Complex PTSD symptoms mediate the association between childhood trauma and physical health problems

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ABSTRACT

The ICD-11 reconceptualized Posttraumatic Stress Disorder (PTSD) as a narrowly defined fear-based disorder, and introduced Complex PTSD (CPTSD) as a new diagnosis comprised of PTSD symptoms and symptoms of 'Disturbances in Self-Organization' (DSO) that are more reflective of general dysphoria. Previous research suggests that PTSD symptoms mediate the association between childhood trauma and physical health problems, including cardiovascular disease. No study has yet assessed how posttraumatic stress symptoms, as outlined in the ICD-11, influence the association between childhood trauma and somatic problems in adulthood.

Objective: This cross-sectional descriptive study examined whether PTSD and DSO symptoms mediated the associations between childhood physical and sexual abuse and childhood emotional abuse and neglect and somatic problems and cardiovascular diseases (CVD) load in adulthood.

Methods: General adult population samples from Ireland ($N = 1020$) and the United Kingdom ($N = 1051$) completed self-report questionnaires online.

Results: Structural equation modelling results indicated that PTSD and DSO symptoms fully mediated the association between both forms of childhood trauma and somatic problems, and that PTSD symptoms but not DSO symptoms fully mediated the association between childhood trauma and CVD load.

Conclusion: Psychological interventions that effectively treat CPTSD symptoms may have the added benefit of reducing risk of physical health problems.

Childhood trauma is pervasive across geographic and socioeconomic settings [63], and its adult health sequelae are well-established [1,13]. In addition to increasing the risk of psychopathology, these negative childhood experiences can have a lifelong impact on the biological system, leaving those affected at greater risk of physical morbidity and mortality [29,41]. Specifically, somatic problems and cardiovascular diseases (CVD), two physical health problems that constitute a substantial burden on healthcare systems worldwide, have been consistently linked with trauma exposure early in life. For example, many studies have shown that somatic problems, such as musculoskeletal pain, ear, nose, and throat symptoms, abdominal pain and gastrointestinal symptoms, fatigue, and dizziness are more common among adults

with a history of childhood trauma compared to their non-traumatized counterparts [23,45,54]. These subjective, medically unexplained physical health problems often persist and present as functional somatic syndromes, such as fibromyalgia, chronic fatigue/pain, and irritable bowel syndrome [49], which account for 40–49% of patient complaints in primary healthcare settings [36]. There is also evidence that CVD - a group of clinically observable pathological conditions that involve the heart and blood vessels, and the leading cause of death globally [74] – are positively associated with exposure to childhood trauma, especially in the context of abuse and neglect [6,39].

While biological and behavioural mechanisms (e.g. increased inflammation and risky health-related behaviors, respectively) have explain some of the increased risk of physical health problems following exposure to childhood trauma [21,60,64], psychological risk factors have also been identified. Most notably, there is evidence that posttraumatic stress disorder (PTSD) is associated with increased somatic problems [10,14,15,50–52,56,57,59,62] and risks for developing CVD [27,28,46,55]. There is also evidence that PTSD symptoms mediate the association between childhood maltreatment and physical health problems [10,55], but this relationship requires further consideration in light of the recently published 11th version of the International Classification of Diseases (ICD-11) [75].

In contrast to ICD-10 [73] and DSM-IV/DSM-5 [2,3], PTSD is no longer comprised of both fear (e.g., startle response, flashbacks) and dysphoria (e.g., diminished interests in activities, sleep difficulties, concentration problems) symptoms in ICD-11. Instead, PTSD is described in more narrow terms and as a purely fear-based disorder, with six symptoms that are directly related to the traumatic event. The dysphoria symptoms, which are common to many other mental disorders, were removed in an effort to increase specificity of the diagnosis [32]. Thus, it remains to be seen if PTSD symptoms - as reconceptualized by ICD-11 – continue to mediate the association between childhood trauma and physical health problems in adulthood as fewer but more severe cases PTSD will likely be identified using ICD-11 compared with ICD-10 or DSM-5 [5].

