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Differences in COVID Related Anxiety Between Those with and without Type 2 Diabetes

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DIFFERENCES IN COVID RELATED ANXIETY BETWEEN THOSE WITH AND WITHOUT TYPE 2 DIABETES

By

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ABSTRACT

JANE GRAYSON HEWES: Differences in COVID Related Anxiety Between Those with and without Type 2 Diabetes

As a result of the COVID-19 pandemic, individuals with diabetes may be at higher risk for experiencing negative behavioral, psychosocial, and disease-related outcomes. The purpose of the present study was to compare COVID-19-related anxiety between adults with and without type 2 diabetes. Two separate samples were recruited for this study from web-based panels of adults: 372 adults with type 2 diabetes and 259 adults without type 2 diabetes. COVID-19-related anxiety was assessed using the Fear of COVID-19 Scale (FCV-19S)This scale includes 7 items scored on a 5-point Likert scale. Scores are summed to generate a total score with higher scores indicating greater anxiety. Bivariate comparisons were used to compare the sociodemographic and medical characteristics of the samples. An independent samples t-test was used to compare means of FCVS-19 between the two samples. A multivariable linear regression model was used to examine the relationship between diabetes status and the COVID-19 anxiety scale, controlling for age, race, sex, level of education, income, having a primary care provider, and health insurance status. There was a significant difference in the COVID-19 anxiety scores between those with Type 2 diabetes (M = 20.34, SD = 6.93) and those without Type 2 diabetes (M = 18.37, SD = 7.07; t = 3.48, df = 548.50, p <.001). The multivariable regression model accounted for 16.1% of the variance in COVID-19 anxiety (F [8, 622] = 14.92, p <.001). Diabetes status was a significant predictor of COVID-19 anxiety (B = 2.20, SE = 0.56, p < .001). Age was also significantly associated with lower COVID anxiety (B = -0.17, SE = 0.02, p <

.001). However, race, sex, level of education, income, having a primary care provider, and health insurance status were not significantly associated with COVID-19 anxiety. Adults with type 2 diabetes are significantly more likely to experience COVID-19 anxiety than participants without type 2 diabetes – even when controlling for potentially important sociodemographic and healthcare variables. Additional research is needed to determine whether COVID-related anxiety is adaptive or maladaptive among adults with type 2 diabetes. If maladaptive, additional work is needed to evaluate the effectiveness of evidence-based approaches for the treatment of COVID-related anxiety in medical populations with risk factors for severe COVID-related outcomes.

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INTRODUCTION

Diabetes

With almost half a billion cases and over a million deaths a year, diabetes is one of the most serious diseases affecting people all over the globe (Roglic, 2016). The World Health Organization (WHO) defines diabetes as a chronic disease that occurs either when the pancreas does not create enough insulin or when the insulin that the body creates cannot be used effectively (Roglic, 2016). Adults who are overweight or obese have a significantly greater risk of developing Type 2 diabetes. Other risk factors for type diabetes include both uncontrollable (i.e., older age, family history, ethnicity) and controllable risk factors (smoking) (Roglic, 2016).

Because of the nature of the disease, diabetes can lead to many complications. Diabetes complications are classified as either microvascular or macrovascular complications. Microvascular complications affect capillaries in various organs, such as in the eyes (retinopathy) or the kidneys (nephropathy). Retinopathy, which has the main risk factors of hyperglycemia and hypertension, is the most common cause of blindness in those with diabetes (Khalil, 2017). Nephropathy is also very common, occurring in almost 40% of all people with diabetes (Khalil, 2017). High blood sugar leads to loss of proteins in the kidney, which, over time, worsens kidney function (Khalil, 2017).

