Distribution Agreement

Signature:

______________________ ____________
Ankeeta Saseetharran Date

COVID-19 pandemic-related healthcare interruptions and diabetes distress: A national study of US adults with diabetes

By

Ankeeta Saseetharran

Master of Public Health

Epidemiology

____

Shivani A. Patel

Committee Chair

COVID-19 pandemic-related healthcare interruptions and diabetes distress: A national study of US adults with diabetes

By

Ankeeta Saseetharran

B.S.

University of California, San Diego

2020

Thesis Committee Chair: Shivani A. Patel, PhD, MPH

An abstract of

A thesis submitted to the Faculty of the

Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of

Master of Public Health

in Epidemiology

2023

Abstract

COVID-19 pandemic-related healthcare interruptions and diabetes distress: A national study of US adults with diabetes

By Ankeeta Saseetharran

Objective: Diabetes distress is an emotional state characterized by worry, conflict, frustration, and discouragement due to living with diabetes. This analysis aimed to determine the association between COVID-19 pandemic-related healthcare interruptions and diabetes distress in 2021 among adults with Type 1 and Type 2 diabetes in the United States.

Method: A representative sample of adults aged 20 years and older with Type 1 (n=228) and Type 2 (n=2534) diabetes from the National Health Interview Survey in 2021 were analyzed with survey adjusted methods. Participants reported pandemic-related healthcare delays and deferrals, as well as the experience of diabetes-related distress through a single item regarding frequency of diabetes distress in the past month. Diabetes distress was dichotomized as never or ever having experienced diabetes distress in the past month. Logistic regression was used to determine the associations of experiencing delayed medical care and being unable to get medical care (exposures) with diabetes distress (outcome).

Results: 60.3% of individuals with Type 1 diabetes and 50.8% of individuals with Type 2 diabetes experienced diabetes distress. 23.2% of individuals with Type 1 diabetes experienced delayed medical care and 18.0% did not get medical care. 21.1% of individuals with Type 2 diabetes experienced delayed medical care and 15.1% did not get medical care. In individuals with Type 1 diabetes, people who delayed medical care, compared to those who did not delay care, were more likely to experience diabetes distress (adjusted odds ratio [aOR]= 4.14; 95% CI: 1.89-9.11). Similarly, not receiving medical care was associated with aOR= 3.37 (95% CI: 1.35-8.45) for diabetes distress in people with Type 1 diabetes. In individuals with Type 2 diabetes, the adjusted odds ratio of diabetes distress for delayed medical care was 1.72 (95% CI: 1.35-2.20) and the adjusted odds ratio of diabetes distress for not receiving medical care was 1.50 (95% CI: 1.13-1.98).

Conclusion: Over half of adults with diabetes reported diabetes distress in 2021. Experience of pandemic-related healthcare disruptions was associated with higher reports of diabetes distress.

COVID-19 pandemic-related healthcare interruptions and diabetes distress: A national study of US adults with diabetes

By

Ankeeta Saseetharran

B.S.

University of California, San Diego

2020

Thesis Committee Chair: Shivani A. Patel, PhD, MPH

A thesis submitted to the Faculty of the

Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of

Master of Public Health

in Epidemiology

2023

Contents

Chapter 1: Introduction and Extended Literature Review

Diabetes mellitus

Diabetes mellitus includes Type 1 and Type 2 diabetes. Type 1 diabetes accounts for 5.6% of total diagnosed diabetes cases. It is an autoimmune condition where the pancreatic beta cells are unable to produce enough insulin. The cause is unknown, but it typically develops in children and young adults. Type 2 diabetes is the most common form of diabetes and accounts for 91.2% of total diagnosed cases. It results when the body does not effectively use insulin. Risk factors for Type 2 diabetes include high body mass index (BMI), a sedentary lifestyle, family history, polycystic ovary syndrome, gestational diabetes, hypertension, and high lipid levels. Although this condition is often diagnosed in adults, it is becoming more common in children. Symptoms of Type 1 and Type 2 diabetes include frequent urination, weight loss, high level of thirst, and fatigue. In the United States, the distribution of Type 1 and Type 2 diabetes varies by age, sex, race/ethnicity, education, family income, and BMI [1-3].

Diabetes distress

Diabetes distress is the worry, conflict, frustration, and discouragement that can accompany living with diabetes [4]. It is prevalent among adults with Type 1 and Type 2 diabetes and is associated with other mental health conditions, demographical factors, and diabetes control. Diabetes distress is associated with anxiety, depressive symptoms, and diabetes complications [4-13]. Higher diabetes distress levels are significantly associated with younger age, lower income, non-white race/ethnicity, female gender, and higher blood glycemic levels [6, 8, 13-17]. Diabetes distress is linked to poorer diabetes management. Diabetes distress has been observed to affect self-efficacy, which in turn affects diabetes self-care practices [4, 18]. Lower levels of diabetes distress are associated with better regimen adherence in individuals with Type 2 diabetes, which include diet, physical activity, glucose monitoring, and medication adherence

[14]. In individuals with Type 1 diabetes, higher levels of diabetes distress are associated with increased missed insulin boluses in both cross-sectional and longitudinal analyses [19].

Sources of diabetes distress among individuals with Type 1 diabetes include: feelings of powerlessness, feelings of potentially being perceived negatively for having diabetes, physician distress, friend and family distress, hypoglycemia distress, management distress, and eating distress. Physician distress encompasses feeling that one's doctor lacks knowledge about diabetes, one can't get the support that they need, and that one can't communicate openly with their doctor [8]. Among individuals with Type 2 diabetes, sources of diabetes distress include: hypoglycemia, long-term health concerns, relationships with healthcare providers, interpersonal issues, shame and stigma, healthcare access, and management demands [20].

While no single comprehensive method to measure diabetes distress exists, there are several questionnaires that can be used to assess diabetes distress levels. These include the Problem Areas in Diabetes (PAID) scale, the Diabetes Distress Scale (DDS), Type 1 Diabetes Distress Scale (T1-DDS), and the Diabetes-specific Quality of Life Scale-Revised (DSQoLS-R). These scales measure diabetes distress, taking into account how diabetes distress relates to treatment regimen, diet, hypoglycemia, interpersonal relationships, and healthcare professionals [21].