Furthermore, ICD-11 introduced Complex PTSD (CPTSD) into the diagnostic nomenclature for the first time. This disorder includes the core PTSD symptoms along with an additional three symptom clusters reflective of dysphoria, i.e. problems with emotion regulation, self-concept, and interpersonal relationships. These symptoms are collectively termed 'Disturbance in Self-Organization' (DSO), which are not necessarily linked to trauma-specific triggers but, rather, more pervasive and long-term experiences of trauma. Existing evidence indicates that CPTSD is more likely to result following exposure to childhood trauma than PTSD [19]; that it is a more impairing disorder than PTSD [42]; and is more strongly correlated with other mental health problems such as depression, generalized anxiety, dissociation [40], and comorbid borderline personality and somatoform disorders [70]. To date, no study has assessed if DSO symptoms also mediate the association between childhood trauma and physical health problems. The separation of PTSD and DSO symptoms in the diagnostic nomenclature offers the opportunity to test (1) if specific fear-based symptoms (i.e., PTSD symptoms) and more general, dysphoria-related symptoms (i.e., DSO symptoms) are differentially associated with physical health problems, and (2) if one, both, or neither of these symptoms mediate the association between childhood trauma and adult physical health problems.

In this study, we examined if PTSD and DSO symptoms mediated, partially or fully, the associations between childhood trauma and somatic problems and CVD load. We tested if PTSD and DSO symptoms mediated the association between childhood trauma and somatic problems in a general population sample of adults from the Republic of Ireland, and if PTSD and DSO symptoms mediated the association between childhood trauma and CVD load in a trauma-exposed general population sample of adults from the United Kingdom (UK). We did not aim to establish causal pathways given the cross-sectional nature of our datasets but, rather, aimed to assess the magnitude of differences in

physical health outcomes due to childhood trauma that would remain when an intermediate psychological risk factor (i.e. posttraumatic stress) varies. We separated childhood trauma into two categories: (a) physical or sexual abuse, representing physical forms of maltreatment that cause pain and direct bodily harm, and (b) emotional abuse or neglect, representing psychological forms of maltreatment that cause emotional pain and do not involve direct bodily harm [1,13]. Although both types of maltreatment often co-occur, they can happen independent from one another ([25,35]., Accepted) and far fewer studies have assessed specific long-term effects of emotional abuse and neglect, relative to physical and sexual abuse, on physical health [37].

1. Methods

1.1. Participants and procedures

This cross-sectional descriptive study was based on data collected from general population surveys of adults in Ireland ($N = 1020$) and the UK ($N = 1051$). These data were collected in 2019 and 2017, respectively, using very similar recruitment methods. In both cases, an Irish-based online research panel survey company that maintains nationally representative panels of adults in both countries (Qualtrics) was employed to recruit participants. The participants were members of nationally representative research panels in Ireland and the UK. Participants in both surveys were eligible for inclusion if they were aged 18 years or older at the time of survey and were capable of completing the survey in English. In the Irish study, participants were selected to be representative of the general adult population in terms of sex, age, and geographical distribution. No further inclusion or exclusion criteria were used. In the UK study, two additional inclusion criteria were applied: Participants were selected if they were born in the UK, and had experienced at least one traumatic life event, defined as screening positive for any event from the Life Events Checklist for DSM-5 [72]. Basic sociodemographic information for two samples is presented in Table 1. Ethical approval for the collection of both datasets was obtained from the university ethics committee by the final author. No inducements were used to recruit the participants but remuneration was offered on a general basis for participation in the research surveys.

1.2. Measures

1.2.1. Predictor variables

Childhood trauma: In the Irish and UK surveys, participants completed the Adverse Childhood Experiences Questionnaire [29]. This questionnaire includes ten binary coded items (0 = No, 1 = Yes) that measure different types of traumas and adversities that occur in the first 18 years of life. We selected four of these items to measure childhood physical or sexual abuse and childhood emotional abuse or neglect. Physical/sexual abuse was indicated by a positive response to either

Table 1
Sociodemographic characteristics for the Irish ($N = 1020$) and UK ($N = 1051$) samples.

	Irish sample	UK sample
Sex		
Male	49.0% ($n = 500$)	31.6% ($n = 332$)
Female	51.0% ($n = 520$)	68.4% ($n = 719$)
Employment status		
Employed/retired/student/ homemaking	91.4% ($n = 932$)	92.9% ($n = 976$)
Unemployed	8.6% ($n = 88$)	7.1% ($n = 75$)
Educational status		
Attended university	53.7% ($n = 548$)	62.7% ($n = 659$)
Did not attend university	46.3% ($n = 472$)	37.3% ($n = 392$)
Age	Mean = 43.1 years (SD = 15.1, range = 18–87)	Mean = 47.28 years (SD = 15.0, range = 18–90)

ACE2 ('*Did a parent or other adult in the household often push, grab, slap, or throw something at you? Or, ever hit you so hard that you had marks or were injured?*') or ACE3 ('*Did an adult or person at least 5 years older than you ever touch or fondle you or have you touch their body in a sexual way? Or, try to or actually have oral, anal, or vaginal sex with you?*'). Emotional neglect/abuse was indicated by a positive response to either ACE1 ('*Did a parent or other adult in the household often swear at you, insult you, put you down, or humiliate you? Or, act in a way that made you afraid that you might be physically hurt?*') or ACE4 ('*Did you often feel that no one in your family loved you or thought you were important or special? Or, your family didn't look out for each other, feel close to each other, or support each other?*').

