantly improved.[12]

The current situation of self-management of patients with diabetes during the pandemic lacks a relevant data and sufficient evidence in China. Therefore, we designed a questionnaire to determine how Chinese patients with diabetes coped and adjusted during the pandemic period.

Materials and Methods
Participants
The survey was conducted between in South China between July and September 2020. Trained interviewers in the clinic interviewed individual participants face-to-face. The inclusion criterion was that type 2 diabetes mellitus (T2DM) duration of not < 3 months. The exclusion criteria included psychiatric disorders with psychotic phenomena, language barriers, and a significant lack of vision or hearing. In addition, we evaluated the glycaemic control of patients based on the standards of medical care in diabetes.[13,14] If the patient's fasting plasma glucose (FPG) ranged from 3.9 to 7.0 mmol/L, postprandial plasma glucose (PPG) < 10.0 mmol/L and glycosylated haemoglobin (HbA1c) < 7%, we think that blood glucose level was well controlled. Moreover, hypoglycemia was defined as symptomatic or asymptomatic plasma glucose ≤ 3.9 mmol/L according to the ADA criteria.

The study protocol was approved by the Ethics Committee of Zhujiang Hospital, Southern Medical University, China. The survey was going on following the Declaration of Helsinki. All the participants provided informed consent.

Questionnaires
Questionnaires including demographic information, glycaemic control status, diabetes education, and the Summary of Diabetes Self-Care Activities (SDSCA) [15] were used. The SDSCA is a self-report questionnaire developed by Toobert et al to measure diabetes self-management behaviour. According to the actual situation of the Chinese people, we chose some questions from the SDSCA, translated them into Chinese, and used them to assess diabetes management during novel coronavirus outbreak. The demographic characteristics included age, gender, education level, and body mass index (BMI). Glycaemic control status was based on the HbA1c, FPG, and PPG levels. Medical records included the duration of diabetes, treatment regimen, complications, comorbidities, and blood pressure. Participants were asked if they experienced diabetes-related stress during the pandemic. If the answer is yes, the patient should rate the degree on a scale of 1 (slightly anxious) to 10 (strongly anxious).

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) software (version 26.0) was used to analyse the data. We used frequencies and percentages to summarise categorical variables. Continuous variables were described as mean and standard deviation (SD) or median and interquartile range, as appropriate. We divided patients into two groups based on their self-assessment of diabetes self-management. Chi-square test and independent samples *t*-test were used to test for significance. Single-factor analysis was used to compare the mean values of each group and evaluate whether there were significant differences.

Results

In total, 872 patients were eligible and agreed to participate in the study. The content validation index of the questionnaire was 0.748, and Cronbach's alpha index was 0.708.

Demographic Characteristics

The demographic information of the participants is presented in Table 1. The median age of the participants was 58.0 years (interquartile range, 50–67 years), and 43.9% were female. Normal BMI was observed in 47.7% of the study cohort, overweight (33.6%), obesity (11.4%), and underweight (4.1%). Most patients had less than 12 years of education, and 130 patients (14.9%) had a university degree or above.

Health and Diabetes-Related Variables of Study Participants

The median duration of diabetes mellitus was 7.0 years (interquartile range, 3.0 to 12.0) (Table 2). More than half (65.4%) of the participants reported that they already had complications from diabetes. Comorbidities such as hypertension, coronary heart disease, abnormal lipid metabolism, and gout were present in 73.5% of the respondents. Over half of