The relationship between diabetes distress and healthcare access

Diabetes distress is associated with various measures of healthcare access, including the ability to engage with healthcare providers, quality of interactions with healthcare providers, and the ability to navigate the healthcare system. Adults with easier access to healthcare providers report less diabetes distress [22-25]. Literature suggests that employment status, geographic region, education, and marital status could also be potential confounders in looking at the association between health care and diabetes distress [26-30].

Health care among individuals with diabetes

Health care access and utilization is important for diabetes management [31, 32]. Several studies on subsets of populations with either Type 1 or Type 2 diabetes suggest that there are differences in healthcare support, utilization, and access by age, sex, race/ethnicity, income, health insurance status, depression, and education [16, 23, 33-37]. Individuals satisfied with their diabetes care reported lower anxiety scores [26]. In addition, a study on African Americans with Type 2 diabetes found that females usually relied on health care professionals as their main source of support [38].

Health care access and diabetes distress during the pandemic

During the pandemic, individuals in the US, regardless of diabetes status, reported experiencing healthcare interruptions. Over 40% of individuals experienced delayed or missed health care appointments due to provider-initiated cancellation or delay, fear of SARS-CoV-2 infection, provider discouragement, and feeling that their health concerns were not as important as others' health concerns. Missed or delayed healthcare was associated with being female, older in age, white, having a higher educational attainment, and a higher income [39,40].

Research on health care access among individuals with diabetes during the pandemic is limited. During the pandemic, there have been interruptions and changes to health care and diabetes management among individuals with Type 1 and Type 2 diabetes [41]. In the first few weeks of the pandemic, approximately 10% of survey respondents in a national study reported difficulties contacting their health care team. In addition, approximately one third of individuals reported cancelled or postponed labs and tests [42]. In 2021, 87% of individuals with diabetes reported delayed medical care. Younger adults were more likely to experience health care interruptions than older adults. Reasons for health care interruptions included concerns about the overwhelm on the health care system and about becoming infected with SARS-CoV-2 [41]. Among Medicare beneficiaries with diabetes, non-Hispanic blacks and Hispanic individuals had an increased odds of being unable to get a regular check-up or treatment for an ongoing condition than non-Hispanic whites during different time periods throughout the pandemic [43].

There is a lack of research about diabetes distress in the US during the pandemic. Most research is centered around diabetes control and coronavirus in individuals with diabetes. So far, one national study found that over half of respondents reported an increase in diabetes distress at the onset of the COVID-19 pandemic [42]. This study expands on early pandemic research by examining how pandemic-related healthcare interruptions and diabetes distress persisted in 2021, and analyzing the association between pandemic-related healthcare interruptions and diabetes distress among adults with Type 1 and Type 2 diabetes.

Chapter 2. Manuscript

Title: COVID-19 pandemic-related healthcare interruptions and diabetes distress: A national study of US adults with diabetes

Authors: Ankeeta Saseetharran, Shivani A. Patel

Abstract

Aim: To determine the association between COVID-19 pandemic-related healthcare interruptions and diabetes distress among adults with Type 1 and Type 2 diabetes in the US in 2021.

Method: Logistic regression was used to analyze data for 228 individuals with Type 1 diabetes and 2534 individuals with Type 2 diabetes interviewed in the National Health Interview Survey in 2021.

Results: Among adults with Type 1 diabetes, 60.3% experienced diabetes distress, 23.2% experienced delayed medical care, and 18.0% did not get medical care. Among adults with Type 2 diabetes, 50.8% experienced diabetes distress, 21.1% experienced delayed medical care, and 15.1% did not get medical care. For Type 1 diabetes, the adjusted odds ratio (aOR) of diabetes distress was 4.14 (95% CI: 1.89-9.11) for experiencing delayed medical care and 3.37 (95% CI: 1.35-8.45) for not receiving medical care. For Type 2 diabetes, the aOR of diabetes distress was 1.71 (95% CI: 1.35-8.45) for experiencing delayed medical care and 1.50 (95% CI: 1.13-1.98) for not receiving medical care.

Conclusion: Among people with diabetes, experiencing delayed medical care and not receiving care due to the pandemic were associated with higher reports of diabetes distress.

Keywords: diabetes distress, COVID-19 pandemic, Type 1 diabetes, Type 2 diabetes

Introduction

Diabetes mellitus, which includes Type 1 and Type 2 diabetes, is a chronic condition characterized by high blood sugar levels [1, 2]. In 2016 and 2017, among US adults, the prevalence of Type 1 diabetes was 0.5% and the prevalence of Type 2 diabetes was 8.5%. Type 2 diabetes is the most common subgroup of diabetes, accounting for 91.2% of total diagnosed cases [3].

Diabetes distress is the worry, conflict, frustration, and discouragement that can accompany living with diabetes [4]. It poses a psychological burden on patients and is linked to poorer diabetes management. Diabetes distress affects self-efficacy, which in turn affects diabetes self-care practices, such as medication adherence, foot care, diet, exercise, and glucose self-monitoring [4,5]. Diabetes distress has been observed to be associated with poor glycemic control, lower medication adherence, and increased missed insulin boluses [5-9]. In turn, suboptimal control or uncontrolled diabetes can result in serious complications, such as kidney disease, retinopathy, neuropathy, and nephropathy as well as life-threatening difficulties [2].

Healthcare access has been linked to diabetes distress. Healthcare access includes the ability to engage with healthcare providers, quality of interactions with healthcare providers, and the ability to navigate the healthcare system [10-13]. Adults with easier access to healthcare providers and better healthcare provider support report less diabetes distress [10, 11, 14]. During the pandemic, interruptions and changes to health care and diabetes management have been documented among individuals with Type 1 and Type 2 diabetes [15]. Particularly in the first few weeks of the pandemic, approximately 10% of respondents in a national study reported difficulties contacting their health care team, and approximately 30% reported cancelled or postponed labs and tests. Over half of these respondents reported an increase in diabetes distress at the onset of the pandemic [16].

It is unclear, however, whether the interruptions to healthcare and related distress at the onset of the pandemic persisted in subsequent years when vaccines became available, social distancing restrictions had begun loosening, and thus pandemic-related constraints on healthcare access lessened. To address this gap, we investigated the extent to which pandemic-related healthcare interruptions were reported by people with Type 1 and Type 2 diabetes in the United States in 2021, and whether there was an association between pandemic-related healthcare interruptions and diabetes distress.