1.2.2. Mediator variables

PTSD and DSO symptoms: In the Irish and UK surveys, participants completed the International Trauma Questionnaire (ITQ: [20]. This questionnaire is a self-report measure of all diagnostic requirements for ICD-11 PTSD and CPTSD. The ITQ first screens for the respondents' worst traumatic event, and how long ago this event occurred. Respondents are then instructed to answer all subsequent questions in relation to this event. There are six questions measuring each PTSD symptom (Irish sample, $\alpha = 0.90$; UK sample, $\alpha = 0.91$) and six questions measuring each DSO symptom (Irish sample, $\alpha = 0.93$; UK sample, $\alpha = 0.92$). PTSD symptoms are answered in terms of how much the respondent has been bothered by that symptom in the past month, and DSO symptoms are answered in terms of how the respondent typically feels, thinks about oneself, and relates to others. All items are answered on a five-point Likert scale ranging from 0 (Not at all) to 4 (Extremely) with higher scores reflecting higher levels of PTSD and DSO symptoms. Multiple factor analytic studies indicate that the ITQ measures two correlated second-order factors: 'PTSD' and 'DSO' symptoms. The 'PTSD' factor captures the covariation between three first-order factors ('Re-experiencing in the here and now', 'Avoidance', and 'Sense of Threat') and the 'DSO' factor explains covariation between another three first-order factors ('Affective Dysregulation', 'Negative Self Concept', and 'Disturbed Relationships') [11,20]. The reliability and validity of the ITQ has been demonstrated in multiple general population samples [8,18].

1.2.3. Criterion variables

Somatic problems: In the Irish study, participants completed the 10-item somatization subscale of the Trauma Symptom Inventory 2 (TSI-2: [12]. This subscale measures ten different types of somatic problems (aches and pains, lower back pains, muscle spasms, chest pain, dizziness, nausea, indigestion, ringing in ears, difficulty swallowing, and difficulty maintaining balance). Respondents were asked to indicate how often they experienced each type of somatic problem in the last six months on a four-point Likert scale from 0 (Never) to 3 (Often). Higher scores reflect higher levels of somatic problems. The internal reliability of this measure in the Irish sample was satisfactory ($\alpha = 0.87$).

CVD load: In the UK study, participants completed the Charlson Comorbidity Index (CCI) [16,58], a commonly used self-report measure of whether respondents have ever been diagnosed (0 = No, 1 = Yes) with 19 different chronic illnesses that are categorized in line with the ICD-10 diagnostic codes [65]. The CCI includes five diseases reflecting CVDs: hypertension, cerebrovascular disease, heart disease (i.e., cardiovascular disease, myocardial infarction, congestive heart failure, chronic heart disease, or dilated cardiomyopathy), peripheral vascular disease, and stroke. Affirmative responses to each of these diseases are summed to recreate a score representative of overall CVD load. The psychometric properties of the CCI, including its predictive validity for mortality outcomes, have been well-documented [24,69].

1.2.4. Covariates

We were able to include four sociodemographic variables as covariates of somatic problems and CVD load in all analyses as these

variables were answered in the Irish and UK studies. These variables were sex (0 = male, 1 = female), age, employment status (0 = employed, retired, student, or homemaking, 1 = unemployed and seeking work), and educational status (0 = did not attend university, 1 = attended university). These covariates were included in the models based on existing evidence of their association with somatic problems or CVD in trauma samples [7,61].

1.3. Data analysis

Structural equation modelling (SEM) was used to test if PTSD and DSO symptoms mediated – fully, partially, or not at all – the associations between the two types of childhood trauma (i.e., physical or sexual abuse and emotional abuse or neglect) and somatic problems (based on the Irish sample) and CVD load (based on the UK sample). Three nested models were tested, and these are illustrated in Figs. 1 and 2.

Model 1 was a 'direct effects only model' where PTSD and DSO symptoms had no mediating effect on the associations between both types of childhood trauma and physical health problems. As per Figs. 1 and 2, the a and b paths were fixed to zero and the c' paths were freely estimated.