Table 1 The Demographic Information of the Study Patients

Variable	All Patients (n=872)	Self-Management Compliance		X^2	P
		Good (n=606)	**Poor (n=266)**		
Age, Median (IQR)	58.0(50.0–67.0)	59.0 (50.0–67.0)	59.0(52.0–67.0)		0.118
Female, n (%)	383(43.9%)	272 (44.9%)	111(41.7%)	0.747	0.387
BMI, kg/m², n (%)				18.008	<0.001
Underweight (≤18.4)	36(4.1%)	24(4.0%)	12(4.5%)		
Normal BMI (18.5–23.9)	416(47.7%)	317(52.3%)	99(37.2%)		
Overweight (24.0–27.9)	293(33.6%)	189(31.2%)	104(39.1%		
Obese (≥28)	99(11.4%)	58(9.6%)	41(15.4%)		
Education, n (%)				6.069	0.108
Primary school and below	228(26.1%)	149(24.6%)	79(29.7%)		
Junior high	278(31.9%)	191(31.5%)	87(32.7%)		
Senior high	236(27.1%)	165(27.2%)	71(26.7%)		
Bachelor and above	130(14.9%)	101(16.7%)	29(10.9%)		
Living status, n (%)				5.038	0.81
Live with family	808(92.7%)	568(93.7%)	240(90.2%)		
Live lonely	52(6.0%)	29 (4.8%)	23(8.6%)		
Other (nursing home, etc.)	12(1.4%)	9(1.0%)	3(0.3%)		
Smoking, n (%)	195(22.4%)	124(20.5%)	71(26.7%)	4.132	0.042
Drinking, n (%)	115(13.2%)	72(11.9%)	43(16.2%)	2.964	0.085

Note: We divided patients into two groups based on their self-assessment of diabetes self-management. Chi-square test and Independent-Sample *t*–Test were used to test for significance.
Abbreviation: BMI, body mass index.

Table 2 Health and Diabetes-Related Variables of Participants (n = 872)

Variable	All Patients (n= 872)	Self-Management Compliance		X^2	P
		Good (n=606)	Poor (n=266)		
Diabetes duration, year, median (IQR)	7.0(3.0–12.0)	7.0(3.0–12.0)	10.0(4.0–11.0)		0.94
Received diabetes education, n (%)	643(73.7%)	522(86.1%)	121(45.5%)	157.740	<0.001
Sources of Diabetes Education, n (%)				12.868	0.045
Health professionals	485(37.8%)	390(36.6%)	95(43.8%)		
Community health counseling spot	283(22.1%)	243(22.8%)	40(18.4%)		
Journals/books	146(11.4%)	122(11.5%)	24(11.1%)		
TV/radio	200(15.6%)	169(15.9%)	31(14.3%)		
Internet/APPs	144(11.2%)	119(11.2%)	25(11.5%)		
Others	24(1.9%)	22(2.1%)	2(0.9%)		
Medical history, n (%)				17.885	0.007
None	343(26.5%)	254(28.9%)	89(21.5%)		
Hypertension	409(31.7%)	275(31.3%)	134(32.4%)		
Cerebrovascular disease	120(9.3%)	77(8.8%)	43(10.4%)		
Coronary heart disease	120(9.3%)	75(8.5%)	45(10.9%)		
Lipid metabolism abnormal	248(19.2%)	168(19.1%)	80(19.3%)		
Others	52(4.0%)	29(3.3%)	23(5.6%)		
Diabetic complications, n (%)				6.842	0.446
None	420(34.6%)	294(35.5%)	126(32.7%)		
Diabetic foot	35(2.9%)	22(2.7%)	13(3.4%)		
Nephropathy	104(8.6%)	68(8.2%)	36(9.4%)		
Peripheral vascular disease	134(11.0%)	97(11.7%)	37(9.6%)		
Neuropathy	307(25.3%)	211(25.5%)	96(24.9%)		
Retinopathy	191 (15.7%)	124(15.0%)	67(17.4%)		
Others	23(1.9%)	13(1.6%)	10(2.6%)		
Treatment regimen, n (%)				29.994	<0.001
OAD only	449(51.5%)	330(54.5%)	119(44.7%)		
Insulin (OR GLP-1)	151(17.3%)	95(15.7%)	56(21.1%)		
OAD + insulin (OR GLP-1)	249(28.6%)	177(29.2%)	72(27.4%)		
Not on medication treatment	20(2.3%)	4(0.7%)	16(6.0%)		
Not available	3(0.3)	0(0.0%)	3(1.1%)		

Abbreviations: OAD, oral anti-diabetic drug; GLP-1, glucagon like peptide 1.

the participants were giving a positive answer when asked whether their diabetes self-management had been ongoing at this particular time.

