Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Impact of worries associated with COVID-19 on diabetes-related psychological symptoms in older adults with Type 2 diabetes

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ABSTRACT

This study examined the associations between worries associated with COVID-19, diabetes-specific distress, and depressive symptoms in older adults with type 2 diabetes (T2D), who are particularly vulnerable to COVID-19 and its psychological impacts. A cross-sectional online survey was conducted with 84 older adults with T2D from June to December 2020. Participants had little to moderate worries associated with COVID-19, with the greatest worries about the economy recession, followed by a family member catching COVID-19, lifestyle disruptions, and overwhelmed local hospitals. Bivariate correlation and tobit regression revealed that increases in worries associated with COVID-19 were associated with increased diabetes distress and depressive symptoms. Specifically, worries associated with COVID-19 increased diabetes-specific emotional burden and physician-related and regimen-related distress. Increased diabetes distress and depressive symptoms worsened by COVID-19 may ultimately lead to poor glucose control. Additional assessment by mental health experts should be considered for older adults with T2D during and after infectious disease pandemic.

Introduction

On March 11, 2020, the World Health Organization (WHO) declared the world prevalence of the coronavirus disease 2019 (COVID-19) to constitute a pandemic.[1] This historic health crisis has had serious health impacts on the global population in 2020. In the United States, a total of 609,012 deaths have been reported to date (July 27, 2021), of which approximately 80% have occurred among adults ≥ 65 years old.[2] Notably, older age combined with a chronic disease, such as diabetes, is known to increase the risk of COVID-19 mortality.[3] For example, individuals aged ≥ 80 years were 20.6 times more likely to die of COVID-19 infection than those aged 50 to 59 years.[4] Presence of diabetes was also found to increase the risk of COVID-19 severity 2.75 times and its mortality 1.90 times.[5] For these reasons, older adults with diabetes may require closer medical attention for COVID-19 and its complications during and after the pandemic period.

The COVID-19 pandemic takes a significant psychological toll. A meta-analysis found that, during the pandemic, the prevalence of stress, anxiety, and depression was 29.6%, 31.9%, and 33.7%, respectively, in the general population from Asian and European countries.[6] These percentages were much higher compared to the 2017 global prevalence of anxiety (3.8%) and depression (3.4%).[7] The rates were even greater than the point prevalence of depression (12.9%) estimated from a meta-analysis using data from 30 countries from 1994 to 2014.[8] In the United States, the prevalence of depressive symptoms in adults during the COVID-19 pandemic was three times higher than before the crisis.[9] Similar patterns were found among U.S. older adults; they experienced more depressive symptoms and loneliness in April and May 2020 than in the prior year.[10] Older adults with diabetes are more vulnerable to experience increased psychological symptoms during the pandemic than those without diabetes. Diabetes is highly associated with anxiety,[11] major depressive disorders,[12] and high rates of diabetes-related distress,[13] all of which can be exacerbated by stress associated with COVID-19 pandemic.

Fear or worry surrounding the COVID-19 pandemic may contribute to the increased psychological symptoms among older adults. In one study, having more COVID-19-related stressors, such as losing a

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job, the death of significant others owing to COVID-19, or financial problems, was associated with a greater degree of depressive symptoms in U.S. adults.[9] Similarly, fear, worry, and the threat of COVID-19 were associated with increased depressive and anxiety symptoms in a U.S. national sample.[14] However, few studies have investigated specific COVID-19-related worries among older adults with diabetes, who may be disproportionately vulnerable to COVID-19 and its psychological impacts. Psychological impacts of COVID-19 can be more significant among older adults with diabetes than those with other chronic conditions. Diabetes is one of the most complex disease to self-manage, and the self-management can be easily interrupted during the pandemic. This can be stressful to older adults with diabetes since the interruption can have immediate negative impact on their daily blood glucose and overall health.