Methods

Data Source

Data were obtained from the National Health Interview Survey (NHIS) from 2021. This is a cross-sectional household interview survey conducted by the National Center for Health Statistics at the Centers for Disease Control and Prevention. The study population consists of participants from the civilian noninstitutionalized US population in the 50 states and District of Columbia, excluding those who reside in long term care institutions, correctional facilities, and foreign countries. Geographically clustered sampling techniques were used to select a nationally representative sample of dwelling units. Interviews were conducted both in-person and by phone, and data were collected continuously from January to December 2021 [17].

Adults aged 20 years and older with either Type 1 diabetes (n=249) or Type 2 diabetes (n=2647) were eligible to be included in this study. The analysis was restricted to individuals who had complete information on exposures, outcomes, and study covariates (228 individuals with Type 1 diabetes and 2534 individuals with Type 2 diabetes).

Diabetes distress

The primary outcome was diabetes distress, which was queried in the NHIS survey as how often the individual felt overwhelmed by the demands of living with diabetes in the past month. Participants responded “always”, “usually”, “sometimes”, “rarely”, or “never.” For the analysis, the outcome was dichotomized. Participants were categorized as having experienced diabetes distress if they responded “always”, “usually”, “sometimes”, or “rarely” to this question, and not having diabetes distress if they responded “never.”

Pandemic-related healthcare interruptions

Primary exposures were pandemic-related healthcare interruptions, which included delayed medical care and not receiving medical care. Participants were asked if there was a time when they delayed getting medical care because of the COVID-19 pandemic or if there was a time when they needed medical care for something other than COVID-19, but did not get it because of the COVID-19 pandemic. These exposures were binary with “yes” or “no” responses.

Demographic and health covariates

Covariates included in the model were age, sex, race and ethnicity, marital status, geographical region, educational level, employment status, income, health insurance status, anxiety, and depression. Age was a continuous variable from 20 to 84 years old. Sex was self-reported as male or female. Combined race and ethnicity were categorized as Hispanic, non-Hispanic white, non-Hispanic black, and other. Marital status was dichotomized as “currently married or cohabiting” and “other”. Geographical region was dichotomized as “metropolitan” for individuals reporting living in large central metros, large fringe metros, or medium and small metros, and “non-metropolitan” if individuals lived outside of a metropolitan area. Educational level was categorized as below high school, high school graduate/GED/equivalent, and college or above. Current employment status was determined from a “yes” or “no” answer to the question of whether or not the individual worked the previous week. Income was the ratio of family income to poverty threshold for the sampled adult’s family grouped into the following categories: 0-0.99, 1-1.99, 2-2.99, and 3 or greater. Health insurance status was reported as “yes” or “no” in response to the question of whether or not the individual was covered by any kind of health insurance or health care plan. Anxiety was self-reported as ever being told by a doctor or health professional that they have an anxiety disorder, and depression was self-reported as ever being told by a doctor or health professional that they have any type of depression.

Statistical analysis

All analyses accounted for the survey design using sampling elements and weights provided by NHIS.

Descriptive analysis was conducted to determine the prevalence of background characteristics, exposures, and outcomes. Logistic regression was conducted for individuals with Type 1 diabetes and Type 2 diabetes separately. One set of logistic regression models evaluated the unadjusted associations between each of the pandemic-related healthcare interruption variables and diabetes distress. A second set of logistic regression models evaluated the adjusted associations between each exposure and the outcome. The adjusted models included age, sex, race and ethnicity, marital status, geographical region, educational attainment, employment status, income, health insurance status, anxiety, and depression as they were identified as potential confounders from previous literature. Furthermore, we assessed whether the association between pandemic-related healthcare interruptions and diabetes distress was modified by the type of diabetes by including the presence of statistical interaction between the presence of the healthcare exposure and type of diabetes in a model pooling individuals with Type 1 and Type 2 diabetes.

A sensitivity analysis was conducted to assess whether findings were robust to the dichotomous specification of diabetes distress. Whereas the primary analysis modeled diabetes distress as a dichotomous outcome, the sensitivity analysis modeled diabetes distress as a 5-level categorical variable: always, usually, sometimes, rarely, and never.

Results

Descriptive analysis

Characteristics of US adults with diabetes in 2021 are provided in Table 1. Individuals with Type 1 diabetes had a mean age of 51.9 ± 1.3 years old. They self-reported as 59.3% non-Hispanic white, 14.7% non-Hispanic black, and 18.4% Hispanic. 56.2% reported an educational attainment of college or above, 50.6% were employed as of the previous week, and 96.9% had health insurance. 82.8% reported living in a metropolitan area and 57.0% were married or cohabiting with a partner (Table 1).

Individuals with Type 2 diabetes had a mean age of 62.8 ± 0.3 years old. They self-reported as 58.0% non-Hispanic white, 16.0% non-Hispanic black, and 17.7% Hispanic. 50.2% reported an educational attainment of college or above, 38.5% were employed as of the previous week, and 95.7% had health insurance. 84.0% reported living in a metropolitan area and 63.8% were married or cohabiting with a partner (Table 1).

60.3% of individuals with Type 1 diabetes and 50.8% of individuals with Type 2 diabetes experienced diabetes distress. Individuals with Type 1 diabetes experienced a statistically significantly higher prevalence of diabetes distress than individuals with Type 2 diabetes (p=0.0123). 23.2% of individuals with Type 1 diabetes and 21.1% of individuals with Type 2 diabetes experienced delayed medical care. 18.0% of individuals with Type 1 diabetes and 15.1% of individuals with Type 2 diabetes did not get medical care. (Table 2).

Associations between pandemic-related healthcare interruptions and diabetes distress

Among individuals with Type 1 diabetes, the unadjusted odds of diabetes distress in those who experienced delayed medical care was 4.20 (95% CI: 1.98-8.90) times the odds of diabetes distress among those who did not experience delayed medical care. The unadjusted odds of diabetes distress among those who did not get medical care was 3.38 (95% CI: 1.46-7.83) times the odds of diabetes distress among those who did get care. After adjusting for age, sex, race and ethnicity, education, income, health insurance status, marital status, employment status, geographical region, anxiety, and depression, the odds ratio of diabetes distress was 4.14 (95% CI: 1.88-9.11) for delayed medical care and 3.37 (95% CI: 1.35-8.45) for not receiving medical care (Table 3).

