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Unique relations between post-traumatic stress disorder symptoms and patient functioning in type 2 diabetes

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Abstract

This study examined reported post-traumatic stress disorder symptoms in adults with poorly controlled type 2 diabetes who had no history of psychiatric diagnosis or treatment ($n = 184$, $M_{HbA1c} = 9.13\%$, standard deviation = 1.68). Participants reported moderate to severe intensity of post-traumatic stress disorder symptoms ($M = 19.17$, $SD = 17.58$). Together, depressive and post-traumatic stress disorder symptoms accounted for 10–40 percent of the variance in type 2 diabetes outcomes; post-traumatic stress disorder symptoms were associated with elevated diabetes distress and more frequent exercise and self-blood glucose testing (unique $R^2 \sim 3\%$). Post-traumatic stress disorder symptoms may be overlooked in type 2 diabetes among patients without formal psychiatric diagnoses, and warrant increased attention.

Keywords

chronic illness; depression; diabetes; post-traumatic stress disorder; psychological distress

Introduction

Comorbid psychiatric symptoms are present in 10–40 percent of individuals with type 2 diabetes (T2DM; Egde and Dismuke, 2012; Lin et al., 2008; Thomas et al., 2003), and addressing such symptoms is a high priority for improving diabetes care. Much of the existing knowledge about psychiatric comorbidities is related to depressive symptoms. For example, the presence (vs absence) of depressive symptoms is associated with higher prevalence of functional disability and greater healthcare use and expenditures (Egde and

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Ellis, 2010), as well as greater risk for health complications (e.g. retinopathy; De groot et al., 2010; Lin et al., 2009) and higher all-cause mortality (Pan et al., 2011). Thus, patients with comorbid T2DM and depressive symptoms have worse outcomes than T2DM patients who do not experience depression (Das-Munshi et al., 2007; Ducat et al., 2014); it is likely that this is in part due to the low levels of arousal and self-care motivation commonly seen in depression (Trew, 2011). Conversely, treating depressive symptoms in T2DM with psychological intervention reduces both symptom intensity and total healthcare costs (Katon et al., 2006), and may improve glycemic control (Bogner et al., 2012; Delamater et al., 2001), although results are inconclusive on the latter.

In contrast to depressive symptoms, which tend to be associated with low energy and low motivation in T2DM (Egede and Osborn, 2010), exposure to traumatic events tends to be associated with psychological and physiological arousal (e.g. specific anxiety symptoms such as hypervigilance). Arousal may negatively affect glycemic control and impede a patient's ability to engage in healthy self-care behaviors (Albright et al., 2001; Soo and Lam, 2009), in ways that are conceptually and practically distinct from depression. For example, among general samples of adults with T2DM, although both depressive and anxiety symptoms are associated with ratings of functional impairment, comorbid depressive symptoms, but not anxiety symptoms, are associated with the number of days on which patients report functional disability (Smith and Schmitz, 2014). In contrast, some data have shown that T2DM patients with (vs without) comorbid anxiety have low engagement in physical activity, whereas there is little difference in activity engagement between those with and without comorbid depression (adjusting for other risk factors; Khuwaja et al., 2010). Thus, anxiety-related symptoms may require interventions distinct from those that are effective for comorbid T2DM and depression.

Yet "anxiety" reflects a large and diverse category of experiences, with varying relevance to T2DM. For example, approximately 3 percent of adults with T2DM in the general population experience clinically relevant post-traumatic stress disorder (PTSD), and an additional 7 percent report subclinical PTSD symptoms (Goodwin and Davidson, 2005; Lukaschek et al., 2013). Moreover, 23 percent of adults with T2DM experience a traumatic event and report either no or mild PTSD symptoms (Lukaschek et al., 2013). Similar rates of PTSD and traumatic event exposure exist among adults with T2DM who receive care in VA or other general medical settings (Scott-Tilley et al., 2010; Trief et al., 2006).

