General Hospital Psychiatry 101 (2026) 19–25

Contents lists available at ScienceDirect

General Hospital Psychiatry

journal homepage: www.elsevier.com/locate/genhospsych

Pre-existing diabetes mellitus is associated with an increased risk for high PTSD symptom levels. Results of a prospective population-based study

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ARTICLE INFO

Keywords:
Anxiety
Depression
Diabetes mellitus
General population
Prospective studies
Post-traumatic stress disorder

ABSTRACT

Aim: Longitudinal studies indicate that PTSD increases the risk of developing Diabetes Mellitus (DM). However, the extent to which pre-existing DM elevates the risk of PTSD and anxiety and depression symptomatology (ADS) following Potentially Traumatic Events (PTEs) remains largely unexplored. The present study aims to examine this risk.

Methods: Data were extracted from the Longitudinal Core Study on Health and the VICTIMS study conducted with the Dutch population-based LISS panel. First, adult respondents were selected who were exposed to PTEs in the past 12 months (between T2 and T3; $n = 1339$). A series of (stepwise) multivariate logistic regression analyses (MLRAs) were conducted with ADS and high PTSD-symptom levels (PTSS) at T3 as dependent variables. Physician-diagnosed pre-existing DM/hyperglycaemia at T1 (3 months before T2) and potential confounders, such as pre-existing anxiety and depression-symptomatology and lack of support at T2 were entered as predictors. Control MLRAs were conducted with physician-diagnosed cardiac or vascular disease problems instead of DM as predictor.

Results: By PTEs affected respondents with pre-existing DM ($n = 62$) compared to those without, were significantly more at risk of moderate-severe ADS (aOR = 2.26) and high PTSD symptom levels (aOR = 2.08) at T3. Pre-existing cardiac or vascular disease problems were not significantly associated with ADS and PTSS at T3.

Conclusion: After PTEs adults with pre-existing DM are more at risk for PTSD and moderate-severe ADS than those without. Findings suggest that the relationship between DM on the one hand and PTSD and ADS on the other hand, is bi-directional.

1. Introduction

Diabetes mellitus (DM, type 2) is a common comorbidity in people with psychiatric disorders such as anxiety and depression as shown by an umbrella review and meta-analyses of observational studies and previous systematic reviews [1]. Systematic reviews and meta-analysis of studies aimed at PTSD and diabetes mellitus have proven that PTSD is associated with an increased risk of DM, although the observed heterogeneity is high and many studies used cross-sectional study designs [2–4]. In addition, a study among veterans showed that those who recovered from PTSD were less likely to need insulin therapy [5].

Studies examining the extent to which pre-existing DM increases the risk of PTSD or other mental health problems following potentially traumatic events (PTEs) are almost absent (excluding studies in which having DM is considered a PTE [6–9]). The study by Song and colleagues [10], based on data of the genome-wide association study (GWAS), found no evidence that DM increased the risk of PTSD. However, it is unclear when DM and PTSD were diagnosed or reported, and when the PTEs took place. In contrast, the longitudinal study by Sommer and colleagues [11] among Canadian military personnel found that pre-existing DM was significantly associated with new onset PTSD at follow-up. In this study, those who indicated no traumatic experiences were coded as no-PTSD respondents (personal communication Renee El-Gabalaw). Importantly, potential confounders such as pre-existing

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https://doi.org/10.1016/j.genhosppsych.2026.05.008
Received 16 March 2026; Received in revised form 27 April 2026; Accepted 6 May 2026
Available online 7 May 2026

anxiety disorder and number of life-time traumas before follow-up, were controlled for (adjusted OR was 1.80). To the best of our knowledge, no prospective study to date has examined the extent to which pre-existing DM increases the risk of PTSD symptomatology and other mental health problems following PTEs among the general population.

To gain more insight into the role of pre-existing DM in the development of mental health problems among the general population after PTEs, the present study was conducted. The main research question was: *to what extent are adults with pre-existing DM more at risk of high PTSD symptom levels (PTSS) and post-PTE anxiety and depression symptoms (ADS) after recent PTEs than by recent PTEs affected adults without pre-existing DM*?