Model 2 was an 'indirect effects only model' where PTSD and DSO symptoms fully mediated the associations between both types of childhood trauma and physical health problems. In this model, the a and b paths were freely estimated and the c' paths were fixed to zero.

Model 3 was a 'direct and indirect effects model' where the two types of childhood trauma were directly associated with physical health problems and were also indirectly associated with physical health problems via PTSD and DSO symptoms. This model reflects a partial mediation effect for PTSD and DSO symptoms between childhood trauma and physical health problems. Thus, the a, b, and c' paths were freely estimated.

In both models, the predictor variables of childhood physical and sexual abuse, and childhood emotional abuse and neglect, were treated as observed variables. The mediator variables of PTSD and DSO symptoms were treated as latent variables; consistent with the ITQ's latent structure, PTSD was measured via the total subscale scores of re-experiencing, avoidance, and sense of threat, and DSO was measured via the total subscale scores of affective dysregulation, negative self-concept, and disturbed relationships. The criterion variables of 'Somatic Problems' and 'CVD Load' were entered into the model as latent variables. Somatic Problems was measured via the ten items of the somatic subscale of the TSI-2, and CVD Load was measured via the five items chosen from the CCI. The covariates were treated as observed variables and were regressed onto the criterion and mediator variables in both models.

Constructing latent variables for the mediator and criterion variables had the advantage of (a) controlling for measurement error and thus producing more reliable direct and indirect parameter estimates, and (b) ensuring that both models were tested using the same model estimator and, therefore, that all parameters were estimated as linear regression coefficients. This is especially important when estimating and interpreting indirect effects.

All models were tested using Mplus version 8.2 [53], and estimated using the weighted least squares mean- and variance-adjusted estimator (WLSMV). This estimator is appropriate for use with binary and ordinal categorical indicators, and has been shown to produce "...accurate test statistics, parameter estimates and standard errors under both normal and nonnormal latent response distributions across all sample sizes and model complexities" [31]. Standard guidelines were followed to determine the adequacy of model fit [38]. Acceptable fit is indicated by Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values >0.90, Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) values <0.08, and a non-significant chi-square (χ^2) result. However, the χ^2 test produces Type 1 errors in large samples and should not be used to reject otherwise good fitting
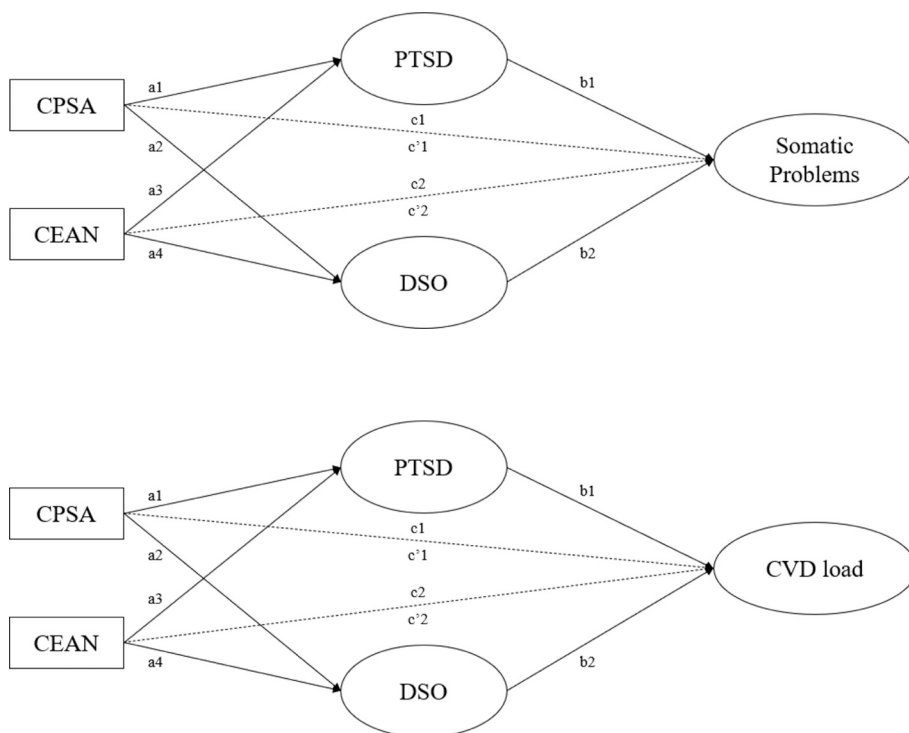
Fig. 1. SEM model of Somatic Problems in the Irish sample (N = 1020).
Note: Model 1 = a and b paths are fixed to zero and c paths are freely estimated; Model 2 = a and b paths are freely estimated and c paths are fixed to zero; Model 3 = a, b, and c paths are freely estimated; PTSD, DSO, and Somatic Problems were regressed onto the covariates of sex, age, employment status, and educational status in all cases. The covariates are not illustrated for the sake of simplicity; CPSA = childhood physical or sexual abuse; CEAN = childhood emotional abuse or neglect; PTSD = post-traumatic stress disorder symptoms; DSO = disturbance in self-organization symptoms.