PTSD symptoms may have negative effects on physical and emotional health outcomes in T2DM, and may play a key role in the health outcomes of high-risk patients (i.e. those with poor glycemic control). To date, however, there has been little investigation of trauma exposure or PTSD symptoms among individuals with poorly controlled T2DM, and it is not clear whether PTSD symptoms are uniquely associated with diabetes outcomes for these patients. Of particular importance is (1) establishing relations between PTSD symptoms and key diabetes outcomes (e.g. glycemic control and illness self-care behaviors) for these individuals and (2) differentiating the influence of PTSD symptoms from those of depression.

Aims of this study

The goal of this study was to expand the current understanding of self-reported PTSD symptoms in T2DM in a high-risk sample of adult patients from the general community. Importantly, these patients were not selected for traumatic event exposure, and individuals who self-reported current psychiatric diagnoses were not eligible to participate. The first aim of this study was to describe patients' self-reported prior experience of traumatic events and to determine the extent of PTSD symptoms associated with these events. The second aim was to establish the relationship between depressive symptoms and critical diabetes outcomes in the present sample: (1) glycemic control (Hb_{A1c} levels), (2) reported diabetes distress, and (3) reported self-care behaviors (e.g. diet and glucose testing). We hypothesized that greater severity of depressive symptoms would be associated with worse diabetes outcomes in this sample (i.e. higher Hb_{A1c}, more severe distress about one's illness, and less frequent engagement in recommended self-care behaviors).

The final two aims were to examine the unique variance in diabetes outcomes attributable to PTSD symptoms, controlling for depressive symptoms. For the third aim, PTSD symptoms initially were characterized using a composite score of three symptom clusters: intrusion, avoidance, and arousal symptoms. We predicted that overall experience of PTSD symptoms (i.e. the composite score) would be associated with worse diabetes outcomes, over and above the contribution of depressive symptoms. Finally, the fourth aim was to examine relations between each of the three PTSD clusters of event-related anxiety symptoms and diabetes outcomes, controlling for depressive symptoms. As there is little evidence to inform a priori hypotheses about differential relations between symptom clusters and diabetes outcomes, these tests in aim four were exploratory.

Method

Participants and procedures

Adults with T2DM were recruited for a multi-session behavioral intervention study on daily stress in T2DM. Recruitment methods included direct referral from diabetes clinics; newspaper, radio, and television advertisements; and flyers and brochures made available in public locations at four different U.S. sites: Syracuse, New York ($n = 46$); Nashville, Tennessee ($n = 63$); Hershey, Pennsylvania ($n = 52$); and University Park, Pennsylvania ($n = 24$). The sample size was based on targets for the larger behavioral intervention study. Interested individuals were initially screened via phone by trained research staff to determine their eligibility. Inclusion criteria required that participants (1) were between 22 and 75 years of age, (2) had glycated hemoglobin (Hb_{A1c}) levels ≤ 7.5 percent, (3) were diagnosed with adult onset diabetes (i.e. at age 21 years or older), (4) were not using insulin to control diabetes during the first year after diagnosis (to rule out type 1 diabetes diagnosis), (5) were fluent in English, (6) were free from substance abuse or other psychiatric disorders (i.e. not currently in psychotherapy or taking medication for psychiatric conditions), and (7) if female, were not pregnant or not planning to become pregnant during the study period. Institutional Review Boards at each study site approved all recruitment and intervention procedures and materials, and all participants provided written informed consent prior to enrollment in the parent study. For participants who were excluded based on self-reported

current diagnosis of a psychiatric condition (i.e. 18 of 594 interested individuals were in treatment for depression, or 3%), study staff provided referral information to community and mental health resources.