For glucose monitoring, approximately 85.0%, 62.7%, and 53.8% of the patients had FPG, PPG, and HbA1c records, respectively (Table 3). In terms of glycaemic control, the data showed that patients with FPG < 7.0 mmol/L (36.4%), PPG < 10.0 mmol/L (26.3%), or HbA1c < 7.0% (18.6%) in our investigation has well-controlled blood glucose level, and 11.9% of patients reported that they experienced blood glucose < 3.9 mmol/L during the outbreak. We believe that these patients had hypoglycemia. The remaining patients did not have their blood glucose recorded or not measured.

Impact of the COVID-19 Pandemic on Diabetes Self-Management

All participants reported four aspects of diabetes self-management within 7 days, including exercise, medication adherence, monitoring of complications, and blood glucose monitoring (Table 4). The final mean of diabetes self-management was 3.4 ± 1.3 per week. Medication adherence, which they did the best, was calculated with a mean score of 6.3 ± 1.7 per week. However, the mean score of self-examinations of diabetes-related complications was 1.6 ± 2.2 only.

The COVID-19 pandemic has caused them to visit their physicians for routine clinical follow-ups. The majority of the patients (72.1%) reduced the frequency of hospital visits, while the remaining patients did not report any changes. In addition, 45.8% of the participants reported that they had consulted online, while 69.7% had consulted offline. Nearly

Table 3 The Glycemic Control Status of Participants During the COVID-19 Pandemic. (n = 872)

Variable	All Patients (n= 872)	Self-Management Compliance		X^2	P
		Good (n=606)	Poor(n=266)		
HbA1c, %, median (IQR)	7.5(6.7–9.2)	7.4(6.5–8.7)	8.1(7.2–10.4)	17.015	<0.001
<7.0%, n (%)	162(18.6%)	137(22.6%)	25(9.4%)		
7.0–8.0%, n (%)	127(14.6%)	93(15.3%)	34(12.8%)		
>8.0%, n (%)	180(20.6%)	117(19.3%)	63(23.7%)		
Not Available, n (%)	403(46.2%)	259(42.7%)	144(54.1%)		
FPG, mmol/L, median (IQR)	7.3(6.4–8.8)	7.1(6.3–8.2)	8.4(7.0–10.4)	23.293	<0.001
< 6.1 mmol/L, n (%)	138(15.0%)	113(18.6%)	25(9.4%)		
6.1–7.0 mmol/L, n (%)	187(21.4%)	154(25.4%)	33(12.4%)		
> 7.0 mmol/L, n (%)	416(47.7%)	276(45.5%)	140(52.6%)		
Not Available, n (%)	131(15.0%)	63 (10.4%)	68(25.6%)		
PPG, mmol/L, median (IQR)	10.7(9.0–13.2)	10.3(8.9–12.5)	12.0(9.5–15.5)	19.869	<0.001
<8.0 mmol/L, n (%)	55(6.3%)	39(6.4%)	16(6.0%)		
8.0–10.0 mmol/L, n (%)	174(20.0%)	150(24.8%)	24(9.0%)		
>10.0 mmol/L, n (%)	318(36.5%)	216(35.6%)	102(38.3%)		
Not available, n (%)	325(37.3%)	201(33.2%)	124(46.6%)		
Hypoglycemia(<3.9mmol/L), n (%)	104(11.9%)	80(13.3%)	24(9.0%)	3.073	0.08
Blood pressure				22.494	<0.001
Good(<140/90mmHg)	518(59.4%)	391(64.5%)	127(47.7%)		
Uncontrolled(≥140/90mmHg)	204(23.4%)	128(21.1%)	76(28.6%)		
Not available	150(17.2%)	87(14.4%)	63(23.7%)		

Notes: For glucose monitoring, approximately 85.0% (n=741), 62.7% (n=547), and 53.8% (n=469) of the patients had FPG, PPG, and HbA1c records, respectively.
Abbreviations: FPG, fasting blood glucose; PPG, postprandial plasma glucose.