Fig. 2. SEM model of cardiovascular disease (CVD) load in the UK sample (N = 1051).
Note: Model 1 = a and b paths are fixed to zero and c paths are freely estimated; Model 2 = a and b paths are freely estimated and c paths are fixed to zero; Model 3 = a, b, and c paths are freely estimated; PTSD, DSO, and CVD load were regressed onto the covariates of sex, age, employment status, and educational status in all cases. The covariates are not illustrated for the sake of simplicity; CPSA = childhood physical or sexual abuse; CEAN = childhood emotional abuse or neglect; PTSD = posttraumatic stress disorder symptoms; DSO = disturbance in self-organization symptoms.

models [66].

To compare the three nested models, we examined changes in the RMSEA (ΔRMSEA) as this fit index includes penalties for increasing model complexity. ΔRMSEA values >0.015 indicate a significant improvement in model fit [17]. To test the significance of indirect effects in Models 2 and 3, we used tests of joint significance [44,48]. Simulation studies have shown that this method may be superior to alternative methods such as the bias-corrected bootstrapping method as it produces fewer Type 1 errors [33,47,67,68].

2. Results

2.1. Descriptive statistics

In the Irish sample, 35.9% (n = 366) reported a history of childhood physical or sexual abuse and 44.3% (n = 452) reported a history of childhood emotional abuse or neglect; 29.0% (n = 296) reported a history of both. Their mean PTSD symptom score was 6.16 (Mdn = 5.00, SD = 5.75, range 0–24), and their mean DSO symptom score was 7.31 (Mdn = 6.00, SD = 6.21, range 0–24). Their somatic problems scores ranged from 0 to 29, with a mean of 9.93 (Mdn = 9.00, SD = 6.52).

In the UK sample, 40.8% (n = 429) and 47.0% (n = 494) reported a history of childhood physical or sexual abuse and childhood emotional abuse or neglect, respectively; 32.9% (n = 326) reported a history of both. Their mean PTSD symptom score was 6.55 (Mdn = 4.00, SD = 6.59, range 0–24), and their mean DSO symptoms score was 8.12 (Mdn = 6.00, SD = 6.99, range 0–24). 9.0% (n = 95) of participants reported at least one indicator of CVD, with a mean CVD load of 0.11 (Mdn = 0.00, SD = 0.37, range 0–3).

2.2. SEM model of somatic problems

The fit statistics for the three models of somatic problems in the Irish sample are reported in Table 2. The direct effects only model (Model 1) was a poor fit of data. The fully indirect model (Model 2) was significantly better than the direct effects only model (ΔRMSEA = −0.060) and the CFI, TLI, RMSEA, and SRMR results indicated acceptable model fit.

Table 2
SEM results for somatic problems in the Irish sample (N = 1020) and cardiovascular disease load in the UK sample (N = 1051).

	χ^2	df	CFI	TLI	RMSEA (90% CI)	SRMR
Irish sample: Somatic Problems						
Model 1: Direct effects only	3089.53	193	0.640	0.598	0.121 (0.118, 0.125)	0.185
Model 2: Indirect effects only	**875.39**	**181**	**0.914**	**0.897**	**0.061 (0.057, 0.065)**	**0.059**
Model 3: Direct and indirect effects	934.53	179	0.906	0.887	0.064 (0.060, 0.068)	0.057
UK sample: CVD Load						
Model 1: Direct effects only	836.38	103	0.611	0.543	0.082 (0.077, 0.088)	0.182
Model 2: Indirect effects only	**199.79**	**91**	**0.942**	**0.923**	**0.034 (0.027, 0.040)**	**0.126**
Model 3: Direct and indirect effects	199.83	89	0.941	0.920	0.034 (0.028, 0.041)	0.127

Note: All χ^2 results are statistically significant (p < .001); Best fitting models in bold.