Individuals deemed eligible after the initial phone screen ($n = 458$) were scheduled for a baseline assessment visit at which they engaged in informed consent procedures and had their height, weight, and Hb_{A1c} levels measured by research staff. A total of 349 participants attended the initial assessment visit; 184 met eligibility criteria based on verified Hb_{A1c} levels ≤ 7.5 percent. These eligible individuals then completed an assessment that included validated measures of depressive symptoms, PTSD symptoms, diabetes distress, and diabetes self-care behaviors (described below). These measures were completed by hand at the research center on the same day that Hb_{A1c} and body mass index (BMI) were assessed. Participants ($n = 184$) were mostly women (81%) and were primarily of Caucasian descent (81%), with a mean age of 55.4 (standard deviation (SD) = 10.17) years and an average of 14 years of completed education (i.e. completed some college; $SD = 2.66$). The mean age at diabetes diagnosis was 42.7 ($SD = 10.85$) years, and the average number of years since diagnosis was 11.99 ($SD = 8.29$). The average participant had a BMI of 37.49 ($SD = 8.28$) kg/m² and objectively verified Hb_{A1c} of 9.13 percent ($SD = 1.68$), indicating a high-risk sample. Based on power calculations, the available sample size of 184 exceeded the size necessary to detect a small effect (for power > 0.80).

Measures: main predictors and covariates

Demographics.—During the initial assessment visit, participants completed a demographic questionnaire and reported on their gender, age, race/ethnicity, and years of education.

Reported depressive symptoms.—The Center for Epidemiological Studies—Depression Scale (CES-D; Radloff, 1977) is a 20-item measure of depressive symptomatology, with emphasis on the affective component (depressed mood). Respondents rate how often they experienced each symptom during the past week. Response options range from 0 (“rarely/none of the time/less than 1 day”) to 3 (“most or all of the time/5–7 days”). Scores on this measure range from 0 to 60, with higher scores indicating more severe depressive symptoms. A score of 16 or higher indicates possible clinical depression (Chwastiak et al., 2002). The CES-D has internal consistency with alphas of roughly 0.85 for the general population and 0.90 for the psychiatric population; the alpha for the present sample was 0.93.

Reported PTSD symptoms.—The Impact of Events Scale—Revised (IES-R; Weiss and Marmar, 1997) asks participants to identify their most stressful life event and PTSD symptoms associated with this event (e.g. “I stayed away from reminders about it.”). Each of the 22 items is rated on a five-point scale (1 = “not at all” to 5 = “extremely”), with respect to how much a respondent has been “distressed or bothered” by each symptom in the past 7 days. All items are summed for a total composite score (possible range from 0 to 88), with higher scores indicative of more severe PTSD symptoms. Symptoms can also be clustered in three subscales: intrusive thoughts/intrusions, avoidance, and physiological/psychological

hyperarousal. Total composite scores of 19 or higher indicate that symptoms may warrant clinical concern (Horowitz, 1982). Reported internal consistency and test–retest reliability indicate good psychometric properties. Although the IES-R is not an accepted diagnostic tool, it has demonstrated specificity and sensitivity for detecting full or partial PTSD (at a composite score of 33 or above; Creamer et al., 2003). In this study, Cronbach’s alphas were 0.94 (total composite score), 0.92 (intrusion symptoms), 0.82 (avoidance symptoms), and 0.89 (hyperarousal symptoms).

Measures: diabetes outcomes

Glycated hemoglobin (HbA1c) level.—Hb_{A1c} provides a measure of glucose control over approximately 2–3 months and is an accepted method for monitoring disease outcomes in diabetes control research and clinical practice. Hb_{A1c} was assessed via capillary sample using a DCA-2000 (Bayer).

Diabetes distress.—The Problem Areas in Diabetes (PAID) scale (Polonsky et al., 2005) is a 20-item inventory that asks respondents to rate their level of distress related to living with diabetes (e.g. feeling overwhelmed by diabetes). Each item is rated on a scale of 0 (“not a problem”) to 4 (“serious problem”); the measure generates a total score between 0 and 80, with higher scores representing greater diabetes-related distress. In this study, Cronbach’s alpha was equal to 0.93.