Table 4 Impact of Covid-19 Pandemic on Diabetic Self-Management (n=872)

Variable	All Patients (n=872)	Self-Management Compliance		X^2	P
		Good (n=606)	Poor (n=266)		
Exercise (days/week), mean (SD)	3.4(2.5)	4.0(2.3)	2.1(2.3)		<0.001
Medication compliance(days/week), mean (SD)	6.3(1.7)	6.6(1.2)	5.8(2.2)		<0.001
Blood glucose testing (days/week), mean (SD)	2.3(1.9)	2.5(1.9)	1.8(1.8)		<0.001
Complications monitoring (days/week), mean (SD)	1.6(2.2)	1.7(2.3)	1.2(2.0)		<0.001
The final mean of diabetes self-management, mean (SD)	3.4(1.3)	3.7(1.2)	2.7(1.3)		<0.001
Reduce the number of visits to hospitals, n (%)	629(72.1%)	455(73.4%)	184(69.2%)	1.668	0.196
Online consultation, n (%)	399(45.8%)	272(44.9%)	127(47.7%)	0.609	0.435
Offline consultation, n (%)	608(69.7%)	448(73.9%)	160(60.2%)	16.622	<0.001
Diabetes-related stress, n (%)	391(44.8%)	289(47.7%)	102(38.3%)	6.525	0.011
Degree of diabetes-related stress(n=286), mean (SD)	5.3(2.8)	5.1(2.8)	6.0(2.8)		
Treatment way, n (%)				25.197	<0.001
Community hospital	465(36.2%)	337(36.2%)	128(3639%)		
Comprehensive hospital	699(54.5%)	506(54.4%)	193(54.7%)		
Buy medicine online	17(1.3%)	11(1.2%)	6(1.7%)		
Internet clinic	26(2.0%)	24(2.6%)	2(0.6%)		
Mobile phone application	12(0.9%)	9(1.0%)	3(0.8%)		
Others	64(5.0%)	43(4.6%)	21(5.9%)		

Abbreviation: SD, Standard Deviation.

half the participants (44.8%) considered that they had diabetes-related stress during the pandemic (Table 4). A total of 286 patients rated their anxiety levels on a scale of 1 (slightly anxious) to 10 (strongly anxious), and the mean score was 5.3 ± 2.8. Patients who self-perceived not having self-management during the outbreak had higher anxiety levels than those with self-management (6.0 versus 5.1).

Table 5 Comparison of Self-Management Data Among Different Variables

Variable	Self-Management Status	
	Mean (SD)	P value
Age (year)		0.008
≤60	3.5(1.3)	
>60	3.3(1.3)	
BMI (kg/m^2)		0.497
Underweight (≤18.4)	3.4(1.8)	
Normal BMI (18.5–23.9)	3.4(1.3)	
Overweight (24.0–27.9)	3.5(1.3)	
Obese (≥28)	3.3(1.4)	
Sex		0.102
Female	3.3(1.3)	
Male	3.4(1.3)	
Education		<0.001
Primary school and below	2.9(1.4)	
Junior high	3.5(1.3)	
Senior high	3.5(1.2)	
Bachelor and above	3.8(1.2)	
Living status		0.049
Live with family	3.4(1.3)	
Live lonely	3.1(2.0)	
Orders (nursing home, etc.)	4.1(1.9)	
Diabetes duration (year)		0.070
<5	3.4(1.2)	
5–10	3.3(1.4)	
11–15	3.3(1.3)	
16–20	3.8(1.5)	
>20	3.3(1.4)	
Received diabetes education		<0.001
Yes	3.6(1.3)	
No	3.0(1.4)	
Self-assessment of diabetes self-management		<0.001
Good	3.7(1.2)	
Poor	2.7(1.3)	
Complication		0.115
Absent	3.4(1.4)	
Present	3.3(1.2)	
Comorbidities		0.014
Absent	3.5(1.4)	
Present	3.3(1.2)	
Online consultation		0.012
Yes	3.5(1.4)	
No	3.3(1.2)	
HbA1c, %		<0.001
<7.0%	3.6(1.2)	
7.0–8.0%	3.5(1.4)	
>8.0%	3.0(1.1)	

Note: Nonparametric Test and One-way ANOVA were used.