To answer the research question a two-wave prospective population-based study was conducted in which we controlled for potential risk factors for post-PTE ADS and PTSS such as pre-existing ADS, other illnesses, and lack of emotional support besides several demographic and biographic variables such as age and stressful life-events. In addition, in a comparable way we examined the relationships between another illness -in this case cardiac or vascular disease problems- on the one side and post-PTE mental health problems on the other to explore how specific the relationships between DM and post-PTE mental health problems are.

2. Method

2.1. Procedures

Data were extracted and aggregated from eight surveys (2017 to 2024) of the yearly Health surveys each administered in November–December, and eight surveys of the prospective VICTIMS study (2018–2025), each administered in March–April, conducted with the Longitudinal Internet studies for the Social Sciences (LISS) panel [12]. The LISS panel, managed by Centerdata, is based on a traditional probability sample from the Dutch population register, drawn by Statistics Netherlands (CBS). Individuals and households without internet access are provided with a computer and broadband connection. Respondents are compensated with an incentive of €15 per hour for their participation. Further information about the LISS panel and free access to the data can be found at https://www.dataarchive.lissdata.nl (in English).

The VICTIMS-study [13] was approved by an Internal Review Board (IRB) at Centerdata, consisting of independent internal and external reviewers not involved in the development of the study. The yearly Health survey (which started at the beginning of the LISS panel in 2007) was approved by the Board of Overseers, an Internal Review Board (IRB) of the LISS panel until 2014. In compliance with the General Data Protection Regulation (GDPR), all participants provided explicit digital consent for the use of their data for scientific and policy-relevant research. Only when respondents agree to the LISS informed consent they can become a LISS panel member, and only panel members are administered the surveys (see https://www.lissdata.nl/ethics). Regarding data security, Centerdata, which manages the LISS panel, is certified under ISO 27001 and NEN 7510, and the LISS data archive is CoreTrustSeal certified.

2.2. Participants

In the present study sex was treated as a control variable. We excluded a few respondents who met our selection criteria but did not identify themselves as male or female but as "other" for statistical reasons.

We first composed a comparison group consisting of adult respondents (18+) affected by PTEs *without* pre-existing DM. The following criteria and stepwise selection strategy were applied. In the first step, we selected respondents *without* pre-existing DM who participated in the 2018 and 2019 VICTIMS surveys (March–April) and who experienced PTEs in the 12 months between these two waves. Respondents were classified as free of pre-existing DM if they reported no DM in both the 2017 Health Survey (conducted 3–4 months prior to the 2018 VICTIMS survey) and the 2018 Health survey (November–December), the latter being used to ascertain non–pre-existing DM as accurately as possible. This procedure was repeated for subsequent surveys, excluding respondents selected in earlier steps. Applying this sequential selection process yielded a final sample of 1337 PTE-affected respondents without pre-existing DM. In the remainder of this manuscript, the assessment time points at the beginning and end of the 12-month period of PTE occurrence are labeled as T2 and T3, respectively, and the assessment point three months prior to T2 as T1.

We next composed the target group of adult respondents affected by PTEs *with* pre-existing DM, that is, respondents who had DM before being affected by PTEs using the same stepwise selection strategy. Respondents were classified as having pre-existing DM if, in the Health survey (conducted approximately three months before this 12-month period), they reported having DM or high blood sugar diagnosed by a medical doctor and reported using medication specific to this condition. The use of medication was added as a selection criterion to increase, as much as possible, the likelihood that a respondent indeed had DM, similar to the study by Trief [14], in which pharmacy records were used to identify respondents with DM. This process yielded a total of 62 PTE-affected respondents with pre-existing DM.

With respect to cardiac or vascular disease problems, the same stepwise selection strategy as described above was applied among respondents without D. Respondents were considered to have pre-existing heart and blood vessel problems if they also reported having such conditions in the Health survey conducted 3–4 months prior to T2. Applying this procedure resulted in a comparison group of 1089 PTE-affected respondents *without* pre-existing heart and blood vessel problems and a target group of 248 PTE-affected respondents *with* pre-existing heart and blood vessel problems.

The response of the Health and VICTIMS surveys (completers) varied between 78.1% and 87.7%. Of the respondents who participated in the first selected Health survey, between 68.9% and 79.4% participated in the two consecutive VICTIMS surveys.