Increased psychological symptoms in older adults with diabetes may negatively affect glucose control (A1C) and related diabetes health outcomes.[15] COVID-19 may create more psychological symptoms in older adults, which could lead to poorer glucose control. For example, in Japan, after the declaration of the state of emergency with COVID-19, A1C values of older adults aged ≥ 65 years were significantly increased.[16] Similarly, during COVID-19 lockdown in India, worsening hyperglycemia was found in adults with T2D.[17] In the same study, psychological stresses (e.g., financial issues, stress of COVID-19, and reduced social interactions) were the most common cause of worsening hyperglycemia perceived by participants.[17]

People with diabetes experience diabetes specific emotional distress that can result from living with diabetes.[18] Specifically, diabetes distress is an emotional state associated with the burden of self-care, a lack of support from family and health care providers, and feelings of failure in one's ability to manage diabetes. Diabetes distress is distinct from depression in that it is more disease-specific; as such, it specifically can negatively impact self-care behaviors and result in poor glucose control.[19,20]

A nationwide study in Denmark addressed diabetes distress and its associations with COVID-19-specific worries in adults with diabetes.[21] In that study, participants with moderate to severe diabetes distress were more likely to have greater COVID-19-specific worries than the group with low or no diabetes distress.[21] Worries in the former group included being overly affected by COVID-19 due to diabetes (odds ratio [OR] 4.9), being characterized as belonging to the high-risk group (OR 2.4), and being unable to manage diabetes if infected (OR 3.2). The study was meaningful in that it was among the first to jointly examine diabetes distress and COVID-19, but the COVID-19 questionnaire used in the Danish study addressed only worries specific to diabetes care, overlooking broader societal consequences of COVID-19 such as its financial impact. Additionally, the study sample included adults of all ages and thus did not focus on older adults, who are more vulnerable to COVID-19.

Therefore, the aim of this study was to examine the associations between worries associated with COVID-19 and diabetes-related psychological symptoms among U.S. older adults with type 2 diabetes (T2D). The psychological symptoms addressed in the study included diabetes distress and depressive symptoms. The study focused on T2D because this disease is more common than type 1 diabetes in the older population.[22] The study hypothesized that increased worries of COVID-19 will increase diabetes distress and depressive symptoms among older adults with T2D.

Material and methods

Ethical considerations

The university's Institutional Review Board reviewed and approved all study procedures (#2020-0242).

Design

A cross-sectional, correlational study was conducted.

Participants

The study included older adults aged ≥ 60 years with T2D across the United States. The data used in this study were obtained from a primary study that examined the relationships between cognitive function and self-management behaviors in older adults with T2D. Participants were recruited using (1) study flyers, (2) recruitment calls to previous research participants who had given permission to be contacted for future studies, and (3) university's email listservs and ResearchMatch, a research volunteer registry. ResearchMatch allows recruitment of a large population of volunteers who have agreed to be contacted by researchers about potential health studies for which they may be eligible; the system was created by several academic institutions and supported by the U.S. National Institutes of Health as part of the Clinical Translational Science Award Program.[23]

Eligibility requirements included 1) the ability to access the internet survey; 2) being proficient in English; and 3) having been diagnosed with T2D for at least one year (self-reported). Older adults who were reported to have a diagnosis of cognitive impairment, cerebrovascular disease, or serious mental illnesses such as schizophrenia or bipolar disorder were excluded from the primary study.

A total of 133 older adults were contacted by telephone, and 119 were screened for eligibility. Among those not screened for eligibility, 11 were not interested in the study, and 3 were under medical treatment or had a personal issue that made participation difficult. After screening eligibility, 98 older adults met the inclusion criteria, but 12 were not enrolled due to loss of contact or a family issue. Finally, 86 older adults were enrolled in the study, but 2 were lost to follow up, leaving 84.