Among individuals with Type 2 diabetes, the unadjusted odds of diabetes distress in those who experienced delayed medical care was 1.88 (95% CI: 1.49-2.37) times the odds of diabetes distress among those who did not experience delayed medical care. The odds of diabetes distress among those who did not get medical care was 1.74 (95% CI: 1.33-2.27) times the odds of diabetes distress among those who did get medical care. After adjusting for sociodemographic and psychosocial characteristics, the odds ratio of diabetes distress was 1.71 (95% CI: 1.35-2.20) for delayed medical care and 1.50 (95% CI: 1.13-1.98) for not receiving medical care (Table 3). There was statistically significant interaction between diabetes type for delayed medical care (p=0.0284), but not for missed medical care (p=0.0968) (Table 3).

Sensitivity Analysis

The results of the primary analysis were confirmed with polytomous logistic regression, which showed a higher odds of experiencing each level of diabetes distress (always, usually, sometimes, and rarely) among individuals with Type 1 and Type 2 diabetes who reported delayed medical care or not receiving medical care (Table 4). This sensitivity analysis confirms that findings from the dichotomized diabetes distress variable and frequency of diabetes distress offer similar interpretations.

Discussion

We conducted a national study of diabetes distress associated with pandemic-related disruptions to healthcare in 2021. We found an increased odds of diabetes distress among adults who experienced delayed or missed medical care due to the pandemic. These findings can be generalized to the US population, and adds more recent analysis to the experiences of individuals with diabetes during the pandemic.

Our findings show that heightened distress due to pandemic-related impacts on healthcare persisted in 2021, even after COVID-19 vaccines were available and social distancing policies were relaxed. Adults with Type 1 diabetes were approximately four times as likely to experience diabetes distress if they experienced delayed medical care and approximately three times as likely to experience diabetes distress if they did not get care. Similarly, adults with Type 2 diabetes were almost twice as likely to experience diabetes distress if they experienced delayed medical care and 1.5 times as likely to experience diabetes distress if they did not get medical care. The findings suggest that impeded access to healthcare during the pandemic, particularly among people with Type 1 diabetes, was a source of stress. This may inform recommendations for diabetes care during future public health emergencies.

The prevalence of diabetes distress was high among adults with diabetes. Over half of individuals with Type 1 or Type 2 diabetes experienced diabetes distress during 2021. The prevalence of COVID-19 pandemic-related healthcare interruptions was also high, but not as high as the prevalence of diabetes distress. Under a quarter of individuals with either Type 1 or Type 2 diabetes experienced delayed or missed medical care within the past year.

We hypothesized that the pandemic may be associated with increased diabetes distress through pandemic-related healthcare interruptions. Our findings show that individuals who experienced delayed or missed medical care had a statistically significant higher odds of diabetes distress regardless of diabetes type. This supports our hypothesis and suggests that the psychological burden of pandemic-related healthcare changes on individuals managing their diabetes was significant and should not be overlooked. Inconsistent health care access could have posed a risk for individuals with diabetes during the pandemic.

This study has many strengths. First, nationally representative data were used, so findings can be generalized to the entire US population with Type 1 or Type 2 diabetes. Second, the most recent yearly data (2021) were used. Third, the dataset that was analyzed measured many covariates associated with healthcare access and diabetes distress, and these covariates were included in the regression models. Fourth, a sensitivity analysis was conducted, which validated the findings that there was a higher odds of diabetes distress among individuals who experienced pandemic-related healthcare interruptions, regardless of how diabetes distress was defined. Fifth, interaction was assessed between healthcare access and diabetes type.

This study has some limitations. First, the data used are cross-sectional, so conclusions cannot be made about causation between the pandemic-related healthcare interruptions and diabetes distress. It is possible that individuals experiencing diabetes distress may be more likely to delay or not seek medical care. Second, all data are self-reported. This could lead to recall and social desirability biases for the exposures and issues of subjectivity in the outcome variable, as diabetes distress was not measured objectively using a diagnostic tool. Third, case-wise deletion of observations with missing values for covariates could have created bias in the estimates from the regression analyses. Among adults with Type 1 diabetes, 8.4% were excluded due to missing data and among adults with Type 2 diabetes, 4.3% were excluded due to missing data.

In order to gain a better understanding of the nature of association, it could be beneficial to investigate how health care access and diabetes distress levels may have changed or persisted from pre-pandemic to present. Future research can also look at other potential risk and protective factors of diabetes distress during the pandemic, such as social support changes during the pandemic. Studies with a larger sample size for Type 1 diabetes may be beneficial to reduce bias.

These findings expand on early pandemic research on diabetes distress and suggest the need for the consideration of the psychological impact of the pandemic on individuals managing their diabetes.

References

[1] CDC. What is Diabetes? Centers for Disease Control and Prevention 2022. https://www.cdc.gov/diabetes/basics/diabetes.html (accessed January 30, 2023).

[2] Balakumar P, Maung-U K, Jagadeesh G. Prevalence and prevention of cardiovascular disease and diabetes mellitus. Pharmacol Res 2016;113:600–9. https://doi.org/10.1016/j.phrs.2016.09.040.

[3] Xu G, Liu B, Sun Y, Du Y, Snetselaar LG, Hu FB, et al. Prevalence of diagnosed type 1 and type 2 diabetes among US adults in 2016 and 2017: population based study. BMJ 2018;362:k1497. https://doi.org/10.1136/bmj.k1497.

[4] Devarajooh C, Chinna K. Depression, distress and self-efficacy: The impact on diabetes self-care practices. PLoS One 2017;12:e0175096. https://doi.org/10.1371/journal.pone.0175096.

[5] Gonzalez JS, Shreck E, Psaros C, Safren SA. Distress and type 2 diabetes-treatment adherence: A mediating role for perceived control. Health Psychol 2015;34:505–13. https://doi.org/10.1037/hea0000131.

[6] van Bastelaar KMP, Pouwer F, Geelhoed-Duijvestijn PHLM, Tack CJ, Bazelmans E, Beekman AT, et al. Diabetes-specific emotional distress mediates the association between depressive symptoms and glycaemic control in Type 1 and Type 2 diabetes. Diabet Med 2010;27:798–803. https://doi.org/10.1111/j.1464-5491.2010.03025.x.

[7] Fisher L, Mullan JT, Arean P, Glasgow RE, Hessler D, Masharani U. Diabetes distress but not clinical depression or depressive symptoms is associated with glycemic control in both cross-sectional and longitudinal analyses. Diabetes Care 2010;33:23–8. https://doi.org/10.2337/dc09-1238.