Self-care behaviors.—The Summary of Diabetes Self-Care Activities (SDSCA) scale (Toobert et al., 2000) is an 11-item inventory used to assess recent self-care behaviors for patients with diabetes. The 11 core items ask on how many of the last 7 days the respondent has engaged in a specific self-care behavior (i.e. 0–7, higher scores representing more days); additional items assess other self-care behaviors recommended by healthcare professionals. Core items can be grouped into five subscales: general diet (i.e. following a general healthy diet), exercise, specific diet (i.e. following a diabetes-specific diet), foot care, and blood glucose testing. In this study, these subscales were examined individually. Internal consistency coefficients in the present sample were 0.92 (general diet), 0.85 (exercise), 0.13 (specific diet), and 0.32 (foot care); the glucose testing subscale has only one item. Given the lack of internal consistency of the specific diet and foot care subscales, these were not included in our analyses.

Data analysis plan

Two independent raters examined the traumatic events identified by participants when they completed the IES-R and grouped them into descriptive categories. Raters showed 90 percent initial agreement and discrepancies were resolved through discussion. Descriptive statistics for reported PTSD symptoms were obtained for the study sample, and average scores were compared to those from previous patient samples. We then tested whether demographic characteristics (i.e. gender, age, race/ethnicity, and education) and years since diagnosis (a factor that can be related to psychiatric symptoms and health in patients) were associated with the main variables of interest (reported PTSD symptoms, reported depressive symptoms, and illness outcome variables). Only age was consistently associated with the main variables of interest and was included as a continuous covariate in all models.

The study site indicator was also included as a single categorical variable to account for potential differences across recruitment locations. Our main hypotheses were tested using general linear modeling in SAS 9.4 (SAS Institute, 2013). Demographic covariates, depressive symptoms (CES-D score), and PTSD symptoms (IES-R total composite score) were used to predict Hb_{A1c} , diabetes distress, and diabetes self-care behaviors. In separate models, relations between IES-R subscales and outcomes were tested, with demographics and depressive symptoms included as covariates.

Results

Types of stressful events

The life events that participants identified as intensely stressful/traumatic are grouped thematically in Table 1. A subset of participants (15%) reported more than one stressful event in response to the scale prompt. (As the IES-R scores of this subset of participants did not significantly differ from those participants who reported one event, all participants were included in the following analyses.) As shown, the most common events were the death of a loved one (25%), divorce or other marital problems (19%), and oneself or a loved one receiving a chronic illness diagnosis (e.g. diabetes or cancer; 16%). Less commonly reported events include car accidents (5%), military combat experience (3%), and being wounded by a gun (outside of combat experience; 3%). Other categories and frequencies are listed in Table 1.

Psychiatric symptoms among patients with T2DM

In the present sample, the mean depressive symptom score was 13.42 ($SD = 11.66$); this average CES-D score is below the threshold on this scale indicative of possible depression (i.e. 16), but comparable to scores for previous samples of T2DM patients (e.g. 12.9; Tsujii et al., 2012). Approximately 30 percent of this sample scored at or above the possible depression threshold, indicating meaningful depressive symptoms (Radloff, 1977). The average total score for reported PTSD symptoms was 19.17 ($SD = 17.58$, range = 0–75); although this average is similar to scores in other patient samples (e.g. 12.64–23.67; Ingles et al., 2013), it corresponds to a “high” symptom level that may warrant clinical concern (Horowitz, 1982). Indeed, 39 percent of the present sample met or exceeded the “high” threshold score of 19, although a smaller proportion (18%) met the suggested clinical threshold of 33 (Creamer et al., 2003). In the present sample, a mean PAID score of 31.39 ($SD = 17.25$) for diabetes-related distress was slightly higher than levels reported in previous patient samples (e.g. 18.7; Delahanty et al., 2007). On the SDSCA, participants reported engaging in recommended diabetes self-care behaviors between 2 and 5 days per week, on average. Descriptive statistics for, and correlations between, outcomes of interest are shown in Table 2.