2.3. Measures

2.3.1. Diabetes, cardiac or vascular disease problems

In each Health survey, the following question was asked "*Has a physician told you this last year that you suffer from one of the following diseases /problems?*" (0 = no, 1 = yes) with items varying from Angina to Other diseases/problems not yet mentioned (18 items, and 19 items since COVID-19 pandemic). Physician-diagnosed DM or a too high blood sugar is one of the items. In addition, in each Health survey the question is asked "*Are you currently taking medicine at least once a week for* (among others) *DM* (0 = no, 1 = yes). Respondents were considered to have pre-existing DM at T1 when they reported in the survey to have DM or a too high blood sugar *and* were currently taking medicine for diabetes. When respondents did not report that, according to a physician, they suffered from DM or a too high blood sugar they were considered not to have diabetes.

With respect to physician diagnosed cardiac or vascular disease problems, we extracted data from the items 1.) angina, pain in the chest, 2.) a heart attack including infarction or coronary thrombosis or another heart problem including heart failure, 3.) high blood pressure or hypertension/ high cholesterol content in blood, 4.) a stroke or brain infarction or a disease affecting the blood vessels in the brain level (0 = no, 1 = yes). Respondents were considered to have pre-existing cardiac or vascular disease problems at T1 when they endorsed at least one of these four items in the survey, and not having cardiac or vascular disease problems when they did not endorse any of these four items.

2.3.2. Potentially traumatic events (PTEs)

Potentially traumatic events (PTEs) and other stressful life events (SLEs) in the 12 months between T2 and T3 were examined by a list of 21 events (1 = no, 2 = yes) [13]. Respondents were offered the opportunity to report on any drastic event they encountered in this period that was not listed. The answers were coded into new or existing categories. In line with the DSM5, in the present study the following events were defined as PTEs: (i) physical violence, including sexual violence/sexual abuse (not online), online sexual violence/sexual abuse, robbery, physical violence but not by own partner, and/or physical violence by own partner; (ii) accidents, including traffic accidents, disasters, fire, medical errors; and (iii) serious threats, including serious threats without the use of physical violence (not online), and/or online serious threats without use of physical violence. In case two or more PTEs were reported, respondents were asked to take the most stressful in mind when answering follow-up question about the PTE.

2.3.3. Anxiety and depression symptomatology (ADS)

Anxiety and Depression Symptomatology (ADS) was assessed with the 5-item Mental Health Inventory (MHI-5) [15,16]. Respondents were asked to rate their mental health during the past month on 6-point Likert scales (0 = never to 5 = permanently). Following the instructions of the MHI-5, after recoding the three negatively formulated items, the total scores were computed and multiplied by four (to arrive at a 0–100 scale). Lower scores indicate higher symptoms levels. A cut-off of ≤60 was used to identify respondents with moderate-severe ADS and a cut-off of ≤44 for severe ADS at T2 and T3 [17].Cronbach's alpha MHI-5 were both 0.88.

2.3.4. High PTSD-symptom levels (PTSS)

High PTSD-symptom (PTSS) levels during the past month were examined using the 8-item version of PTSD Checklist for DSM-5 (PCL 5) [18], that uses a 5-point Likert scale (0 = not at all to 4 = extremely). The checklist examines symptoms across the four symptom clusters of PTSD. If respondents had been affected by two or more PTEs, they were asked to keep the most stressful PTE in mind when completing the PCL. To identify participants with high PTSS at T3, the cut-off score of ≥13 for probable PTSD was applied [19,20]. Of the respondents with DM (n = 62), 23 had been exposed to their most stressful PTE within the past month. To retain the relatively small DM subgroup, we ignored the one-month criterion for PTSD. Cronbach's alpha PCL-5 was 0.94.