The direct and indirect effects model (Model 3) had very similar fit to Model 2, and the RMSEA value was 0.003 higher than Model 2. Thus, the inclusion of the direct effects from childhood trauma to Somatic Problems was not supported. Model 2 was deemed the best fitting model as the additional parameters added in Model 3 did not lead to a significant improvement in fit.

As detailed in Table 3, Model 2 explained 25.2% of variance in PTSD symptoms, 28.2% of variance in DSO symptoms, and 39.8% of variance in somatic problems (ps < 0.001). With the effect of the covariates removed, the model explained 19.0%, 20.7%, and 37.6% of variance in PTSD, DSO, and somatic problems, respectively (ps < 0.001). All

Table 3
Direct and indirect standardized regression coefficients derived from Model 2 in the Irish sample ($N = 1020$).

	β	SE	p
Direct associations			
CPSA → PTSD	0.12	0.04	0.001
CPSA → DSO	0.10	0.04	0.004
CEAN → PTSD	0.34	0.04	< 0.001
CEAN → DSO	0.37	0.04	< 0.001
PTSD → Somatic Problems	0.30	0.05	< 0.001
DSO → Somatic Problems	0.38	0.05	< 0.001
Indirect associations			
CPSA → PTSD → Somatic Problems	0.04	0.01	0.003
CPSA → DSO → Somatic Problems	0.04	0.02	0.007
CEAN → PTSD → Somatic Problems	0.10	0.02	< 0.001
CEAN → DSO → Somatic Problems	0.14	0.02	< 0.001

R^2	without covariates	with covariates
PTSD	0.190 ($p < .001$)	0.252 ($p < .001$)
DSO	0.207 ($p < .001$)	0.282 ($p < .001$)
Somatic Problems	0.376 ($p < .001$)	0.398 ($p < .001$)

Note: All direct and indirect regression effects are adjusted for sex, age, employment status, and education status; R^2 = percentage of variance explained; CPSA = childhood physical or sexual abuse; CEAN = childhood emotional abuse or neglect; PTSD = posttraumatic stress disorder symptoms; DSO = disturbances in self-organization symptoms; β = standardized regression coefficient; SE = standard error; p = statistical significance.

Table 4
Direct and indirect standardized regression coefficients derived from Model 2 in the UK sample ($N = 1051$).

	β	SE	p
Direct associations			
CPSA → PTSD	0.18	0.03	< 0.001
CPSA → DSO	0.08	0.03	0.014
CEAN → PTSD	0.22	0.04	< 0.001
CEAN → DSO	0.34	0.03	< 0.001
PTSD → CVD load	0.28	0.07	< 0.001
DSO → CVD load	0.09	0.06	0.15
Indirect associations			
CPSA → PTSD → CVD load	0.05	0.02	0.001
CPSA → DSO → CVD load	0.01	0.01	0.21
CEAN → PTSD → CVD load	0.06	0.02	< 0.001
CEAN → DSO → CVD load	0.03	0.02	0.15

R^2	without covariates	with covariates
PTSD	0.144 ($p < .001$)	0.240 ($p < .001$)
DSO	0.182 ($p < .001$)	0.322 ($p < .001$)
CVD load	0.133 ($p < .001$)	0.283 ($p < .001$)

Note: All direct and indirect regression effects are adjusted for sex, age, employment status, and education status; R^2 = percentage of variance explained; CPSA = childhood physical or sexual abuse; CEAN = childhood emotional abuse or neglect; PTSD = posttraumatic stress disorder symptoms; DSO = disturbances in self-organization symptoms; β = standardized regression coefficient; SE = standard error; p = statistical significance.

indicators of the PTSD, DSO, and Somatic Problems latent variables loaded onto their respective factors positively, significantly (*ps* < 0.001), and robustly (all factor loadings >0.50). The direct and indirect regression coefficients are also reported in Table 3.

Childhood physical or sexual abuse and childhood emotional abuse or neglect were positively and significantly associated with PTSD and DSO symptoms, and the effects were stronger for emotional abuse and neglect. Additionally, PTSD and DSO symptoms were significantly and positively associated with Somatic Problems. Childhood physical and sexual abuse was indirectly associated with Somatic Problems via PTSD (β = 0.04, SE = 0.01, *p* = .003) and DSO (β = 0.04, SE = 0.02, *p* = .007) symptoms. Likewise, childhood emotional abuse and neglect was indirectly associated with Somatic Problems via PTSD (β = 0.10, SE = 0.02, *p* < .001) and DSO (β = 0.14, SE = 0.02, *p* < .001) symptoms.