On the other hand, macrovascular complications occur as a result of damage to endothelial tissue lining the larger blood vessels and narrowing and hardening of arterial walls, a process called atherosclerosis (Fowler, 2008). Cardiovascular disease, the most prominent

macrovascular complication, is the primary cause of heart attacks and the leading cause of death in those with diabetes (Fowler, 2008). In addition to increased risk of heart attack, type 2 diabetes also increases the risk for stroke almost 4 times (Fowler, 2008). Diabetes can cause issues outside of microvascular and macrovascular complications, such as the hyperglycemia related to diabetes leading to a weakened immune system, making patients more vulnerable to infection (Berbudi et al., 2020). While type 2 diabetes is preventable, it is still a costly and burdensome medical condition that affects millions around the world.

Coronavirus Disease

Another disease that is affecting hundreds of millions around the world is coronavirus disease, or COVID-19, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). First found in late 2019 in Wuhan, China, COVID-19 has caused global lifestyle changes through mask and vaccine mandates, social distancing, stay at home requests, quarantines, and national restrictions. The burden of the global pandemic has had a serious impact on mental health. For example, the global COVID pandemic has been linked to an increased risk of various mental health disorders, such as depression and anxiety. In the United States, 48% of adults report being anxious about the potential of serious illness or death due to coronavirus, and 62% report feeling anxious about the possibility of their loved ones becoming infected (American Psychiatric Association, 2021). Importantly, fear of COVID infection could directly affect the ways in which people react to the virus and the restrictions that are associated with it. Hospitalized COVID-19 patients may be particularly likely to experience increased psychological distress because of the severity of the infection and the unpredictable sequela of COVID infection. A study of 106 hospitalized COVID-19 patients, found that 97.2% of patients

had some degree of depression and all patients surveyed had either severe or very severe anxiety (Zandifar et al., 2020).

Diabetes and COVID-19

COVID-19 has become a serious risk factor for many negative psychosocial, behavioral, and disease-related outcomes among adults with diabetes. First, many people with diabetes have shown a greater prevalence of mental conditions during the pandemic. A Brazilian study found that 93% of the 120 diabetic adults reported struggling with some type of psychological distress during the pandemic and those with type 2 diabetes had an even greater tendency to report distress (Alessi et al., 2021). A study in Pakistan found that, among those with type 2 diabetes, women and smokers had higher levels of fear surrounding COVID (Basit et al., 2021). Some specific areas this study focused on were emotional distress, eating disorders, and sleeping disorders. Another study examined the psychological status of 65 Saudi Arabian adults with type 1 diabetes during the pandemic and found that more than half of the participants reported mild to severe depression and over 40% had mild to severe anxiety, with less than 10% reporting a previous mental disorder diagnosis – suggesting that current levels of distress were primarily due to the global COVID pandemic (Magliah et al., 2021). A Turkish study focused on the change in sexual functioning and alexithymia levels of 162 people with type 2 diabetes during the pandemic found an increase in alexithymia, anxiety, and depression in their population (Dincer et al., 2021). Difficulty accessing health care added another level of stress to those with diabetes. Even before the COVID-19 pandemic, low support from health care providers has been linked with higher diabetes distress (Al-Sofiani et al., 2021). In an Arab Gulf region study, people with diabetes who had clinic appointments canceled or had no method of communication with their

health care provider during the pandemic were more likely to report symptoms of anxiety and depression (Al-Sofiani et al., 2021).