Data collection

Recruitment and data collection occurred from June to December 2020. After initial phone contact, potential participants were screened for eligibility. If eligible, they were provided with a link to an online consent form stored in the Research Electronic Data Capture (REDCap) system. REDCap is a web-based platform that allows secure data collection that is validated in real time.[24,25] After providing informed consent, participants completed an online survey addressing the study variables. Within one week, the participants received the A1CNow+™ and were asked to telephone the principal investigator (PI) for guidance in administering the test themselves. A video guide provided by the manufacturer was also provided to help participants better understand the process. The A1CNow+™ device displays the test result in 5 minutes, and the participants were asked to report their result to the PI by telephone. Participants who fully completed the study received compensation.

Measures

Worries Associated with COVID-19. The extent to which participants worried about the COVID-19 pandemic's impact on their daily lives was measured using the validated COVID-19 Worries questionnaire developed by Barber and Kim.[26] This questionnaire included eight items that asked respondents if they were worried about (a) personally catching COVID-19, (b) dying as a result of it, (c) a family member catching it, (d) disruptions to their own lifestyle, (e) local hospitals being overwhelmed, (f) the economy entering a recession, (g) local stores running out of important items such as food or medicine, and (h) their family's income declining because of it.[26] Responses were made on a 5-point Likert scale ranging from 0 = *not*

at all to 4 = *a great deal*. The scores from each of the eight items were combined and averaged for the total COVID-19 Worries score. A higher total score indicates a higher degree of worries associated with COVID-19. The Cronbach's α for the questionnaire in the original development study was 0.88 with adults aged 18 to 81 years.[26] In the present study, the questionnaire's reliability with older adults with T2D was supported by a Cronbach's α of 0.88.

Diabetes Distress. The Diabetes Distress Scale (DDS)[27] was used to measure diabetes-related emotional distress in the study. The tool has 17 items comprising four subscales: emotional burden, physician distress, regimen distress, and interpersonal distress. Item responses are made on a 6-point Likert scale ranging from 1 = *not a problem* to 6 = *a very serious problem*. The scores were averaged for the total and each subscale. A higher score indicated greater diabetes distress. In the original development study, the internal consistency of the total scale and each subscale ranged from 0.88 to 0.93.[27] In the present study, the Cronbach's α for the total DDS was 0.92, and α values for each subscale ranged from 0.81 to 0.93, supporting the internal consistency of this scale.

Depressive Symptoms. Patient-Reported Outcomes Measurement Information System (PROMIS) Depression version 1.0 was used to measure the degree of depressive symptoms in study participants. PROMIS Depression has a 5-point Likert scale ranging from 1 = *never* to 5 = *always*. This measure provides standardized *t* scores in which a score of 50 indicates the mean with one standard deviation of 10.[28] PROMIS Depression was shown to have strong reliability when used in the U.S. general population (r = .92)[29] and with depressed adults recruited from outpatient settings (r = .92).[30]

Other Variables. Demographic and diabetes health information was self-reported and included age (in years as of the survey date), sex, race/ethnicity, diabetes duration (years since first diagnosis), and types of diabetes treatment (lifestyle modification for diet and exercise, oral medication, insulin, or a combination of oral medication and insulin). The numbers of family members in residence and housing types were also asked. The number of family members was measured using categorical values ranging from 0 = *live alone* to 5 = *5 or more people*. A housing type was assessed by asking the place that they had lived most of the year. The answer options included their own house, apartment, or condo; senior citizen apartment; home of their relatives or friends; retirement home; adult foster care; nursing home; or other. Glucose control (A1C) was measured using the Bayer A1CNow+^{TM} (Metrika, a member of Bayer Healthcare LLC, Sunnyvale, CA), that has been validated against laboratory results following the National Glycohemoglobin Standardization Program reference standards.[31]

Data analysis

All statistical analyses were conducted using Stata/IC 15.0 (StataCorp LP, College Station, TX). Data distribution, outliers, and the missingness for each variable were examined before data analysis. Of the 84 participants who completed the study, two older adults were not able to successfully perform the A1C at-home test even after being provided with oral instructions and the video guide by the PI, resulting in two missing values for A1C. In addition, for worries associated with COVID-19, one person did not complete the questionnaire. Pairwise deletion was used for these missing data.