Regarding the covariates in the model, higher PTSD symptom scores were associated with being female (β = 0.09, *p* = .003) and younger age (β = −0.19, *p* < .001); higher DSO symptoms were also associated with being female (β = 0.09, *p* = .002) and younger age (β = −0.21, *p* < .001); and higher Somatic Problems scores were associated with being female (β = 0.08, *p* = .006), older age (β = 0.16, *p* < .001), and lower educational attainment (β = 0.06, *p* = .042).

2.3. SEM model of CVD load

The fit statistics for the three SEM models of CVD Load in the UK sample are also reported in Table 2. Similar to the models of Somatic Problems, the direct effects only model (Model 1) was a poor representation of the sample data; the fully indirect model (Model 2) was statistically superior to the direct effects only model (ΔRMSEA = −0.048) and provided acceptable fit to the data based on the CFI, TLI, and RMSEA results (however, the SRMR indicated poor model fit). The direct and indirect effects model (Model 3) yielded similar fit statistics to Model 2, therefore, the inclusion of the direct effects from childhood trauma to CVD Load were not supported. The fully indirect model (Model 2) was deemed to the best representation of the UK sample data on the grounds of parsimony and overall model fit.

As detailed in Table 4, Model 2 explained 24.0% of variance in PTSD symptoms, 32.2% of variance in DSO symptoms, and 28.3% of variance in CVD Load (*ps* < 0.001). With the effect of the covariates removed, the model explained 14.4%, 18.2%, and 13.3% of variance in PTSD, DSO, and CVD Load, respectively (*ps* < 0.001). All indicators of the PTSD, DSO, and CVD Load latent variables loaded onto their respective factor positively, significantly (ps < 0.001) and robustly (all factor loadings >0.50). The direct and indirect associations are also reported in Table 4.

Childhood physical or sexual abuse and childhood emotional abuse or neglect were significantly and positively associated with PTSD and DSO symptoms, and the effects were again stronger for emotional abuse and neglect. PTSD symptoms, but not DSO symptoms, were significantly and positively associated with CVD Load. Childhood physical and sexual abuse was indirectly associated with CVD Load via PTSD symptoms (β = 0.05, SE = 0.02, *p* = .001), and childhood emotional abuse and neglect was also indirectly associated with CVD Load via PTSD symptoms (β = 0.06, SE = 0.02, *p* < .001).

Regarding the covariates in the model, higher PTSD symptom scores were associated with being female (β = 0.08, *p* = .019) and younger age (β = −0.26, *p* < .001); higher DSO symptoms were associated with younger age (β = −0.36, *p* < .001) and being unemployed (β = 0.09, *p* = .001); and higher CVD Load was associated with older age (β = 0.54, *p* < .001).

3. Discussion

In this study, we used data from two general population surveys to conduct the first assessment of whether ICD-11 CPTSD symptoms mediated the associations between physical and psychological forms of childhood trauma and physical health problems during adulthood. Our results showed that the more narrowly defined set of PTSD symptoms in ICD-11 were positively associated with physical health problems – both subjective (somatic problems) and objective (diagnosis of a CVD related disease) – and mediated the association between different forms of childhood trauma and physical health problems. The decision in ICD-11 to narrow the focus of PTSD symptoms to fear-based responses to the traumatic events appears not to have affected previously established relationships between PTSD and physical health problems (see Bisson [9]).

Notably, our findings corroborate with previous research suggesting somatic problems are indirectly associated with childhood maltreatment through PTSD [14,15,56,57], and further showed that the DSO

symptoms that distinguish CPTSD from PTSD in ICD-11 were positively correlated with these subjective physical health complaints. Together, these results suggest that, in the context of childhood trauma, subjective measures of adult physical health are influenced by stress symptoms that directly relate to trauma (i.e. PTSD factors), as well as psychological symptoms that culminated as a result of sustained, significant stressors in childhood (i.e. DSO factors). In contrast, DSO symptoms did associate with objective measures of physical disease in the form of CVD load. One possible explanation for why PTSD symptoms, but not DSO symptoms, were related to CVD load is that PTSD symptoms - especially those related to repeated activation of the autonomic nervous system such as flashbacks, hypervigilance, and hyperarousal - result in intermittently exaggerated cardiovascular demands which, in the long-run, can induce chronic cardiovascular alterations in the form of increased resting heart rate and lower heart rate variability; both of which are associated with poorer heart health [22,28]. DSO symptoms, which involve a persistent sense of low self-worth, affect dysregulation, and disturbances in interpersonal relationships, may not necessarily induce the same types or the same extent of physiological responses as the PTSD symptoms that subsequently increase cardiovascular morbidity and mortality.