Relations between psychiatric symptoms and diabetes outcomes

As expected, experiencing more (vs less) severe depressive symptoms was significantly associated with higher Hb_{A1c} ($F(5, 171) = 4.83$), greater diabetes distress ($F(5, 171) = 89.89$), less frequent exercise behavior ($F(5, 170) = 4.43$), and less frequent adherence to dietary recommendations ($F(5, 168) = 15.82$, $ps < 0.05$). Controlling for depressive

symptoms, PTSD symptom score was unrelated to Hb_{A1c} or dietary intake ($ps > 0.20$), but was associated with higher diabetes distress ($F(6, 162) = 5.55, p = 0.02$; see Table 3). PTSD symptoms uniquely accounted for 2 percent of the variance in diabetes distress. There was also an unexpected *positive* association between PTSD symptoms and exercise adherence ($F(6, 161) = 4.99$) and between PTSD symptoms and blood glucose testing ($F(6, 161) = 3.99, ps < 0.05$), indicating that participants with more severe PTSD symptoms reported engaging in exercise and self-monitoring their blood glucose more frequently. Together, reported depressive symptoms and PTSD symptoms explained approximately 40 percent of the variance in diabetes distress and 10 percent of the variance in each self-care behavior; PTSD symptoms explained ~3 percent of the variance in these outcomes beyond the contribution of depressive symptoms and their shared variance.

With respect to specific clusters of PTSD symptoms (assessed with IES-R subscales), when controlling for depressive symptoms, intrusion symptoms were positively associated with Hb_{A1c} ($F(6, 163) = 3.83$) and avoidance symptoms were positively associated with diabetes distress ($F(6, 166) = 9.65; ps < 0.05$; see Table 3). Conversely, both avoidance ($F(6, 165) = 7.09$) and hyperarousal ($F(6, 164) = 5.01$) symptoms were associated with greater exercise adherence ($ps < 0.04$), and avoidance symptoms were associated with more frequent blood glucose testing ($F(6, 165) = 5.42, p = 0.02$). Symptom cluster scores uniquely accounted for 3–4 percent of the variance in these outcomes (i.e. beyond the contribution of depressive symptoms and their shared variance).

Discussion

The presence of psychiatric symptoms in T2DM is known to increase risk for poor diabetes outcomes. To date, however, evidence in this area that might inform clinical intervention has focused on depressive symptoms (e.g. hopelessness and low mood), which may be distinct from other types of symptoms—primarily those that are closely related to anxiety and physiological arousal, such as PTSD. The goal of this study was to examine the reported PTSD symptoms among adults with poorly controlled T2DM who had no history of psychiatric diagnosis and to determine whether these symptoms are uniquely associated with diabetes outcomes (beyond the contribution of depressive symptoms and their shared variance). In the current sample, PTSD symptoms fell into the “high” range on the relevant self-report scale (Horowitz, 1982). In fact, the proportion of participants with meaningful PTSD symptoms (39%) exceeded the proportion with possible depression (30%), although the subset who met the suggested clinical threshold for PTSD diagnosis was 18 percent. Thus, adults with poorly controlled T2DM may experience considerable difficulty with PTSD symptoms (i.e. intrusions, avoidance, and hyperarousal), and a subset may qualify for diagnosis and treatment of PTSD. This finding suggests a broad need for greater attention to PTSD symptoms in T2DM care.

Similar to the demonstrated role of depressive symptoms (in this study and elsewhere; e.g. Snoek et al., 2015), in the present sample, the experience of more severe PTSD symptoms was associated with greater distress about T2DM symptoms and healthcare. This relation (i.e. controlling for both depressive symptoms and shared variance between PTSD and depression) was associated with small effect sizes. Patients with greater diabetes distress

tend to show worse medication adherence and physical activity engagement (Aikens, 2012), as well as worse glucose regulation (Fisher et al., 2010), than those with less diabetes distress; PTSD symptoms may exacerbate diabetes distress, and deter self-care behaviors that would promote effective glucose regulation. In contrast, however, more severe PTSD symptoms were associated with *more frequent* self-blood glucose testing and engagement in exercise in this sample (when controlling for depressive symptoms). As regular exercise and self-blood glucose testing are recommended for their health benefits to patients (American Diabetes Association, 2010), the mechanism underlying this relationship would benefit from further investigation. Of note, participants in this study reported engaging in these behaviors 3–4 days per week, on average, which is less than what is frequently recommended (i.e. daily; Russell et al., 2005; Shrivastava et al., 2013). As such, PTSD symptoms do not appear to be associated with over-engagement or unhealthy preoccupation with diabetes management.