[8] Tsujii S, Hayashino Y, Ishii H, Diabetes Distress and Care Registry at Tenri Study Group. Diabetes distress, but not depressive symptoms, is associated with glycaemic control among Japanese patients with type 2 diabetes: Diabetes Distress and Care Registry at Tenri (DDCRT 1). Diabet Med 2012;29:1451–5. https://doi.org/10.1111/j.1464-5491.2012.03647.x.

[9] Hessler DM, Fisher L, Polonsky WH, Masharani U, Strycker LA, Peters AL, et al. Diabetes distress is linked with worsening diabetes management over time in adults with Type 1 diabetes. Diabet Med 2017;34:1228–34. https://doi.org/10.1111/dme.13381.

[10] Rubin RR, Peyrot M, Siminerio LM. Health care and patient-reported outcomes: results of the cross-national Diabetes Attitudes, Wishes and Needs (DAWN) study. Diabetes Care 2006;29:1249–55. https://doi.org/10.2337/dc05-2494.

[11] Walker RJ, Gebregziabher M, Martin-Harris B, Egede LE. Relationship between social determinants of health and processes and outcomes in adults with type 2 diabetes: validation of a conceptual framework. BMC Endocr Disord 2014;14:82. https://doi.org/10.1186/1472-6823-14-82.

[12] Chen P, Callisaya M, Wills K, Greenaway T, Winzenberg T. Cognition, educational attainment and diabetes distress predict poor health literacy in diabetes: A cross-sectional analysis of the SHELLED study. PLoS One 2022;17:e0267265. https://doi.org/10.1371/journal.pone.0267265.

[13] Polonsky WH, Fisher L, Guzman S, Sieber WJ, Philis-Tsimikas A, Edelman SV. Are patients' initial experiences at the diagnosis of type 2 diabetes associated with attitudes and self-management over time? Diabetes Educ 2010;36:828–34. https://doi.org/10.1177/0145721710378539.

[14] Wardian J, Sun F. Factors associated with diabetes-related distress: implications for diabetes self-management. Soc Work Health Care 2014;53:364–81. https://doi.org/10.1080/00981389.2014.884038.

[15] Czeisler MÉ, Barrett CE, Siegel KR, Weaver MD, Czeisler CA, Rajaratnam SMW, et al. Health Care Access and Use Among Adults with Diabetes During the COVID-19 Pandemic — United States, February–March 2021. MMWR Morb Mortal Wkly Rep 2021;70:1597–602. https://doi.org/10.15585/mmwr.mm7046a2.

[16] Fisher L, Polonsky W, Asuni A, Jolly Y, Hessler D. The early impact of the COVID-19 pandemic on adults with type 1 or type 2 diabetes: A national cohort study. J Diabetes Complications 2020;34:107748. https://doi.org/10.1016/j.jdiacomp.2020.107748.

[17] NHIS - About the National Health Interview Survey. National Center for Health Statistics 2022. https://www.cdc.gov/nchs/nhis/about_nhis.htm (accessed February 1, 2023).

Tables and Figures

Table 1. Characteristics of adults 20 years and older with Type 1 and Type 2 diabetes in the US, NHIS 2021

	Type 1 diabetes (n=228)	Type 2 diabetes (n=2534)
Population size (weighted frequency)	1,951,899	19,350,659
Age in years, mean ± SD[2]	51.9 ± 1.3	62.8 ± 0.3
Female, %	47.0 (39.4-54.7)	48.5 (46.1-50.8)
Race and ethnicity, %		
Non-Hispanic White	59.3 (51.3-67.2)	58.0 (55.1-60.9)
Non-Hispanic Black/African American	14.7 (8.9-20.5)	16.0 (14.0-18.1)
Hispanic	18.4 (12.0-24.8)	17.7 (15.2-20.2)
Other (non-Hispanic Asian, non-Hispanic AIAN[3], multiracial, other)	7.6 (2.5-12.6)	8.3 (6.7-9.8)
Married or cohabiting, %	57.0 (49.5-64.4)	63.8 (61.6-65.9)
Lives in a metropolitan area, %	82.8 (77.2-88.5)	84.0 (82.0-86.0)
Educational Attainment, %		
Below high school	15.7 (10.1-21.3)	16.4 (14.5-18.3)
High school graduate, GED, or equivalent	28.1 (21.2-35.0)	33.5 (31.2-35.8)
College or above	56.2 (48.7-63.8)	50.2 (47.8-52.5)
Employed, %	50.6 (43.1-58.1)	38.5 (36.3-40.8)
Family income to poverty ratio, %		
0-0.99	13.4 (8.4-18.3)	11.4 (9.9-12.9)
1.00-1.99	21.9 (15.3-28.4)	23.1 (21.2-25.1)
2.00-2.99	17.0 (11.4-22.6)	20.0 (18.1-22.0)
3.00 or greater	47.8 (40.5-55.1)	45.4 (43.0-47.8)
Has health insurance, %	96.9 (93.9-99.8)	95.7 (94.6-96.7)
Ever had anxiety disorder, %	24.1 (17.8-30.4)	19.8 (18.0-21.6)
Ever had depression, %	29.8 (22.9-36.7)	23.9 (21.9-25.9)

[1] *Table cell values are given as percents (95% confidence interval) unless otherwise indicated*

[2] *SD = standard deviation*

[3] *AIAN = American Indian, Alaska Native*

Table 2. Prevalence of pandemic-related healthcare interruptions and diabetes distress experienced among adults 20 years and older with Type 1 and Type 2 diabetes in the US, NHIS 2021

	Type 1 diabetes (n=228) Prevalence (95% CI)	Type 2 diabetes (n=2,534) Prevalence (95% CI)	p-value comparing difference between Type 1 and Type 2 diabetes
Experienced delayed medical care	23.2 (17.3-29.2)	21.1 (19.2-23.1)	p = 0.5040
Did not get medical care	18.0 (12.7-23.3)	15.1 (13.5-16.7)	p = 0.2817
Experienced diabetes distress	60.3 (52.6-68.1)	50.8 (48.4-53.3)	p = 0.0238

Table 3. Associations of pandemic-related healthcare interruptions and diabetes distress among adults with Type 1 and 2 diabetes in the US, NHIS 2021