2.3.5. Control variables

The following variables were treated as control variables in the analyses:

- *Demographics* such as sex, age, education level, employment status at T2;
- *Lack of emotional support* at T2 which was measured using the 8-item subscale Lack of emotional support of the Social Support List-Discrepancy [21,22]. Respondents were asked to take people in mind with whom they interact when answering the questions. The SSL-D items apply 4-point Likert scales (1 = I miss it, I would like it to happen more often to 4 = It happens too often, it would be nice if it happened less often). For the present study, total scores were subtracted from the total maximum scores (32) whereby higher scores reflect a greater lack of emotional support. A cut-off of 14 was applied to distinguish respondents with and without a lack of emotional support [23]. Cronbach's Alpha was 0.88.
- *Financial problems* at T2 which were assessed with the brief Problems and Help Inventarisation List [13]. The PHIL examines various problems varying from physical problems to financial problems (1 = yes, 2 = no).
- *Stressful life events* (SLEs) between T2 and T3 which were examined at T3. As described above, SLEs were assessed by the list of 21 events with yes-no answer categories. Examples of SLEs assessed in the 21 list are (un)expected death of a significant other or colleague and burglary [13]. Examples of events respondents reported in the open answer questions were conflicts at work and marital problems. We made a distinction between respondents who were not exposed to any SLE (1 = no) and respondents who were exposed to one or more SLEs (2 = yes).
- *Having other diseases* at T1 (0 = no, 1 = yes, following the questing "Has a physician told you this last year that you suffer from one of the following diseases/problems?", see above). Out of ten diseases such as chronic bronchitis and cancer (see Supplementary Table 1), a distinction was made between respondents without one of these disease (1 = no), one disease (2 = one disease), or two or more diseases (3 = 2 or more);
- *Moderate severe ADS* at T2 (for details see above);
- *Stress during the PTE* (1 = not at all to moderately, 2 = quite a bit or extremely); and
- *Time PTE* (1 = 1 week to 2 month(s) ago, 2 = 3 to 6 months ago, 3 = 7–12 months ago).

2.4. Statistical analysis

Differences in characteristics between by PTEs affected respondents with and without pre-existing diabetes, and with and without heart and blood vessel problems were examined using the chi-square test.

To answer the main research question, multivariate logistic regression analyses (MLRA) were conducted with the following three dependent variables: moderate-severe anxiety and depression symptoms (ADS), severe ADS, and high PTSD symptom levels (PTSS). In the MLRAs, pre-existing DM and all control variables were entered as predictors. The subgroup of respondents with pre-existing DM was relatively small (n = 62), which prompted us to use the backward procedure (P-out = 0.10). In this way, non-relevant variables (either predictor or control variables) were eliminated from the initially full models, which also contributed to more parsimonious models. Results showed that the events-per-variable (EPV) ratios were above 10 [24,25]. With respect to cardiac or vascular disease problems, the same backward selection strategy as described above was applied among respondents without DM. All analyses were conducted with IBM SPSS version 31.0.

3. Results

3.1. Characteristics of respondents with and without pre-existing diabetes

The characteristics of the study samples are presented in Table 1 showing that respondents *with* and *without* pre-existing DM partly differed from each other. As could be expected, the DM group was significantly older than the non-DM group. No significant differences were observed in pre-existing moderate-severe ADS, lack of emotional support and stress during the PTEs.

3.2. Results of multivariate logistic regression analyses with diabetes as predictor

The final results of the stepwise MLRAs are presented in Table 2. In the most left column, the variables are presented which were included in the final MLRAs of at least one of the three dependent variables. A variable that is absent in Table 2 or a cell of a variable in a column is empty, indicates that this variable was not included in a final regression model of the corresponding dependent variable.

Table 2 shows that respondents affected by recent PTEs with pre-existing DM were at significantly greater risk of moderate-severe ADS at T3 than affected respondents without with pre-existing diabetes, *while controlling for variables* such as sex, pre-existing moderate-severe ADS and pre-existing lack of emotional support. Table 2 furthermore shows respondents with pre-existing DM were also significantly more at risk of high PTSD symptom levels at T3 than affected respondents without pre-

Table 1
Characteristics of by PTE affected respondents.