Focusing on exercise and blood glucose monitoring could be methods for coping with or managing PTSD symptoms in adults with poorly controlled T2DM; the positive associations between exercise and glucose monitoring and avoidance symptoms also indicate that these self-care behaviors could allow for avoidance if they serve as a distraction from thinking about prior stressful events (Coelho et al., 2003; Duangdao and Roesch, 2008). This is consistent with evidence showing that individuals with elevated anxiety, but not elevated depression, tend to focus on goals and plans related to avoiding negative outcomes (rather than approaching positive outcomes; Dickson and MacLeod, 2004). This discrepancy also is consistent with previous research demonstrating that depression is associated with treatment noncompliance in medical patients (Gonzalez et al., 2008), but the relationship between anxiety and treatment noncompliance is less clear. Distress associated with PTSD symptoms may also be channeled into greater vigilance about the illness itself, and manifest as better adherence in certain domains (e.g. domains perceived as most important or controllable). As adults with T2DM tend to view exercise as low in perceived importance and controllability (Broadbent et al., 2011; Gatt and Sammut, 2008), however, understanding the relationship between PTSD symptoms and exercise may be particularly important for future work.

Strengths, limitations, and future directions

Strengths of this study include recruitment of a high-risk, multisite sample with physician-verified diagnosis of T2DM, objective assessment of Hb_{A1c}, and the use of well-validated measures to assess psychiatric symptoms. These features maximize our ability to generalize to other high-risk patients (i.e. those with poorly controlled glucose, high BMIs, and general distress, who may be most in need of clinical attention) across demographic groups and treatment contexts. Important limitations, which point to necessary next steps for ongoing research, were the study's reliance on self-reported symptoms and cross-sectional design. As noted, although both the CES-D and the IES-R have shown correspondence with clinical diagnosis of depression and PTSD, respectively, neither is recommended as a diagnostic tool in the absence of other measures (e.g. structured clinical interview). In this study, psychiatric symptoms, diabetes self-care activities, and clinical outcomes were all measured at the same point (i.e. baseline assessment for a larger and longer study); thus, the temporal and causal sequence of the observed relations is as of yet unclear. This design may mask more complex

relations between depression and PTSD, and their influence on self-care and glucose regulation.

Our cross-sectional design also showed a small-to-moderate effect size of unique relations between self-reported PTSD symptoms and outcomes. It is possible that this reflects a small real-world impact of PTSD symptoms on diabetes outcomes; however, given our single IES-R assessment, capturing the repeated or accumulated experience of PTSD symptoms over time may reveal a much larger effect. In addition, the IES-R assesses traumatic events that occurred prior to completing the measure, but symptom scores do not take into account the time lag between the experience of the event and the assessment of relevant symptoms. Further investigation into the effects of psychiatric symptoms, with emphasis on temporal relations, is needed.

Additional limitations of this study included reliance on self-report of self-care behaviors (which may be inaccurate, particularly among patients with psychiatric symptoms; Gonzalez et al., 2013) and a sample that was predominantly female, Caucasian, and well-educated (which is not broadly representative of the US population with T2DM; Geiss et al., 2014). The prevalence of self-reported traumatic events, relatively high PTSD symptoms, and links between those symptoms and diabetes outcomes in this study suggest that follow-up in a larger, more diverse sample is warranted. Future research that examines relations between PTSD symptoms and diabetes outcomes over time will enable the identification of T2DM patients at highest risk for poor outcomes (and, thus, those who may benefit from targeted intervention). Ideally, such work will clarify the mechanisms underlying differential relations between PTSD symptoms, diabetes distress, and specific self-care behaviors.