The COVID-19 pandemic has not only contributed to greater psychological distress but greater burden associated with diabetes self-management. The pandemic increased the difficulty of adherence to many important daily self-management behaviors. For example, a Saudi Arabian study found that compared to pre-lockdown, adherence to a healthy diet and regular physical activity decreased from 67.7% and 41.5% among adults with diabetes (Magliah et al., 2021). Over half of their sample also reported at least some difficulty obtaining an insulin pump, but most continued their normal insulin pump behavior, such as monitoring their blood glucose level regularly (Magliah et al., 2021). A study conducted in northern India found similar results, with increases in unhealthy diet and snacking and greater consumption of foods high in carbohydrates among adults with diabetes (Ghosh et al., 2020). The same study found that levels of exercise decreased after the start of the pandemic. A Spanish study of adults with type 2 diabetes found an increase in almost all food types, such as vegetables, sugary foods, and snacks. The already low physical activity reported within this population declined further during lockdown because of adherence to confinement and the inability to access many exercise locations (Ruiz-Roso et al., 2020). Adherence to healthy diet and exercise regimens are critical for maintaining glycemic control. A retrospective study done in Wuhan, China, the origin place of COVID-19, found that the current blood glucose management strategies for patients suffering from both diabetes and COVID-19 decreased during lockdown (Zhou & Tan, 2020). Overall, the self-management strategies that many people with diabetes use have been harder to utilize because of the lockdown and limited access to health care resources and healthy lifestyle behaviors due to pandemic-related restrictions.

Not only does COVID-19 cause mental stress and keep people with diabetes from following their usual self-management strategies, but it can lead to poor outcomes when comorbid with diabetes. Adults with diabetes are more likely to have severe complications and poor health outcomes (e.g., hospitalization) if infected with COVID 19 (American Diabetes Association, 2021). Comorbid health conditions associated with diabetes, such as heart disease, further increase the health risks associated with COVID-19 even more serious (American Diabetes Association, 2021). A study done in Israel looked at patients' pre-infection glycemic control in relation to the severity of their experience with COVID-19. The authors found that higher glycated Hemoglobin A1c, a marker of glycemic control over the prior 2-3 months, was a strong predictor of COVID hospitalization (Merzon et al., 2020). These results suggest that poor glycemic control, or high average blood sugar levels, is an important risk factor for worse COVID-19 outcomes. A number of physiological factors may underlie the link between diabetes and COVID risk. For example, inflammation, circulation, and clotting are all problems that many people with diabetes face and COVID-19 seems to exaggerate these problems which leads to worse outcomes and faster progression of COVID symptoms (Singh, 2020). Type 2 diabetes is also more prevalent in older age, which is itself an independent risk factor for COVID-19 severe symptoms (Selvin & Juraschek, 2020).

Current Study

While there are studies about the relationship between COVID anxiety and people with diabetes, no prior studies have specifically examined the relationship between COVID anxiety among U.S. adults with and without type 2 diabetes. This gap in the existing literature is particularly important given the high prevalence of diabetes in the United States and the unique burden of pandemic-related restrictions for adults with diabetes as well as the medical

vulnerability of this population. Further, there has been considerable variability in COVID-related guidelines and restrictions from country to country. Consequently, data from other countries may not be representative of the experiences of U.S. adults with type 2 diabetes. In a German study comparing fear of COVID between those with and without diabetes, those with diabetes answered higher on the Likert scale following the question: I worry about COVID-19 (Musche et al., 2021). The German study measured COVID anxiety using a single question. The German study also contains participants with both type 1 and type 2 diabetes. As a result, it is not clear how the results of this study would generalize to the large population of U.S. adults with type 2 diabetes.

Our study aims to compare levels of anxiety about COVID-19 among adults with and without type 2 diabetes. Because of the many complications that come with comorbid COVID-19 and type 2 diabetes, we hypothesize that people with type 2 diabetes will have a higher COVID anxiety score than those without type 2 diabetes. We also hypothesize that the patients with type 2 patients will have higher levels of COVID anxiety compared to patients without type 2 diabetes even when controlling for other important and established COVID risk factors including age, race, sex, education, income, access to a primary care provider, and health insurance.

METHODS

Participants

The sample of participants with type 2 diabetes was recruited from a web-based panel of adults with type 2 diabetes. To be eligible, respondents had to be older than 18 years of age and report having been diagnosed with type 2 diabetes by a healthcare provider. Eligible respondents were asked to provide informed consent before officially enrolling in the study (Appendix A). After providing informed consent, participants were asked to complete the survey. In the sample with type 2 diabetes, 536 initiated the survey and of those, 518 provided informed consent (96.6%). 428 participants that provide informed consent reported having type 2 diabetes (82.6%). 42 participants dropped out prior to the end of the survey (90.2%) and another 14 did not pass the final check (96.4%).