		Pre-existing diabetes mellitus T1	
		No ($n = 1337$)	Yes ($n = 62$)
	N^{Total}	n (%)	n (%)
Sex at T2			
male	671	632 (47.3)	39 (62.9)*
female	728	705 (52.7)	23 (37.1)
Age at T2 (in years)			
18-34	302	301 (22.5)	1 (1.6)***
35-49	317	305 (22.8)	12 (19.4)
50-64	407	388 (29.0)	19 (30.6)
65 or older	373	343 (25.7)	30 (48.4)
Education level at T2			
low	308	287 (21.5)	21 (33.9)*
medium	509	486 (36.4)	23 (37.1)
high	582	564 (42.2)	18 (29.0)
Employed at T2			
yes	726	705 (52.7)	21 (33.9)**
no	673	632 (47.3)	41 (66.1)
Pre-existing ADS at T2			
no	952	914 (68.4)	38 (61.3)
yes	447	423 (31.6)	24 (38.7)
Lack of emotional support at T2			
no	1063	1021 (76.4)	42 (67.7)
yes	336	316 (23.6)	20 (32.3)
Financial problems at T2			
no	1214	1169 (87.4)	45 (72.6)***
yes	185	168 (12.6)	17 (27.4)
Stressful life events between T2 and T3			
no	701	668 (50.0)	33 (53.2)
yes	698	669 (50.0)	29 (46.8)
Time PTE before T3			
in past 2 months	522	497 (37.2)	25 (40.3)
in past 3–6 months	462	445 (33.3)	17 (27.4)
in past 7–12 months	415	395 (29.5)	20 (32.3)
Stress during PTE[a]			
no	794	755 (56.5)	39 (62.9)
yes	605	582 (43.5)	23 (37.1)
Illness at T1			
no disease	938	920 (68.8)	18 (29.0)***
1 disease	306	282 (21.1)	24 (38.7)
2 or more diseases	155	135 (10.1)	20 (32.3)

PTE = potentially traumatic event. ADS = Anxiety and depression symptoms.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
[a] no = not at all to moderately, yes = quite a bit or extremely.

existing DM. With respect to severe ADS, six variables were included in the final model but not pre-existing DM as predictor. Additional analyses showed that pre-existing DM was not significantly associated with severe ADS at T3 on a bivariate level (OR = 1.45, $p = 0.28$), in contrast to moderate-severe ADS at T3 (OR = 1.99, 95% CI = 1.20–3.32, $p = 0.008$) and PTSS at T3 (OR = 1.80, 95% CI = 1.03–3.13, $p = 0.039$).

Table 2 furthermore shows that sex, pre-existing moderate-severe ADS at T2, pre-existing lack of emotional support at T2, stressful life-events between T2 and T3, and stress during the recent PTE were all included in the final models of all three dependent variables.

3.3. Results of multivariate logistic regression analyses with cardiac or vascular disease problems as predictor

Identical backward MLRAs were conducted with pre-existing heart and blood vessels problems instead of DM as predictor (for characteristics of the study sample see Supplementary Table 2). Results showed that pre-existing heart and blood vessels problems were not significantly and independently associated with moderate-severe ADS, severe ADS, and high PTSD symptom levels at T3 (see Supplementary Table 3). The subgroup of respondents with cardiac or vascular disease problems was four times as large as the subgroup with DM, enabling MLRAs without any selection of predictors. To test the robustness of findings, we therefore repeated the MLRAs without this selection procedure. Results again showed that that pre-existing heart and blood vessels problems were not significantly and independently associated with moderate-severe ADS, severe ADS, and high PTSD symptom levels at T3 (data not shown).

4. Discussion

To the best of our knowledge, this is the first prospective general population-based study assessing the extent to which pre-existing Diabetes Mellitus (DM) among adults increases the risk of high PTSD symptom levels (PTSS), and post-event Anxiety and Depression Symptom levels (ADS) after recent Potentially Traumatic Events (PTEs). In line with the study by Sommer [11] among military personnel, results showed that pre-existing DM significantly increased the risk of PTSS and moderate-severe ADS among by recent PTEs affected adults compared to by recent PTEs affected adults without DM. Pre-existing DM about doubled the odds having PTSS and moderate-severe ADS, while taken into account the effects of influential pre-existing risk factors such as pre-existing ADS, lack of emotional support and experienced stress during the PTEs. As was mentioned in the introduction, most trauma-related studies examining PTSD and DM have focused on PTSD as a risk factor for DM [1–5,10,11].