Practice implications

Treatment guidelines for T2DM strongly recommend screening for depression, diabetes distress, and anxiety (American Diabetes Association, 2010). Anxiety can take many forms, ranging from persistent worry to isolated panic attacks to PTSD symptoms. Commonly used screening tools for anxiety in T2DM, such as the Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983) and the Beck Anxiety Inventory (BAI; Beck et al., 1988), do not isolate PTSD symptoms of intrusions, avoidance, and hyperarousal. The present findings suggest that screening should include specification of PTSD symptoms in T2DM (using measures such as the IES-R), which could identify as many as 39 percent of patients with meaningful symptoms, and as many as 18 percent with likely diagnoses of PTSD. Clinical attention to depression and other anxiety symptoms (e.g. psychological stress) in T2DM has been shown to improve outcomes (Baumeister et al., 2014; Rosenzweig et al., 2007; Van der Feltz-Cornelis et al., 2010); comparable emphasis on PTSD symptoms in diabetes care could show similar benefits.

Conclusion

Beyond the role of depressive symptoms, PTSD symptoms (i.e. intrusions, avoidance, and hyperarousal) represent an aspect of psychiatric functioning in T2DM that deserves increased attention in clinical care and research. A considerable subset of high-risk adults with T2DM who are not currently engaged in psychiatric treatment may experience

meaningful levels of PTSD symptoms, with a smaller subset at diagnosable levels. Such patients may benefit from treatment for these symptoms. PTSD symptoms are associated with poor functioning in some domains, but appear to be associated with more frequent engagement in exercise and blood glucose self-monitoring. Further research in this area to replicate and clarify these relations (as well their mechanisms of action) will inform ongoing improvements to T2DM care.

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Table 1.

Descriptions of stressful life events associated with PTSD symptoms, as identified by participants with T2DM ($n = 184$).

	<i>N</i>	Percent of sample
Death of a loved one	47	25.4
Divorce/marital problems	17	9.2
Illness diagnosis (self)	16	8.6
Illness diagnosis (loved one)	15	8.1
Car accident	9	4.9
Loss of job or housing	8	4.3
Military/war experience	5	2.7
Being shot (not in the context of military/war experience)	5	2.7
Complications during pregnancy or childbirth	4	2.2
Abuse of a loved one	3	1.6
Other	4	2.2

Table 2.

Descriptive statistics for and correlations between psychiatric symptoms and diabetes outcomes.

	Depressive symptoms	PTSD symptoms (total)	HbA _{1c}	Diabetes distress	Self-care behavior: general diet	Self-care behavior: exercise	Self-care behavior: glucose testing
Mean (SD)	13.42 (11.66)	19.17 (17.58)	9.13 (1.68)	31.39 (17.25)	3.80 (2.01)	2.52 (2.14)	4.05 (2.69)
Depressive symptoms (CES-D)	–	0.66***	0.18*	0.60***	–0.31***	–0.17*	0.04
PTSD symptoms: total score (IES)	0.66***	–	0.16*	0.48***	–0.22**	0.01	0.12
Intrusion symptoms	0.58***	0.94***	0.21**	0.41***	–0.21**	–0.02	0.09
Avoidance symptoms	0.49***	0.81***	0.09	0.44***	–0.12	0.07	0.13
Hyperarousal symptoms	0.69***	0.90***	0.10	0.44***	–0.19*	0.01	0.04
HbA _{1c}	0.18*	0.16*	–	0.23**	–0.32***	–0.11	–0.14
Diabetes distress (PAID)	0.60***	0.48***	0.23**	–	–0.34***	–0.15*	–0.06
Self-care behavior: general diet	–0.31***	–0.22**	–0.32***	–0.34***	–	0.35***	0.37***
Self-care behavior: exercise	–0.17*	0.01	–0.11	–0.15	0.35***	–	0.23**
Self-care behavior: glucose testing	0.04	0.12	–0.14	–0.06	0.37***	0.23**	–

CES-D: Center for Epidemiological Studies—Depression scale; IES: Impact of Events Scale; PAID: Problem Areas in Diabetes scale.

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$.

Table 3.

Model results for patient functioning.