Demographic and other study variable information was summarized using descriptive statistics: specifically, means and standard deviations (SD) for continuous variables and frequencies and percentages for categorical variables. Bivariate correlations between the main study variables were examined using Pearson's r correlation if they were normally distributed or Spearman's ρ correlation for the variables having non-normal distribution. Statistical significance (p value) was set at 0.05.

From the histograms and skewness analyses, one outcome variable in the study, diabetes distress, was identified as being left-censored for the total score and each subscale score. To account for the censored distribution, tobit regression was used to examine the impact of worries associated with COVID-19 on the outcome variables. Tobit regression examines the linear relationship between variables when the outcome variable has limited values due to the scale's floor or ceiling effects.[32,33] This method uses maximum likelihood estimation and can provide precise estimations when censoring occurs.[32] In this method, the linear effect of exploratory variables is not on the observed outcome values but on the uncensored latent variable.[33]

In this study, the diabetes distress scores were censored on the left-side; thus only the lower limit of the scale was applied in the analyses. For depressive symptom scores, no limit was applied, as they were normally distributed. Covariates were selected based on the correlational analyses between demographics and main study variables and then were included in the tobit regression models. Variables significantly associated ($p < .05$) with psychological symptoms of adults with T2D were also included as covariates.

Results

A total of 84 older adults with T2D were included in the study. Their mean age was 68.46 (SD 5.41), and most were female (54.76%) and White (77.38%). Nearly all participants (98.81%) were obese. More than a half of the participants lived with one family member, while 25% lived alone, and more than 90% lived at their own house or apartment. Most were treated with oral medication for their T2D (67.86%), and their mean diabetes duration was 13.89 years (SD 7.53). Participants were found to have well-controlled T2D, with a mean A1C of 6.62% (SD 1.11). Participants' median DDS total score was 1.35. Among the four DDS subscales, participants reported the highest median score in the DDS regimen distress (median = 1.80). They also reported fewer depressive symptoms than the U.S. normative sample, with a mean of 48.92 (SD 8.10).

Participants had a few to moderate worries associated with COVID-19, with the mean score of 1.72 (0.92). When each item of COVID-19 Worries was examined, participants reported the greatest worries about the economy entering a recession (2.17 $\pm$ 1.20), followed by a family member catching COVID-19 (2.00 $\pm$ 1.31), disruptions to their own lifestyle due to COVID-19 (1.89 $\pm$ 1.26), and local hospitals being overwhelmed (1.81 $\pm$ 1.23; Table 1).

Bivariate correlation analyses showed that worries associated with COVID-19 were correlated with diabetes distress score ranging from ρ = 0.25 to 0.32. Specifically, worries associated with COVID-19 were positively associated with DDS total (ρ = .29, p = .007), DDS emotional burden (ρ = .32, p = .003), and DDS regimen distress (ρ = .25, p = .025) and showed moderate associations with PROMIS Depression scores (r = .46, p = .000; Table 2).

The tobit regression results are summarized in Table 3. In the uncontrolled model, a one unit increase in worries associated with COVID-19 increased DDS total score by 0.19 (p = .019), DDS emotional burden score by 0.31 (p = .010), DDS physician distress score by 0.49 (p = .038), and PROMIS Depression scores by 3.85 (p = .000). When the model was controlled for age, sex, race/ethnicity, types of diabetes management, diabetes duration, and A1C, worries associated with COVID-19 were significantly associated with DDS total (B = .25, p = .003), DDS emotional burden (B = .32, p = .011), DDS physician distress (B = .57, p = .024), DDS regimen distress (B = .45, p = .001), and PROMIS Depression scores (B = 4.21, p = .000). However, DDS interpersonal distress was not significant in either unadjusted or adjusted model.