	Unadjusted OR (95% CI)	Adjusted[1] OR (95% CI)
Type 1 diabetes		
Experienced delayed medical care	4.20 (1.98-8.90)	4.14 (1.88-9.11)*
Did not get medical care	3.38 (1.46-7.83)	3.37 (1.35-8.45)
Type 2 diabetes		
Experienced delayed medical care	1.88 (1.49-2.37)	1.71 (1.35-2.20)
Did not get medical care	1.74 (1.33-2.27)	1.50 (1.13-1.98)

[1] *Adjusted for age, sex, race and ethnicity, education, income, health insurance status, marital status, employment status, geographical region, anxiety, and depression*

**Indicates statistically significant interaction in the association of healthcare disruption with diabetes distress between groups with Type 1 diabetes and Type 2 diabetes;* p=0.0284

Table 4. Polytomous logistic regression analysis of pandemic-related health care interruptions and frequency of diabetes distress (sensitivity analysis)

		Individuals with Type 1 Diabetes (n=228)	
		Unadjusted OR (95% CI)	Adjusted[1] OR (95% CI)
Experienced delayed medical care (exposure, ref = no)	Diabetes distress (outcome)		
	Never	Ref	Ref
	Rarely	3.42 (1.36-8.61)	3.42 (1.31-8.88)
	Sometimes	5.07 (1.90-13.5)	5.26 (1.94-14.2)
	Usually	4.08 (1.21-13.7)	6.11 (1.27-29.3)
	Always	4.23 (1.50-11.9)	2.80 (0.77-10.2)
Did not get medical care (exposure, ref = no)			
	Never	Ref	Ref
	Rarely	2.02 (0.66-6.19)	1.88 (0.56-6.32)
	Sometimes	4.59 (1.61-13.1)	5.40 (1.74-16.7)
	Usually	1.95 (0.44-8.64)	1.98 (0.25-15.7)
	Always	5.32 (1.78-15.9)	4.03 (0.87-18.6)

		Individuals with Type 2 Diabetes (n=2534)	
		Unadjusted OR (95% CI)	Adjusted[1] OR (95% CI)
Experienced delayed medical care (exposure, ref = no)	Diabetes distress (outcome)		
	Never	Ref	Ref
	Rarely	1.61 (1.20-2.16)	1.56 (1.15-2.11)
	Sometimes	1.83 (1.36-2.46)	1.67 (1.21-2.31)
	Usually	3.03 (1.75-5.23)	2.52 (1.32-4.80)
	Always	2.36 (1.46-3.83)	2.10 (1.29-3.41)
Did not get medical care (exposure, ref = no)			
	Never	Ref	Ref
	Rarely	1.35 (0.97-1.90)	1.29 (0.92-1.81)
	Sometimes	1.74 (1.24-2.44)	1.47 (1.02-2.12)
	Usually	3.28 (1.85-5.79)	2.50 (1.27-4.91)
	Always	2.30 (1.35-3.93)	1.83 (1.02-3.27)

[1] *Adjusted for age, sex, race and ethnicity, education, income, health insurance status, marital status, employment status, geographical region, anxiety, and depression*

Chapter 3. Summary and Conclusions

We conducted a national study of diabetes distress associated with pandemic-related disruptions to healthcare in 2021. We found higher odds of diabetes distress among adults who experienced delayed or missed medical care due to the pandemic. These findings draw on adults with diabetes drawn from a representative sample of the US population, and adds more recent analysis to the experiences of individuals with diabetes during the pandemic.

Our findings show that heightened distress due to pandemic-related impacts on healthcare persisted in 2021, even after COVID-19 vaccines were available and social distancing policies were relaxed. National prevalence data for diabetes distress prior to the pandemic is not available; however, subpopulation studies have found the pre-pandemic prevalence of diabetes distress to range from 8% to 42.1% among adults with Type 1 diabetes and 27.4% to 51.3% among adults with Type 2 diabetes [44-47]. These prevalence ranges are similar to the prevalence of diabetes distress found by our study for Type 2 diabetes, but they are lower than the prevalence of diabetes distress found by our study for Type 1 diabetes. Our study found that adults with Type 1 diabetes were approximately four times as likely to experience diabetes distress if they experienced delayed medical care and approximately three times as likely to experience diabetes distress if they did not get care. Similarly, adults with Type 2 diabetes were almost twice as likely to experience diabetes distress if they experienced delayed medical care and 1.5 times as likely to experience diabetes distress if they did not get medical care. The findings suggest that impeded access to healthcare during the pandemic, particularly among people with Type 1 diabetes, was a source of stress. This may inform recommendations for diabetes care during future public health emergencies.

The prevalence of diabetes distress was high among adults with diabetes. Over half of individuals with Type 1 or Type 2 diabetes experienced diabetes distress during 2021. The prevalence of COVID-19 pandemic-related healthcare interruptions was also high, but not as high as the prevalence of diabetes distress. Under a quarter of individuals with either Type 1 or Type 2 diabetes experienced delayed or missed medical care within the past year.

We hypothesized that the pandemic may be associated with increased diabetes distress through pandemic-related healthcare interruptions. Our findings show that individuals who experienced delayed or missed medical care had a statistically significant higher odds of diabetes distress regardless of diabetes type. This supports our hypothesis and suggests that the psychological burden of pandemic-related healthcare changes on individuals managing their diabetes was significant and should not be overlooked. Inconsistent health care access could have posed a risk for individuals with diabetes during the pandemic.

These findings expand on early pandemic research on diabetes distress and suggest the need for the consideration of the psychological impact of the pandemic on individuals managing their diabetes. Consistent availability of health care services may be beneficial to mitigating diabetes distress during public health emergencies like the COVID-19 pandemic.

References

[1] CDC. What is Diabetes? Centers for Disease Control and Prevention 2022. https://www.cdc.gov/diabetes/basics/diabetes.html (accessed January 30, 2023).

[2] Balakumar P, Maung-U K, Jagadeesh G. Prevalence and prevention of cardiovascular disease and diabetes mellitus. Pharmacol Res 2016;113:600–9. https://doi.org/10.1016/j.phrs.2016.09.040.

[3] Xu G, Liu B, Sun Y, Du Y, Snetselaar LG, Hu FB, et al. Prevalence of diagnosed type 1 and type 2 diabetes among US adults in 2016 and 2017: population based study. BMJ 2018;362:k1497. https://doi.org/10.1136/bmj.k1497.

[4] Devarajooh C, Chinna K. Depression, distress and self-efficacy: The impact on diabetes self-care practices. PLoS One 2017;12:e0175096. https://doi.org/10.1371/journal.pone.0175096.