Comparison of Diabetes Self-Management Between Different Variables

The effects of demographic factors and health risks on diabetes self-management are shown in Table 5. Patients with higher education levels had higher diabetes self-management scores than those with lower education levels ($P < 0.001$). Patients who received diabetes education and insisted on self-management had higher diabetes self-management scores than those who did not. The self-management scores of patients with comorbidities differed significantly from those without comorbidities ($P < 0.05$). Adherence to diabetes self-management was higher in the normal glycaemic control group than in the not-well glycemic control group ($P < 0.05$). Patients who had consulted online performed well in diabetes self-management ($P < 0.05$). No significant differences in BMI, complications, diabetes-related stress, or comorbidities were found.

Discussion

This study was conducted to investigate diabetes self-management in patients with T2DM whose diabetes duration was no less than 3 months in China during the pandemic, demonstrating that the pandemic had a major impact on diabetes self-management. To reduce the risk of infection and transmission of COVID-19, social distancing, travel restrictions, stay-at-home guidance, and quarantine practices are required, which may worsen glycaemic control, reduce the frequency of exercise, change routine clinical follow-ups, and increase diabetes-related stress. A previous study interviewed 12 patients with T2DM during isolation in Wuhan, China, and found that they had barriers to diabetes self-management, including lack of resources and knowledge.[16] The average score of diabetes self-management in Chinese people with T2DM during the pandemic was lower than before.[10]

According to this study, we found that glucose control was generally substandard during the COVID-19 pandemic. More than half of the patients' FPG, PPG, and HbA1c were not up to the standard, which is similar to previous reports in Wuhan.[17] It was well-known that glucose control was associated with diabetes management.[18] Compared with patients with few self-management scores, patients with more self-management scores had better glycaemic control. However, among the 872 participants in this study, most had less overall practice in diabetes self-management, especially in complications and blood glucose monitoring, which is similar to previous studies.[19]

Owing to these official control measures for COVID-19, some patients with T2DM have experienced difficulty in diabetes self-management. Social quarantine and lockdowns had limited physical activity. This study showed that the mean score of the exercise was 3.4 ± 2.5 on a scale of 0 to 7 during the pandemic, which means exercise was inadequate and may lead to deterioration in glycaemic control. It is known that regular physical activity has significant physical and psychological benefits.[20] More people reported that they preferred to take a walk near their home or exercise at home because of the limitation of activity scope. A brief survey published in a Polish study showed a statistically significant increase in the number of walks taken by patients with diabetes during this period.[12] Therefore, during the outbreak, we can guide people with diabetes to perform appropriate exercises at home, such as walking and doing housework, or promote some simple and suitable exercise gymnastics that do not require too much space.

Adults with diabetes have reported significant changes in their healthcare. The number of patients with diabetes outpatient visits decreased in response to social distance guidance. Most of participants said they had reduced the number of visits to hospitals for fear of cross-infection, which would result in the hypoglycaemic regimen for patients with substandard glycaemic control not being adjusted in a timely manner. However, the shift in the medium of clinical consultation from face-to-face to online communication is surprising.

With smartphones prevailing in most households, online consultation has emerged which can help patients keep in contact with their routine physicians via mobile applications and web pages. As a result, care provided by diabetes-related professionals can be accessed more easily than face-to-face contact.[21] Our study demonstrated that some of the respondents (45.8%) consulted online via WeChat Subscription, Doctor Ant, Baidu, Home of Diabetes, and other online platforms. Online consultations can help make it easier to access care without being exposed to the infection. First, online consultation can guide patients with diabetes to properly monitor their condition to emphasise the correct diet, exercise, and drugs. It can also help patients avoid fluctuations in blood glucose levels and prevent hypoglycaemia. A substantial number of patients lack education about the appropriate response to hyperglycaemia or hypoglycaemia. Previous studies have shown that diabetes apps can improve patients' understanding of the disease and their ability to self-manage.[22,23]

Consistent with this finding, patients who consulted online had better glycaemic control and self-care behaviours in our study. In addition, mobile app-based consultation can reduce healthcare costs when patients care away from healthcare organizations.[24] More importantly, online consultation provided comfort and peace of mind to anxious patients in this outbreak because the questions that make them anxious and helpless can be answered in time.