Table 1
Demographic and other variable information of study sample (n = 84).

	$\bar{x}$ (SD) or n (%)	Median	Range
Age (years)	68.46 (5.41)		60–86
Sex (female)	46 (54.76)		
Ethnicity (Non-Latino or Hispanic)	78 (92.86)		
Race			
Caucasian/White	65 (77.38)		
African American/Black	12 (14.29)		
Asian	2 (2.38)		
Other or Mixed	5 (5.95)		
BMI (kg/m)			
Overweight (25-29.9 kg/m)	1 (1.19)		
Obese (> 30 kg/m)	83 (98.81)		
Number of family members			
Live alone	21 (25.00)		
1 person	49 (58.33)		
2 people	9 (10.71)		
3 people	1 (1.19)		
4 people	1 (1.19)		
5 or more people	3 (3.57)		
Type of housing			
Their own house, apartment, or condo	76 (90.48)		
Senior citizen apartment	2 (2.38)		
Home of a relative or friend	5 (5.95)		
Other	1 (1.19)		
Diabetes duration (years)	13.89 (7.53)		1–30
Type of diabetes management			
Lifestyle only	9 (10.71)		
Oral medication	57 (67.86)		
Insulin	7 (8.33)		
Combination of oral medication and insulin	11 (13.10)		
A1C (%)	6.62 (1.11)		4.1–10.0
Diabetes Distress Scale			
Total	1.55 (0.63)	1.35	1–4.7
Emotional burden	1.55 (0.73)	1.20	1–4.8
Physician distress	1.20 (0.60)	1.00	1–5.5
Regimen distress	1.90 (0.95)	1.80	1–5.2
Interpersonal distress	1.47 (0.83)	1.00	1–5.3
PROMIS Depression (t score)	48.92 (8.10)		34.2–69.1
Total COVID-19 Worries	1.72 (0.92)		0–3.9
Personally catching COVID-19	1.83 (1.21)		0–4.0
Dying as a result of it	1.55 (1.37)		0–4.0
A family member catching it	2.00 (1.31)		0–4.0
Disruptions to their own lifestyle	1.89 (1.26)		0–4.0
Local hospitals being overwhelmed	1.81 (1.23)		0–4.0
Economy entering a recession	2.17 (1.20)		0–4.0
Local stores running out of important items	1.45 (1.14)		0–4.0
Family's income declining	1.05 (1.24)		0–4.0

A1C = Glucose Control, BMI = body mass index, COVID-19 = Coronavirus Disease 2019, PROMIS = Patient-Reported Outcomes Measurement Information System.

Table 2
Bivariate correlation analysis between the main study variables (n = 83).

	Worries associated with COVID-19
DDS Total[a]	**.29****
DDS Emotional burden[a]	**.32****
DDS Physician distress[a]	.19
DDS Regimen distress[a]	**.25***
DDS Interpersonal distress[a]	.14
PROMIS Depression[b]	**.46*****

COVID-19 = Coronavirus Disease 2019, DDS = diabetes distress scale, PROMIS = Patient-Reported Outcomes Measurement Information System.
[a] Spearman's rho coefficient.
[b] Pearson's *r* coefficient.
*** $p < 0.001$.
** $p < 0.01$.
* $p < 0.05$.

Discussion

This study examined the associations between the COVID-19 related worry and psychological symptoms that are commonly experienced by older adults with T2D, such as diabetes distress and depression. The study results indicated that increased worries associated with COVID-19 were associated with increased diabetes distress and depressive symptoms in older adults with T2D. Among the four DDS subscales, emotional distress and regimen-related distress were significantly associated with worries associated with COVID-19 after controlling for demographic and diabetes-related clinical factors.