Clearly, far more research on the association between DSO symptoms and CVD is required, but our findings provide a basis to understand how the different sets of posttraumatic stress symptoms relate to cardiovascular health in the context of childhood trauma. These findings have implications for researchers who use the DSM-5 model of PTSD [4] because the DSM-5 takes a broad-based approach to describing posttraumatic responses and includes fear-based and dysphoric symptoms together within the same diagnosis. It is very possible – based on current results – that estimates of the association between DSM-5 PTSD and CVD will be underestimated given the inclusion of a large number of dysphoria-based symptoms. Direct comparisons between the ICD-11 and DSM-5 models of PTSD and CVD are needed to answer this question.

In both samples, we found that the direct effects of emotional abuse or neglect on PTSD and DSO symptoms, and their indirect effects on physical health problems, were stronger than those for physical or sexual abuse. These results are consistent with some existing evidence demonstrating that emotional forms of trauma are more strongly associated with mental health problems, such as depression and psychosis, than physical or sexual forms of trauma [34,71]. In turn, poorer mental health as a result of psychological trauma are associated with increased risks for physical health problems; a well-established pathway is through the upregulation of the inflammatory response system [43]. To date, however, emotional trauma that does not include a physical threat is not necessarily included as a criterion A (potentially traumatic) event in either diagnostic manual. Despite this fact, our results showed that these kinds of event are significantly linked with poorer physical health in adulthood via PTSD and DSO symptoms, and perhaps more so than physical forms of childhood maltreatment. Although emotional and physical forms of childhood maltreatment tend to co-occur, emotional trauma is more common during childhood and these different forms of maltreatment can happen independent from one another ([25,35], Accepted). Therefore, further investigations to clarify the disease burden and healthcare needs that are uniquely associated with emotional abuse and emotional neglect in childhood, and whether and to what extent these forms of trauma should be included as a potentially traumatic event for diagnosis are warranted.

Several study limitations require consideration. First, we used different samples to investigate the two physical health related criterion variables and this precludes identifying unique effects for somatic problems and CVD load. It is possible that some of the somatic problems identified in the Irish sample were attributable to unmeasured CVD, or to some other unmeasured physical disease. Future studies that simultaneously model somatic problems and CVD load will be important to determine if these findings replicate. Second, we did not account for non-interpersonal forms of trauma during childhood (e.g., life-threatening car accidents), or trauma exposure during adulthood, both

of which may have had an influence the criterion variables examined in this study. Third, we only had a limited number covariates available across the two samples and could not, therefore, account for other potentially important health-related sociodemographic risk factors (e.g., ethnicity; smoking; sedentary lifestyle; and other health problems such as mental disorders, metabolic syndrome, or obesity). We were also unable to account for other potentially relevant psychological and social factors that may influence physical health in the context of childhood trauma; these include coping strategies, internal resources, and social support. Further, the samples, although nationally representative of the general adult population in Ireland and the UK, may over-represent well-resourced or well-educated persons due to the use of an online survey platform. Finally, the cross-sectional design of the study precludes interpretations of causality in the longitudinal health impact of childhood maltreatment through PTSD and DSO symptoms; cross-sectional mediation models can be prone to generating biased estimations and is further limited by the assumptions being made about the temporal relation between variables. Retrospective self-reporting bias may also influence tendencies to report past trauma and current CPTSD symptoms or health problems.

Notwithstanding these limitations, this study provides the first piece of empirical evidence that ICD-11 CPTSD symptoms may influence the association between childhood trauma and physical health problems. Moreover, these results are important as they suggest that PTSD and DSO symptoms may play different roles in linking different forms of childhood trauma to different types of physical health problems, with PTSD symptoms being especially pertinent to objectively diagnosed CVD. Clinical interventions that treat CPTSD may, therefore, have the additional benefit of improving different physical health related complaints. The importance of childhood trauma and stress-related psychopathology are only beginning to be recognized as risk-factors in cardiovascular medicine [46]. Our findings add to a growing literature that supports routine screening for early-life trauma and continuing efforts to pinpoint effective interventions that ameliorate the negative health consequences of trauma exposure in the primary care and specialist healthcare settings [26,30,57]. Additional research using longitudinal designs is needed to establish the causal pathways from childhood trauma to different types of adult physical health problems, to ascertain the mediating role of PTSD and DSO symptoms in these relationships, and to further investigate and differentiate the unique contribution of childhood emotional trauma to adult health.

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Declaration of Competing Interest

None.

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