[5] Baek RN, Tanenbaum ML, Gonzalez JS. Diabetes burden and diabetes distress: the buffering effect of social support. Ann Behav Med 2014;48:145–55. https://doi.org/10.1007/s12160-013-9585-4.

[6] Tsujii S, Hayashino Y, Ishii H, Diabetes Distress and Care Registry at Tenri Study Group. Diabetes distress, but not depressive symptoms, is associated with glycaemic control among Japanese patients with type 2 diabetes: Diabetes Distress and Care Registry at Tenri (DDCRT 1). Diabet Med 2012;29:1451–5. https://doi.org/10.1111/j.1464-5491.2012.03647.x.

[7] Yang Q-Q, Sun J-W, Shao D, Zhang H-H, Bai C-F, Cao F-L. The Association between Diabetes Complications, Diabetes Distress, and Depressive Symptoms in Patients with Type 2 Diabetes Mellitus. Clin Nurs Res 2021;30:293–301. https://doi.org/10.1177/1054773820951933.

[8] Fisher L, Polonsky WH, Hessler DM, Masharani U, Blumer I, Peters AL, et al. Understanding the Sources of Diabetes Distress in Adults with Type 1 Diabetes. J Diabetes Complications 2015;29:572–7. https://doi.org/10.1016/j.jdiacomp.2015.01.012.

[9] McCarthy MM, Whittemore R, Gholson G, Grey M. Diabetes Distress, Depressive Symptoms, and Cardiovascular Health in Adults With Type 1 Diabetes. Nurs Res 2019;68:445–52. https://doi.org/10.1097/NNR.0000000000000387.

[10] Pate R, Caswell N, Gardner KJ, Holyoak L. A structural equation model in adults with type 1 and 2 diabetes: exploring the interplay of psychological states and diabetes outcomes, and the mediating effect of resilience. Acta Diabetol 2022;59:1575–87. https://doi.org/10.1007/s00592-022-01955-3.

[11] Stahl-Pehe A, Glaubitz L, Bächle C, Lange K, Castillo K, Tönnies T, et al. Diabetes distress in young adults with early-onset Type 1 diabetes and its prospective relationship with HbA1c and health status. Diabet Med 2019;36:836–46. https://doi.org/10.1111/dme.13931.

[12] Fisher L, Mullan JT, Arean P, Glasgow RE, Hessler D, Masharani U. Diabetes distress but not clinical depression or depressive symptoms is associated with glycemic control in both cross-sectional and longitudinal analyses. Diabetes Care 2010;33:23–8. https://doi.org/10.2337/dc09-1238.

[13] Kintzoglanakis K, Gkousiou A, Vonta P, Sagmatopoulos A, Copanitsanou P. Depression, anxiety, and diabetes-related distress in type 2 diabetes in primary care in Greece: Different roles for glycemic control and self-care. SAGE Open Med 2022;10:20503121221096604. https://doi.org/10.1177/20503121221096605.

[14] Delahanty LM, Grant RW, Wittenberg E, Bosch JL, Wexler DJ, Cagliero E, et al. Association of diabetes-related emotional distress with diabetes treatment in primary care

patients with Type 2 diabetes - PubMed. Diabetic Medicine 2007;24:48–54. https://doi.org/10.1111/j.1464-5491.2007.02028.x.

[15] Powers MA, Richter SA, Ackard DM, Craft C. Diabetes Distress Among Persons With Type 1 Diabetes. Diabetes Educ 2017;43:105–13. https://doi.org/10.1177/0145721716680888.

[16] Vallis M, Willaing I, Holt RIG. Emerging adulthood and Type 1 diabetes: insights from the DAWN2 Study. Diabet Med 2018;35:203–13. https://doi.org/10.1111/dme.13554.

[17] Pandit AU, Bailey SC, Curtis LM, Seligman HK, Davis TC, Parker RM, et al. Disease-related distress, self-care and clinical outcomes among low-income patients with diabetes. J Epidemiol Community Health 2014;68:557–64. https://doi.org/10.1136/jech-2013-203063.

[18] Gonzalez JS, Shreck E, Psaros C, Safren SA. Distress and type 2 diabetes-treatment adherence: A mediating role for perceived control. Health Psychol 2015;34:505–13. https://doi.org/10.1037/hea0000131.

[19] Hessler DM, Fisher L, Polonsky WH, Masharani U, Strycker LA, Peters AL, et al. Diabetes distress is linked with worsening diabetes management over time in adults with Type 1 diabetes. Diabet Med 2017;34:1228–34. https://doi.org/10.1111/dme.13381.

[20] Polonsky WH, Fisher L, Hessler D, Desai U, King SB, Perez-Nieves M. Toward a more comprehensive understanding of the emotional side of type 2 diabetes: A re-envisioning of the assessment of diabetes distress. Journal of Diabetes and Its Complications 2022;36:108103. https://doi.org/10.1016/j.jdiacomp.2021.108103.

[21] Dennick K, Sturt J, Speight J. What is diabetes distress and how can we measure it? A narrative review and conceptual model. J Diabetes Complications 2017;31:898–911. https://doi.org/10.1016/j.jdiacomp.2016.12.018.

[22] Rubin RR, Peyrot M, Siminerio LM. Health care and patient-reported outcomes: results of the cross-national Diabetes Attitudes, Wishes and Needs (DAWN) study. Diabetes Care 2006;29:1249–55. https://doi.org/10.2337/dc05-2494.

[23] Walker RJ, Gebregziabher M, Martin-Harris B, Egede LE. Relationship between social determinants of health and processes and outcomes in adults with type 2 diabetes: validation of a conceptual framework. BMC Endocr Disord 2014;14:82. https://doi.org/10.1186/1472-6823-14-82.

[24] Chen P, Callisaya M, Wills K, Greenaway T, Winzenberg T. Cognition, educational attainment and diabetes distress predict poor health literacy in diabetes: A cross-sectional analysis of the SHELLED study. PLoS One 2022;17:e0267265. https://doi.org/10.1371/journal.pone.0267265.

[25] Polonsky WH, Fisher L, Guzman S, Sieber WJ, Philis-Tsimikas A, Edelman SV. Are patients' initial experiences at the diagnosis of type 2 diabetes associated with attitudes and self-management over time? Diabetes Educ 2010;36:828–34. https://doi.org/10.1177/0145721710378539.