Participants in the current study expressed fewer worries associated with COVID-19 than were reported in the original sample upon which the questionnaire was based.[26] In that study, conducted in the general population, older adults had higher mean COVID-19 worry scores for each item; the scores ranged from 2.8 to 4.1. In contrast, the individual item mean scores in the present study ranged from 1.05 to 2.17. These differences may be attributable to the timing of data collection periods relative to COVID-19 across the two studies. The original study collected data during late March 2020, soon after the pandemic emerged in the U.S., whereas the present study was conducted several months into the pandemic, between June and December 2020. Older adults in the U.S. may have experienced the greatest level of fear or worry when the pandemic had just begun. However, the focus of participants in each study was similar although the intensity differed. Overall, older adults in both studies worried most about the country's economy and whether their family members would catch COVID-19, along with lifestyle disruptions and whether COVID-19 would overwhelm local hospitals.

Emerging data suggest that the COVID-19 pandemic was a stressful life event for adults with T2D, contributing to adverse mental health outcomes. For example, during a COVID-19 social distancing period in Brazil, 92.6% of adults with T2D reported at least one sign of a minor psychiatric disorder or diabetes-related emotional distress, and 52.9% presented with depressive and anxiety symptoms.[34] Moreover, psychological symptoms after a stressful life event, such as the death of a close family member, have been associated with increased diabetes distress in adults with T2D ($r = .54$, $p < .01$).[35] The findings of the present study were also supported by a previous study that included adults with other chronic conditions. COVID-19-related resource loss was associated with depressive symptoms, anxiety, and perceived stress among adults with arthritis, diabetes, and hypertension.[36] In the present study, one in four older adults was living alone, suggesting social isolation might be an additional factor. With COVID-19, older adults with T2D may have experienced fear of contracting the virus, loss of loved ones, and social isolation, all of which could have aggravated any diabetes distress or depressive symptoms that they were already experiencing.

Increased psychological symptoms can adversely affect self-care behaviors and glucose control in adults with T2D.[37,38] This phenomenon is likely worsened when a natural disaster or pandemic occurs. In Japan, A1C in older adults with diabetes increased 1.6 times following a historic earthquake in 2011.[39] In addition, after COVID-19 lockdown in southern India, 28.8% of the adults with T2D showed an absolute increase in A1C, and this increase was more common in those who were less physically active and had an unhealthy diet.[40] In the future, longitudinal cohort studies of older population with T2D are necessary to observe the post-pandemic effects on their A1C and diabetes-related psychological symptoms, as the findings will ultimately be useful for future public health planning.

In the present study, participants maintained good glucose control (A1C < 7%) even during the COVID-19 pandemic and thus exhibited less diabetes-related psychological symptoms. Participants' mental health was relatively good, in that they showed little or no diabetes distress based on a cut-off score of the recommended < 2.[41] The participants also had fewer depressive symptoms than a U.S. normative sample. According to the Centers for Disease Control and Prevention (CDC),[22] more than 45% of adults aged ≥ 65 years had poor A1C (> 7%) between 2013 and 2016. Considering that older adults with

Table 3
Tobit regression of worries associated with COVID-19 on psychological symptoms (n = 81).

Variable	DDS Total	DDS Emotional burden	DDS Physician distress	DDS Regimen distress	DDS Interpersonal distress	PROMIS Depression
Unadjusted						
Worries Associated with COVID-19	**.19***	**.31***	**.49***	.25	.36	**3.85*****
Adjusted						
Worries Associated with COVID-19	**.25****	**.32***	**.57***	**.45****	.42	**4.21*****
Age	.00	-.01	.05	-.03	.04	-.43**
Female	.37*	.38	.07	.52*	1.21**	2.88
Latino or Hispanic	.29	.05	1.27	-.05	1.16	-5.53
Race						
Caucasian/White	*(reference)*					
African American/Black	-.32	-.15	.03	-.84*	-.49	-6.78**
Asian	-.48	-3.95	-4.57	-.63	-6.22	-5.15
Other or Mixed	-.77*	-.76	.18	-1.32*	-2.33	5.58
Types of management						
Lifestyle	*(reference)*					
Oral	-.48	-.48	-1.11	-.90*	-1.06	-4.61
Insulin	-.52	.02	-.76	-1.70*	-.74	-1.84
Combination	-.17	.45	-1.27	-.64	.43	-5.07
Diabetes duration	-.01	-.04*	-.02	.01	-.03	.10
A1C	.19**	.19*	.11	.39***	.10	.89