The findings of Sommer and colleagues [11] among military personnel and our findings among the general population therefore suggest that the relationships between DM on the one side, and PTSD and other post-trauma mental health problems on the other side, may be bi-directional [1,26,27], as was also observed for DM and depression, and DM and anxiety [28–31]. However, future prospective studies are warranted to (re)confirm whether pre-existing DM is an independent risk factor for PTSD and other post-PTE mental health problems. Although we controlled for important confounders, future research could, for example, examine possible common casual or mediating factors, such as overweight or obesity [5,32].

It was outside the aim of the present study to develop or test hypotheses regarding underlying mechanisms. However, if findings are confirmed in future studies, we may expect that both biological and psycho-social mechanisms are involved and interact. With respect to biological mechanisms, for example the metabolic dysregulation of DM may contribute to the risk profile in the development of PTSD symptomatology and other post-PTE mental health problems in which metabolic dysregulation also plays a role [33]. Besides the biological mechanisms, it is conceivable that psycho-social mechanisms play a role. For example, having a chronic disease like DM with known (fear of) complications, 24/7 demands for self-management and regular medical checkups may also contribute to different (fear) responses to PTEs and related mental health problems compared to those without DM. Stress caused by DM may be accumulated by the stress caused by PTEs. But, as said, replicative studies are needed to ensure that DM is indeed an independent risk factor. Our finding that respondents with pre-existing cardiac or vascular disease problems were *not* more at risk for PTSS and post-event ADS than those without these problems nevertheless further suggest that the relationships between DM and post-PTE mental health problems are indeed specific and DM related.

4.1. Strengths and limitations

The major strengths of the present study are the rigorous prospective study design, the use of a traditional probability-based study sample, the relatively high response rates, controlling for influential pre-existing risk factors (confounders such as pre-existing anxiety and depression symptomatology and lack of emotional support) the use of validated PTSD and mental health measures, and additional analyses with cardiac or vascular disease problems instead of DM as predictor. The key study variable DM was based on self-reported DM but, importantly, was based on the diagnoses of a physician and combined with the use of medicines for DM. However, like many other studies we cannot fully rule out the

Table 2
Results of stepwise multivariate logistic regression analyses among by recent PTEs affected respondents.[†]

	Moderate-severe ADS at T3		Severe ADS at T3		High PTSD symptom levels at T3	
	n (%)	aOR (95% CI)	n (%)	aOR (95% CI)	n (%)	aOR (95% CI)
Pre-existing diabetes T1						
no	447 (33.4)	1			264 (19.7)	1
yes	31 (50.0)	2.34 (1.24–4.41)**			19 (30.6)	1.99 (1.02–3.88)*
Sex at T2						
males	188 (28.0)	1	58 (8.6)	1	99 (14.8)	1
females	290 (39.8)	1.35 (1.01–1.79)*	126 (17.3)	1.69 (1.17–2.44)**	184 (25.3)	1.37 (1.00–1.88)
Moderate-severe ADS at T2						
no	158 (16.6)	1	47 (4.9)	1	89 (9.3)	1
yes	320 (71.6)	8.03 (6.01–10.73)***	137 (30.6)	5.09 (3.44–7.54)***	194 (43.4)	5.24 (3.82–7.19)***
Lack or emotional support at T2						
no	273 (25.7)	1	93 (8.7)	1	162 (15.2)	1
yes	205 (61.0)	2.18 (1.59–2.99)***	91 (27.1)	1.85 (1.28–2.67)**	121 (36.0)	1.43 (1.02–1.99)*
Stressful life events between T2 and T3						
no	203 (29.0)	1	70 (10.0)	1	109 (15.5)	1
yes	275 (39.4)	1.59 (1.21–2.11)**	114 (16.3)	1.58 (1.11–2.25)*	174 (24.9)	1.73 (1.28–2.34)***
Stress during PTE[a]						
no	188 (23.7)	1	47 (5.9)	1	83 (10.5)	1
yes	290 (47.9)	2.02 (1.53–2.67)***	137 (22.6)	2.92 (2.00–4.26)***	200 (33.1)	2.96 (2.17–4.06)***
Financial problems at T2						
no	358 (29.5)	1	131 (10.8)	1		
yes	120 (64.9)	1.98 (1.33–2.95)***	53 (28.6)	1.55 (1.02–2.36)*		
Age at T2						
18-34	127 (42.1)	1			76 (25.2)	1
35-49	125 (39.4)	1.05 (0.70–1.58)			78 (24.6)	1.08 (0.70–1.66)
50-64	119 (29.2)	0.70 (0.47–1.04)			73 (17.9)	0.70 (0.45–1.09)
65 or older	107 (28.7)	0.69 (0.45–1.07)			56 (15.0)	0.45 (0.27–0.75)**
Employment at T2						
yes	211 (29.1)	1			121 (16.7)	1
no	267 (39.7)	1.45 (1.04–2.02)*			162 (24.1)	1.49 (1.05–2.10)*
Illness at T1						
no disease					167 (17.8)	
1 disease					67 (21.9)	1
2 or more diseases					49 (31.6)	2.10 (1.29–3.41)**