[26] Kibbey KJ, Speight J, Wong JLA, Smith LA, Teede HJ. Diabetes care provision: barriers, enablers and service needs of young adults with Type 1 diabetes from a region of social disadvantage. Diabet Med 2013;30:878–84. https://doi.org/10.1111/dme.12227.

[27] Mizokami-Stout K, Choi H, Richardson CR, Piatt G, Heisler M. Diabetes Distress and Glycemic Control in Type 2 Diabetes: Mediator and Moderator Analysis of a Peer Support Intervention. JMIR Diabetes 2021;6:e21400. https://doi.org/10.2196/21400.

[28] Hansen UM, Skinner T, Olesen K, Willaing I. Diabetes Distress, Intentional Hyperglycemia at Work, and Glycemic Control Among Workers With Type 1 Diabetes. Diabetes Care 2019;42:797–803. https://doi.org/10.2337/dc18-1426.

[29] Cook A (Sasha), Zill A. Working With Type 1 Diabetes: Investigating the Associations Between Diabetes-Related Distress, Burnout, and Job Satisfaction. Front Psychol 2021;12:697833. https://doi.org/10.3389/fpsyg.2021.697833.

[30] Wardian J, Sun F. Factors associated with diabetes-related distress: implications for diabetes self-management. Soc Work Health Care 2014;53:364–81. https://doi.org/10.1080/00981389.2014.884038.

[31] Zhang X, Bullard KM, Gregg EW, Beckles GL, Williams DE, Barker LE, et al. Access to Health Care and Control of ABCs of Diabetes. Diabetes Care 2012;35:1566–71. https://doi.org/10.2337/dc12-0081.

[32] Rhee MK, Cook CB, Dunbar VG, Panayioto RM, Berkowitz KJ, Boyd B, et al. Limited health care access impairs glycemic control in low income urban African Americans with type 2 diabetes. J Health Care Poor Underserved 2005;16:734–46. https://doi.org/10.1353/hpu.2005.0100.

[33] Harris MI. Racial and ethnic differences in health care access and health outcomes for adults with type 2 diabetes. Diabetes Care 2001;24:454–9. https://doi.org/10.2337/diacare.24.3.454.

[34] Kollannoor-Samuel G, Vega-López S, Chhabra J, Segura-Pérez S, Damio G, Pérez-Escamilla R. Food Insecurity and Low Self-efficacy are Associated with Health Care Access Barriers Among Puerto-Ricans with Type 2 Diabetes. J Immigr Minor Health 2012;14:552–62. https://doi.org/10.1007/s10903-011-9551-9.

[35] Thomas LV, Wedel KR, Christopher JE. Access to Transportation and Health Care Visits for Medicaid Enrollees With Diabetes. J Rural Health 2018;34:162–72. https://doi.org/10.1111/jrh.12239.

[36] Levy NK, Park A, Solis D, Hu L, Langford AT, Wang B, et al. Social Determinants of Health and Diabetes-Related Distress in Patients With Insulin-Dependent Type 2 Diabetes: Cross-sectional, Mixed Methods Approach. JMIR Form Res 2022;6:e40164. https://doi.org/10.2196/40164.

[37] Hippisley-Cox J, Yates J, Pringle M, Coupland C, Hammersley V. Sex inequalities in access to care for patients with diabetes in primary care: questionnaire survey. Br J Gen Pract 2006;56:342–8.

[38] Hood S, Irby-Shasanmi A, de Groot M, Martin E, LaJoie AS. Understanding Diabetes-Related Distress Characteristics and Psychosocial Support Preferences of Urban African American Adults Living With Type 2 Diabetes: A Mixed-Methods Study. Diabetes Educ 2018;44:144–57. https://doi.org/10.1177/0145721718754325.

[39] Papautsky EL, Rice DR, Ghoneima H, McKowen ALW, Anderson N, Wootton AR, et al. Characterizing Health Care Delays and Interruptions in the United States During the COVID-19 Pandemic: Internet-Based, Cross-sectional Survey Study. J Med Internet Res 2021;23:e25446. https://doi.org/10.2196/25446.

[40] Ni B, Gettler E, Stern R, Munro HM, Steinwandel M, Aldrich MC, et al. Disruption of medical care among individuals in the southeastern United States during the COVID-19 pandemic. J Public Health Res 2021;11:2497. https://doi.org/10.4081/jphr.2021.2497.

[41] Czeisler MÉ, Barrett CE, Siegel KR, Weaver MD, Czeisler CA, Rajaratnam SMW, et al. Health Care Access and Use Among Adults with Diabetes During the COVID-19 Pandemic —

United States, February–March 2021. MMWR Morb Mortal Wkly Rep 2021;70:1597–602. https://doi.org/10.15585/mmwr.mm7046a2.

[42] Fisher L, Polonsky W, Asuni A, Jolly Y, Hessler D. The early impact of the COVID-19 pandemic on adults with type 1 or type 2 diabetes: A national cohort study. J Diabetes Complications 2020;34:107748. https://doi.org/10.1016/j.jdiacomp.2020.107748.

[43] Clements JM. Access to care by Medicare beneficiaries in the U.S. with diabetes and multiple chronic conditions during the COVID-19 pandemic. J Diabetes Complications 2022;36:108355. https://doi.org/10.1016/j.jdiacomp.2022.108355

[44] Fisher L, Skaff MM, Mullan JT, Arean P, Glasgow R, Masharani U. A longitudinal study of affective and anxiety disorders, depressive affect and diabetes distress in adults with Type 2 diabetes. Diabet Med 2008;25:1096–101. https://doi.org/10.1111/j.1464-5491.2008.02533.x

[45] Fisher L, Hessler D, Polonsky W, Strycker L, Masharani U, Peters A. Diabetes distress in adults with type 1 diabetes: Prevalence, incidence and change over time. J Diabetes Complications 2016;30:1123–8. https://doi.org/10.1016/j.jdiacomp.2016.03.032.

[46] Beverly EA, Rennie RG, Guseman EH, Rodgers A, Healy AM. High Prevalence of Diabetes Distress in a University Population. Journal of Osteopathic Medicine 2019;119:556–68. https://doi.org/doi:10.7556/jaoa.2019.099.

[47] Fisher L, Glasgow RE, Strycker LA. The relationship between diabetes distress and clinical depression with glycemic control among patients with type 2 diabetes. Diabetes Care 2010;33:1034–6. https://doi.org/10.2337/dc09-2175.