The sample of participants without type 2 diabetes was recruited from a web-based panel of healthy adults. To be eligible, respondents had to be older than 18 years of age and have no history of a diagnosis of type 1 or type 2 diabetes. Eligible respondents were asked to provide informed consent before officially enrolling in the study (Appendix A). After providing informed consent, participants were asked to complete the survey. In the sample of adults without type 2 diabetes, 620 participants provided informed consent. 342 individuals met the quota (55.2%). The final sample consisted of 372 participants with Type 2 diabetes and 259 participants without type 2 diabetes.

Measures

The Fear of COVID-19 Scale (Appendix B) was used to measure respondents' fear of coronavirus infection. The FCV-19S scale includes seven items (i.e., "It makes me uncomfortable to think about coronavirus-19"). Participants are asked to rate each item on a 5-point Likert scale from "Strongly disagree" to "Strongly agree". Item responses are summed to generate a single score with higher scores indicating greater fear and anxiety related to COVID-19. At least one prior study had demonstrated that the FCV-19S is a reliable and valid measure of COVID anxiety (Ahorsu et al., 2020). The FCV-19S has demonstrated good reliability in previous studies ($\alpha = .82$) and excellent reliability in the present sample ($\alpha = .91$).

Participants self-reported previous diagnosis of type 2 diabetes *("Has healthcare provider ever told you that you have type 2 diabetes?"*) which was the primary explanatory variable in this study. Diabetes status was coded 0 = no diabetes and 1 = type 2 diabetes.

Finally, participants were asked to self-report their socio-demographic data such as sex, age, race, ethnicity, education level, and income. These variables were used to characterize the samples and to control for possible differences in the samples of adults with and without type 2 diabetes.

Data Analytic Plan

Univariate distributions of all continuous study variables were examined. Descriptive statistics were used to provide sample characteristics. A series of chi-square and Welch's independent samples t-tests were used to compare sociodemographic characteristics between adults with and without type 2 diabetes. Welch's independent samples t-tests do not require assumptions of equality of variance and are thus a more conservative test of group differences.

Cohen's d, a measure of effect size, was calculated for the difference in COVID anxiety between groups with and without type diabetes.

A Welch's independent samples t-test was used to examine the differences in COVID-19 anxiety among adults with and without type 2 diabetes. A multivariable linear regression was used to determine the relationship between the diabetes status (0 = no diabetes, 1 = type 2 diabetes) and the dependent variable (i.e., The Fear of COVID-19 Scale), controlling for age, race, sex, education, income, access to a primary care provider, and health insurance. Variance Inflation Factor (VIF) was examined for each predictor to assess potential multicollinearity with VIF >4.0 indicative of high multicollinearity. No predictors had a VIF greater than 1.3 indicating that models did not have high levels of multicollinearity. Quantile-quantile plots indicated that residuals were normally distributed with a mean value of zero. Plots of standardized predicted values by standardized residuals indicated homoscedasticity. All analyses were performed using SPSS 28.0 (IBM Corp, 2021). All tests were two-tailed with alpha = 0.05.

RESULTS

Sample Characteristics

Both the sample with Type 2 diabetes and the sample without Type 2 diabetes were moderately diverse in their demographic variables. See Table 1. In the sample with Type 2 diabetes, over half the participants were female and had an average age of 54.86 (SD = 15.70) years. With respect to race, over three-fourths of the sample was white and 12.5% was Black. In terms of ethnicity, almost one and ten participants identified as Latino. Over three-fourths of the sample finished some college or more and over half of the sample reported an income greater than $50,000 a year. Most of this sample had health insurance (95.2%) and had seen a primary care provider during the prior 12-months (94.0%).