A1C = Glucose Control, COVID-19 = Coronavirus Disease 2019, DDS = diabetes distress scale, PROMIS = Patient-Reported Outcomes Measurement Information System.
*** $p < .001$.
** $p < .01$.
* $p < .05$.

higher A1C would be expected to exhibit greater worries associated with COVID-19 and diabetes-related psychological symptoms, inclusion of a wide spectrum of older adults with T2D in future studies would provide additional information about the relationship.

Most of our participants were White and women. This groups probably manage their COVID-19-related stress better than any other population groups in the U.S. Racial disparities in COVID-19 morbidity and mortality have been observed among African American and Hispanic groups relative to Whites.[42] One study showed that the African American population experienced greater COVID-19 pandemic stress than other racial/ethnic groups,[43] along with having greater diabetes distress compared to White counterparts.[44] In addition, men are known to be at a higher risk of COVID-19 infection and experience more severe outcomes than women.[45] Recruitment from underrepresented minority populations and inclusion of more men are needed.

Limitations

First, the study findings apply only to a portion of the total older adult population with T2D. The exclusive use of online recruitment necessitated by pandemic restrictions limited access to a diverse study sample. The participant requirement of internet accessibility may have limited participation by older adults who lacked access to the internet or perhaps had limited knowledge of electronic technology. When possible, more direct recruitment and data collection approaches should be employed to capture a diverse sample for future studies.

Second, the study employed a cross-sectional design, which did not allow for causal inferences with regard to worries associated with COVID-19 and diabetes-related psychological symptoms. Future longitudinal studies are needed to examine COVID-19 and psychological symptoms at different time points in order to provide additional information on this relationship. Lastly, potential confounding factors that were not examined in the study should be considered. For instance, a history of COVID-19 infection in participants or their family members or participants' geographic location related to COVID-19 infection rates might have increased their worries associated with COVID-19 and psychological distress. In these regards, future studies should determine whether participants or their loved ones have ever contracted COVID-19 and consider participants' geographic location when examining worries associated with COVID-19 and diabetes-related psychological symptoms.

Conclusion

This study was among the first to examine worries associated with COVID-19 and diabetes-related psychological symptoms—diabetes distress and depressive symptoms—among U.S. older adults with T2D. The study results provided meaningful insights into the impacts of COVID-19 within this population. The COVID-19 pandemic has created significant physical and psychological hardship for the global population, and its consequences may be felt for years. In people with diabetes, heightened psychological distress, such as diabetes distress and depression, can result in poor glucose control and diabetes outcomes. Because older adults with T2D are particularly vulnerable to COVID-19 and have been significantly impacted by the pandemic, their psychological symptoms should be closely monitored during and after the infectious disease pandemic, with particular attention to diabetes distress and depression. Furthermore, a multidisciplinary approach should be considered to ensure that older adult patients are provided with needed counseling or medical care.

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Author contributions

All authors read and approved the current version of the manuscript. MJK contributed to conceptualization, methodology, formal analysis, writing original draft, and funding acquisition. CP contributed to formal analysis and reviewed and edited the draft. LKS contributed to providing with resources and writing review and editing. LQ, UB, and VG reviewed and edited the writing. CF supervised the study and contributed to conceptualization and methodology of the study, provided with resources, and reviewed and edited the writing.

Declarations of Competing Interest

None.

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