PTEs = potentially traumatic events. T1 = 3 months before 12-month period in which respondents were affected by PTEs. T2 = start of 12-month period in which respondents were affected by PTEs. T3 = end of 12-month period in which respondents were affected by PTEs. aOR = Odds ratio adjusted for variables included in models. Ref. = reference category. ADS = Anxiety and depression symptoms. PTSD = posttraumatic stress disorder. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

[†] A variable that is absent in Table 2 or a cell of a variable in a column is empty, indicates that this variable was not included in a final regression model of the corresponding dependent variable.

[a] no = not at all to moderately, yes = quite a bit or extremely.

possibility that some respondents who did not report having DM at the time of the surveys, in fact did have (un-noticed) DM. In the LISS panel, regular medical assessments by a physician -in this case for DM- are absent. In the present population-based study we focused on adults and on past-year PTEs (Type-I trauma) [34]. Future studies are warranted to examine the extent to which current findings are applicable to youngsters and to civilians exposed to ongoing PTEs such as war [35].

In addition, we were unable to differentiate between respondents with Type 1 and Type 2 DM, the duration of DM (onset DM) and possible physical complications caused by DM that may increase the risk of post-event mental health problems [7–9]. Although pre-existing anxiety and depression symptoms were included in all final MLRA models, we did not examine the role of DM-related distress [36]. Given the number of respondents with DM affected by recent PTEs in the present study (n = 62), we were unable to examine the role of additional variables in the associations between DM and post-event mental health problems such as substance (mis)use, personality factors and self-esteem. Future studies on this topic are warranted.

In the analyses we controlled for other diseases (see Supplementary Table 1) but they do not fully cover all possible physical problems. In addition, we did not conduct clinical interviews that would have enriched our study [37]. Our DM study sample was not large enough to statistically examine possible interaction effects between pre-existing risk factors and DM or an accumulation of different risk factors [38].

4.2. Final remarks

The relevance of and the need for such replicative studies is also rooted in the fact that the prevalence of DM among the general population is increasing dramatically. A report of the World Health Organization showed that in 2022 14% of the adults across the globe were living with DM, a significant increase from 7% in 1990 [39]. According to the International Diabetes Federation (IDF)-atlas this prevalence will further rise in the next decades [40]. This raises the question of whether, should policies and interventions designed to curb or reverse this upward trend prove ineffective, an increase in PTSD and other post-trauma–related mental health disorders can be anticipated as a consequence of this alarming development.

CRediT authorship contribution statement

Peter G. van der Velden: Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Lutz Wittmann:** Writing – review & editing, Methodology, Investigation, Formal analysis, Conceptualization. **Marcel Das:** Writing – review & editing, Methodology, Investigation, Funding acquisition. **Koen P. Grootens:** Writing – review & editing, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declared no potential conflicts of interest concerning this article's research, authorship, and/or publication.

Acknowledgment

This work was supported by Fonds Slachtofferhulp, The Hague, The Netherlands (50006/VICTIMS). Generative AI was not used in any aspect of the literature review, research conduct, drafting, or revision of the manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.genhosppsych.2026.05.008.

Data availability

The data and meta data of the surveys of the Health and VICTIMS study are, after registration, freely available from the LISS data archive for researchers, like the data of all other studies conducted with the LISS panel (Archive see https://www.dataarchive.lissdata.nl, in English). Health surveys see: https://www.dataarchive.lissdata.nl/study-units/view/12. VICTIMS surveys see: https://www.dataarchive.lissdata.nl/study-units/view/945.

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