The sample without Type 2 diabetes was more than half female with an average age of 52.04 (SD = 14.99) years. With respect to race, 81% of the sample was white, and 14% was Black. In terms of ethnicity, 6% of the sample identified as Latino. Most respondents (67%) of the sample reported completing some college or more and 36% reported an income of $50,000 or more in a year. The majority of the sample (88%) had health insurance and (77%) had seen a primary care provider in the prior 12-months.

We used a series of bivariate tests to compare the sociodemographic variables among respondents with and without type 2 diabetes. See Table 1. An independent samples t-test showed that participants with type 2 diabetes were significantly older (M = 54.86, SD = 15.70) compared participants without type 2 diabetes (M = 52.04, SD = 14.99; t = 3.50, df = 919.12, p =

<.001). There were not significant differences between the groups of participants with and without type 2 diabetes in terms of sex ($\chi 2$ (1) = 1.86, p = .172) and race ($\chi 2$ (7) = 9.68, p = .139). However, there were significant differences between the groups with respect to ethnicity ($\chi 2$ (1) = 10.95, p < .001), education ($\chi 2$ [2] = 6.09, p = .048), income ($\chi 2$ [4] = 13.81, p = .008), health insurance ($\chi 2$ (1) = 17.11, p = <.001), and access to a primary care provider ($\chi 2$ (1) = 63.95, p <.001).

COVID Anxiety

There was a significant difference in the COVID-19 Anxiety Scores between those with Type 2 diabetes (M = 20.34, SD = 6.93) and those without Type 2 diabetes (M = 18.37, SD = 7.07), t = 3.48, df = 548.50, p = <.001). This difference was characterized by a small effect size, d = 0.28.

Multivariable Linear Regression

A multivariable linear regression was used to examine differences in COVID anxiety scores among adults with and without type 2 diabetes, controlling for race, age, sex, education, income, primary care provider, and health insurance. See Table 2. The overall regression model accounted for 16.1% of the variance in COVID anxiety (F [8, 622] = 14.92, p <.001). Diabetes status was a significant predictor of the dependent variable (p < .001). Older age was significantly associated with lower COVID anxiety (p < .001). However, race (p = .901), sex (p = .359), level of education (p = .314), income (B = -0.01, p = .794), having a primary care provider (p = .136), and health insurance status were not significantly associated with COVID-19 anxiety (p = .904).

DISCUSSION

Diabetes is a major risk factor for poor COVID-related health outcomes including higher rates of hospitalization (Merzon et al., 2020) and mortality (Singh et al., 2020). This study is the first to examine differences in COVID-related anxiety among U.S. adults with and without type 2 diabetes. This study is also novel in its efforts to examine this relationship while also controlling for various sociodemographic and healthcare variables. Our results add to findings from international studies showing similarly elevated levels of COVID anxiety among adults with diabetes compared to those without.

As predicted, there was a significant group differences in COVID anxiety scores between the groups with type 2 diabetes and without type 2 diabetes. These results are congruent with the results from prior international studies that assessed participants with any type of diabetes (Musche et al., 2021). COVID-related anxiety could have a multitude of impacts on adults with type 2 diabetes. For example, national pandemic restrictions have added additional barriers to diabetes self-management behaviors such as adhering to a healthy diet, engaging in physical activity, obtaining insulin pumps, and regularly managing blood glucose levels (Magliah et al., 2021; Zhou & Tan, 2020). It is possible that these barriers to diabetes self-management have contributed to greater anxiety and emotional distress among individuals with type 2 diabetes.