Although online consultation can overcome physical distance and provide timely physician care, it is still in its infancy and faces numerous challenges,[25] including technological difficulties and lack of access to lab reports. The participants who refused to consult online in our survey explained that they were inexperienced in using the online platform and got used for traditional in-person visits. Therefore, broader access to digital health, and patient training, and simplifying procedures are the next priorities. Otherwise, the tool meant to bring convenience, will also become another burden.[26] At the same time, although there are various applications for diabetes self-management, they have not been designed perfectly and tested rigorously; thus, both patients and clinicians do not have direct evidence to guide them in their choice. More importantly, device manufacturers are reluctant to interoperate with third-party devices because they do not want to risk losing their exclusivity.[21]

Previous studies have shown a significant increase in common and diabetes-related stress in adults with T2DM compared with pre-pandemic levels,[27] associated with the emergence of the pandemic and not knowing how to make appropriate adjustments in time. The results of our study revealed that 44.8% of the participants reported the presence of diabetes-related stress during the pandemic. Similar to this study, diabetes-related stress may be related to the change in diabetes management in previous studies, affecting blood glucose control.[28] It was reported that higher levels of depression are associated with decreased quality of life, unhealthy diets, and lack of physical activity.[29] These aspects are also the influence by the novel coronavirus pandemic in our lives. Several reports have suggested that aggressive interventions should be undertaken, including increasing online consultation and establishing connections with the healthcare community.[30]

It is difficult to deny that something like the novel coronavirus will happen again. Furthermore, with the rise of diabetes prevalence, the diabetes community will increasingly face public health challenges in the following days,[31] impacting the traditional diagnosis and treatment mode and chronic disease management model, such as the 2009 H1N1 pandemic[32] and 2003 severe acute respiratory syndrome epidemic.[33] Because of the new dawn that the diagnosis and treatment line has brought to chronic disease management during the pandemic, we think it is necessary to develop online consultation.

This study had some limitations that must be acknowledged. First, the sample size in the survey was large but only covered South China. In addition, no non-diabetes comparison group and adults with type 1 diabetes mellitus (T1DM) were included. As a result, it is not known whether patients with T2DM, T1DM, or patients without diabetes respond similarly to the pandemic. Another limitation was that this study was retrospective, therefore, some respondents could not recall the information they had to provide completely or accurately.

Conclusion

The novel COVID-2019 pandemic has impacted the self-management of patients with T2DM, including substandard glycemic control, limited exercise range and medical visits, and increased anxiety. We should not only adapt to it, but also seek a new management model. Online consultation can overcome distance limitations, increase physician-patient interaction, provide patients with health information, timely advice on improving health behaviors, and social and psychological support. Therefore, attention should be paid to the online management of chronic diseases and to support the development and promotion of online consultation.

Abbreviations

COVID-19, the coronavirus disease 2019; T2DM, type 2 diabetes mellitus; FPG, fasting plasma glucose; PPG, postprandial plasma glucose; HbA1c, glycosylated haemoglobin; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; ADA, American Diabetes Association; SDSCA, summary of diabetes self-care activities; BMI, body mass index; SD, standard deviation; OAD, oral antidiabetic drug; GLP-1, glucagon-like peptide 1; BP, blood pressure.

Ethics Approval

Waiving to sign the informed consent will not adversely affect the rights and health of the participants. The privacy and personal information of the participants were protected. In this study, all patients were anonymised. The risk of the study to the participants was not greater than the minimum risk. The research protocol was approved by the Ethics Committee of Zhujiang Hospital, Southern Medical University, China (approval no. 2021-KY-177-01). The survey was in accordance with the Declaration of Helsinki. All the participants provided informed consent.

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Disclosure

The authors report no conflicts of interest in this work.

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