	HbA _{1c}		Diabetes distress		Self-care behavior: general diet		Self-care behavior: exercise		Self-care behavior: Glucose testing	
	B (SE)		B (SE)		B (SE)		B (SE)		B (SE)	
Intercept	9.09 (0.85) ***		23.41 (6.65) **		2.96 (0.98) **		1.19 (1.05)		-0.67 (1.34)	
Study site	-0.08 (0.11)		0.14 (0.85)		0.02 (0.13)		0.27 (0.13)		-0.04 (0.17)	
Age	-0.002 (0.01)		-0.12 (0.10)		0.03 (0.01)		0.01 (0.02)		0.08 (0.02) ***	
Depressive symptoms	0.02 (0.02)		0.72 (0.12) ***		-0.06 (0.01) **		-0.05 (0.08) **		0.005 (0.02)	
PTSD symptoms (total score)	0.01 (0.02)		0.54 (0.08) **		0.02 (0.03)		0.03 (0.01) *		0.08 (0.03) *	
Model R ²	0.04		0.44 ***		0.13 ***		0.09 **		0.10 **	
Intercept	9.07 (0.84) ***		20.02 (6.75) **		2.97 (0.98) **		1.31 (1.07)		-0.59 (1.34)	
Study site	-0.10 (0.11)		0.17 (0.87)		0.03 (0.13)		0.28 (0.14) *		-0.04 (0.17)	
Age	-0.003 (0.01)		-0.11 (0.10)		0.03 (0.01)		0.01 (0.02)		0.08 (0.02) ***	
Depressive symptoms	0.01 (0.01)		0.75 (0.11) ***		-0.05 (0.02) **		-0.04 (0.02) **		0.01 (0.02)	
Intrusion symptoms	0.04 (0.02) *		0.26 (0.15)		-0.008 (0.02)		0.03 (0.02)		0.04 (0.03)	
Model R ²	0.06		0.40 ***		0.13 ***		0.07 **		0.10 **	
Intercept	9.09 (0.85) ***		23.41 (6.65) **		2.96 (0.98) **		1.19 (1.05)		-0.95 (1.32)	
Study site	-0.08 (0.11)		0.14 (0.85)		0.02 (0.13)		0.27 (0.13) *		-0.02 (0.17)	
Age	-0.002 (0.01)		-0.13 (0.10)		0.03 (0.01)		0.01 (0.02)		0.08 (0.02) **	
Depressive symptoms	0.02 (0.02)		0.72 (0.10) ***		-0.06 (0.01) **		-0.05 (0.02) **		0.005 (0.02)	
Avoidance symptoms	0.007 (0.02)		0.55 (0.18) **		0.02 (0.03)		0.07 (0.03) **		0.08 (0.04) *	
Model R ²	0.04		0.44 ***		0.13 **		0.09 **		0.11 **	
Intercept	9.13 (0.84) ***		25.83 (6.77) **		3.12 (0.97) **		1.66 (1.04)		-0.58 (1.34)	
Study site	-0.08 (0.11)		0.24 (0.88)		0.005 (0.13)		0.24 (0.14)		-0.01 (0.17)	
Age	-0.003 (0.01)		-0.13 (0.10)		0.02 (0.01)		0.01 (0.02)		0.08 (0.02) **	
Depressive symptoms	0.03 (0.01)		0.83 (0.12) ***		-0.06 (0.02) **		-0.06 (0.02) **		0.02 (0.02)	
Hyperarousal symptoms	-0.003 (0.03)		0.15 (0.26)		0.03 (0.04)		0.09 (0.04) *		0.03 (0.05)	

	HbA _{1c}	Diabetes distress	Self-care behavior: general diet	Self-care behavior: exercise	Self-care behavior: Glucose testing
	<i>B</i> (<i>SE</i>)	<i>B</i> (<i>SE</i>)	<i>B</i> (<i>SE</i>)	<i>B</i> (<i>SE</i>)	<i>B</i> (<i>SE</i>)
Model <i>R</i> ²	0.04	0.41***	0.13***	0.08**	0.08**

* *p* < 0.05;
** *p* < 0.01;
*** *p* < 0.001.