To date, no other studies have examined differences in COVID anxiety among adults with and without diabetes after controlling for sociodemographic and healthcare variables such

as race, age, sex, education, income, access to a primary care provider, and health insurance in order to further examine the relationship between COVID anxiety and diabetes. When controlling for these variables, type 2 diabetes remained a significant predictor of COVID anxiety, as we predicted in the hypothesis. Age was the only sociodemographic variable that was a significant predictor of COVID anxiety, where older age was significantly associated with lower COVID anxiety. This finding is surprising given that older individuals have a significantly greater risk for poor COVID-related outcomes. It is not clear whether this finding reflects differences in perceived susceptibility and severity of COVID-19 infection among older vs. younger adults. Prior studies have investigated the general mental health of adults during the pandemic including anxiety, depression, and trauma or stress-related disorders. In multiple studies, it was found that older adults had significantly lower rates of these disorders than younger adults (Czeisler et al., 2020; González-Sanguino et al., 2020). Additional studies are needed to corroborate this finding for COVID-related anxiety and, if supported, explicitly examine mediating variables that may explain lower levels of COVID anxiety among older adults. Such work could that the potential to inform clinical and public health messaging targeting the adoption of risk reduction strategies (i.e., mask-wearing, vaccination, hygiene practices, social distancing) among older adults.

A strength of this study was the use of the multi-item instrument to assess COVID-related anxiety. In contrast, prior studies examining the link between diabetes and COVID-19 have used single Likert-type items to quantify COVID-related anxiety (e.g., I worry about COVID-19; (Musche et al., 2021)). Importantly, single-item measures measure very narrowly defined constructs and may not fully assess COVID-related fear or anxiety. Further, single items measures have no internal reliability and therefore provide an imprecise measurement of

psychological constructs such as COVID-related anxiety. The Fear of COVID-19 Scale (FCV-19S) includes seven questions answered on a 5-point Likert scale which provides a more complete and meaningful measurement of different facets of COVID anxiety. Further, the FCV-19S demonstrated excellent internal consistency in this sample.

Our study was the only study found that focused on adults in the United States. This is an important population to examine because of many reasons. First, every country responded at various times with different sets of protocols and restrictions. These differences in policies and restrictions could affect the reactions of the citizens to the virus and the pandemic in general. The United States and Germany, the country with the most similar study, had very similar timelines when it comes to stay-at-home requests, travel restrictions, and social distancing policies (Tabari et al., 2020). However, the United States had a much higher number of cases of COVID-19 compared to Germany. For example, to date, Germany has had 16,026, 216 confirmed cases of COVID-19 compared to 78,545,019 COVID cases in the United States (World Health Organization, 2022). With millions more cases in the United States, there are even more people directly affected by the virus and therefore more reason to be worried or fearful about contracting COVID.

The United States also has high rates of diabetes in comparison to other countries in the world. In 2021, it was estimated that the rate of diabetes in the United States was around 11%, while in Germany the rate was about 7% (International Diabetes Federation, 2021). This difference can also be seen in the rates of pre-diabetes diagnoses. Prediabetes is almost three times as prevalent in North America as it is in Europe, with rates being 15.4% and 5.5% respectively (Hostalek, 2019). These rates are also predicted to grow in the coming years to 16.7% and 6.1% respectively (Hostalek, 2019). Those with prediabetes still have an increased

risk for many poor medical outcomes that are associated with diabetes such as retinopathy, neuropathy, and nephropathy (Hostalek, 2019). Studies have concluded that prediabetes is also an important risk factor for COVID-19 and if a person with prediabetes contracts COVID-19, it could lead to exacerbation of the pathophysiology underlying prediabetes (Sathish & Chandrasekaran, 2021). Because these diseases are linked with poorer COVID outcomes, the comparatively high rates of both diabetes and prediabetes in American adults make this population especially important to study.

This study was also the only study that focused on type 2 diabetes rather than using participants with any type of diabetes. There are many sociodemographic and medical characteristic differences between adults with type 2 diabetes and other types that make it especially important to study. Type 2 diabetes is characterized by overweight or obesity, both of which are considered unfavorable factors for COVID-19 (Magdy Beshbishy et al., 2020). Type 2 diabetes becomes more prevalent in older populations, which are at-risk populations as well (Selvin & Juraschek, 2020). For these reasons, the population of type 2 diabetes are an important at-risk group for poor COVID outcomes.

Limitations

This study was limited by the period of time between the reports of the samples. The samples were taken 4 months apart with the type 2 diabetes sample reporting in June 2020 and the sample without reporting in September 2020. It is possible that the differences between the scores could be greater due to the group without type 2 diabetes responding further from the beginning of the pandemic. Future studies on differences in the levels of COVID anxiety between groups should take the samples at the same time. Also, the samples were not matched based on demographic data, so there were some significant differences in the sample

characteristics between the groups. However, these differences were controlled for when examining the differences in COVID-related anxiety in the multivariable linear regression. This study also did not assess the COVID status or COVID history of the participants, which could have affected the anxiety of the participants surrounding COVID. We also did not access the perceived susceptibility or perceived vulnerability of the participants. These variables could have partially explained the link between comorbid type diabetes and underlying causes of COVID anxiety. Finally, this study was limited by the inability to verify the diagnosis of type 2 diabetes of participants, although we did include multiple screening questions to verify their diagnosis to the best of our abilities.

Clinical Implications

Our results suggest that adults with type 2 diabetes have greater fear and anxiety surrounding COVID-19 infection compared to adults without type 2 diabetes. Critically, further research is needed to determine whether this anxiety is adaptive or maladaptive among adults with type 2 diabetes. Because adults with type diabetes are more at risk for poor COVID-related outcomes, such as hospitalization and mortality, they may have an appropriately elevated fear and anxiety related to COVID infection compared to their counterparts without type 2 diabetes. Therefore, on an individual level, fear and anxiety of COVID-19 infection may be adaptive – particularly for individuals with one or more medical risk factors linked to poor COVID-related outcomes such as type 2 diabetes. If an individual has higher COVID anxiety, they may be more cautious and take more health provisions, such as wearing a mask, washing their hands, and getting vaccinated. Importantly, these protective behaviors could lead to a lower rate of COVID-19 infection among those who have an adaptive level of COVID anxiety. However, if COVID-related anxiety is severe enough, it could lead to maladaptive behaviors such as social isolation,

stress, and lack of sleep which may be especially deleterious for adults with an underlying cardiometabolic condition such as type 2 diabetes.

The results of this study have many important public health implications for adults with type 2 diabetes in the United States. Our findings suggest the need for future research to better clarify the adaptive vs. maladaptive nature of COVID-related anxiety among vulnerable populations with underlying medical conditions. To determine if this anxiety is maladaptive for medically at-risk populations, different kinds of studies could be performed in the future. First, a longitudinal study could be useful in tracking the long-term behaviors of adults with type 2 diabetes as the pandemic continues to unfold. Such work could provide greater insight into the tendencies of this population to wear a mask, get vaccinated, and other safety behaviors. A longitudinal study could be especially helpful because of the ever-changing nature of the pandemic, studying these consequences for years to come would provide insight into how deeply populations were affected by COVID-19. A case-control study could also be performed to compare rates of COVID-19 inflection and hospitalization among adults with and without type 2 diabetes. This could provide us insights into if this difference in COVID anxiety scores translates into lower infection, hospitalization, and mortality. If COVID-19 anxiety is found to be maladaptive, additional work is needed to evaluate and develop evidence-based approaches for the treatment of COVID-related anxiety in these populations with medical risk factors for poor COVID-related outcomes.

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Table 1

Sample Characteristics

Variable	Type 2 Diabetes (n = 372)	No Type 2 Diabetes (n = 259)		
	n (%) or Mean (SD)	n (%) or Mean (SD)	t or χ^2	p
Age	54.86 ± 15.70	52.04 ± 14.99	3.50	< .001
Female	56.7	52.9	χ^2 (1) = 1.86	.172
Race			χ^2 (7) = 9.68	.139
White	78.5	80.7		
Black	12.6	13.9		
Asian	3.5	1.2		
American Indian	1.1	1.5		
Multiracial	0.8	1.2		
Other	3.2	1.2		
Unknown	0.3	0.4		
Ethnicity (Latino)	9.9	5.8	χ^2 (1) = 10.95	< .001
Education			χ^2 (2) = 6.09	.048
< High school	2.2	3.9		
High School	20.2	28.6		
≥ Some college	77.6	67.6		
Income			χ^2 (4) = 13.81	.008

< 15,000	9.4	12.0		
15,000 to 30,000	20.2	26.3		
30,000 to 50,000	19.6	25.9		
50,000 to 75,000	21.0	18.5		
≥ 75,000	29.8	17.4		
Health insurance	95.2	88.0	$\chi^2(1) = 17.11$	< .001
Primary Care Provider	94.0	77.6	$\chi^2(1) = 63.95$	< .001

Table 2

Association between diabetes status and COVID-19 anxiety adjusted for sociodemographic and medical characteristics

Variable	*B*	*SE*	95% CI	*p*
Diabetes Status	2.20	0.56	1.10, 3.29	<.001
Race	-0.08	0.66	-1.38, 1.22	.901
Age	-0.17	0.02	-0.20, -0.14	<.001
Sex	0.50	0.53	-0.56, 1.54	.359
Education	-1.59	1.58	-4.70, 1.52	.314
Income	-0.01	.58	-1.02, 1.33	.794
Primary Care Provider	-1.42	0.95	-3.30, 0.45	.136
Health Insurance	0.13	1.06	-1.95, 2.21	.904

B = unstandardized regression coefficient, *SE* = standard error, 95% CI = 95% Confidence Interval

APPENDIX A

Title: Cognitive and Affective Components of Diabetes Distress and Self-Management

Investigator
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☐ *By checking this box I certify that I am 18 years of age or older.*

Description
The purpose of this research project is to determine how people tend to think and feel related to the way that they experience stress about their diabetes and diabetes self-care activities. We would like to ask you questions about the way you think and feel about your diabetes. You will not be asked for your name or any other identifying information.

Cost and Payments
It will take you approximately 20 minutes to complete this survey. You will be compensated by in the manner described on the website through which you reached the survey.

Risks and Benefits
It is possible that you may feel uncomfortable with some of the questions about your diabetes. We do not think that there are any other risks. Your participation in this study will help us to better understand the link between thoughts, emotions, diabetes related stress and self-care.

Confidentiality
No uniquely identifiable information will be recorded. Therefore, we do not think you can be identified from this study.

Right to Withdraw
You do not have to participate in this study, and there is no penalty if you refuse. If you start the study and decide that you do not want to finish, just end the online task. Whether or not you participate or withdraw will not affect your current or future relationship with the University of Mississippi, and it will not cause you to lose any benefits to which you are entitled.

IRB Approval
This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482 or irb@olemiss.edu.

Statement of Consent

I have read and understand the above information. By completing the survey, I consent to participate in the study.

☐ **YES**

☐ **NO**

APPENDIX B

The Fear of COVID-19 Scale (FCV-19S)

Response options: 1 – Strongly disagree, 2 – Disagree, 3 – Neither agree nor disagree, 4 – Agree, 5 – Strongly agree

1. I am most afraid of coronavirus-19.
2. It makes me uncomfortable to think about coronavirus-19.
3. My hands become clammy when I think about coronavirus-19.
4. I am afraid of losing my life because of coronavirus-19.
5. When watching news and stories about coronavirus-19 on social media, I become nervous or anxious.
6. I cannot sleep because I'm worrying about getting coronavirus-19.
7. My heart races or palpitates when I think about getting coronavirus-19.