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Typologies of PTSD clusters and reckless/self-destructive behaviors: A latent profile analysis

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ABSTRACT

Posttraumatic stress disorder (PTSD) is comorbid with diverse reckless and self-destructive behaviors (RSDBs). We examined the nature and construct validity (covariates of age, gender, depression severity, number of trauma types, functional impairment) of the optimal class solution categorizing participants based on PTSD symptom and RSDB endorsement. The sample included 417 trauma-exposed individuals recruited through Amazon's MTurk platform who completed the Life Events Checklist for DSM-5, PTSD Checklist for DSM-5, the Posttrauma Risky Behaviors Questionnaire, and Patient Health Questionnaire-9. Latent profile analyses indicated an optimal three-class solution: the Low PTSD-RSDBs, High PTSD-Low RSDBs, and High PTSD-RSDBs classes. Multinomial logistic regression indicated that impairment and depression predicted the High PTSD-Low RSDBs vs. the Low PTSD-RSDBs classes. Impairment, age, being female, and depression predicted the High vs. Low PTSD-RSDBs classes. Number of trauma types, age, being female, and depression predicted the High PTSD-RSDBs vs. High PTSD-Low RSDBs classes. Results support the presence of a reckless behaviors subtype of PTSD (characterized by greater depression, greater impairment, greater number of trauma types, being male, and being younger), conducting comprehensive assessments of RSDBs for individuals reporting PTSD symptoms and of PTSD symptoms for individuals reporting RSDBs, and the need to tailor interventions to treat PTSD and RSDBs concurrently.

1. Introduction

Although most individuals experience traumatizing events (TEs; 89.70% of U.S. adults), few develop lifetime posttraumatic stress disorder (PTSD; 8.30%; Kilpatrick et al., 2013). PTSD is characterized by a constellation of intrusion, avoidance of trauma reminders, negative alternations in cognitions and mood (NACM), and alterations in arousal and reactivity (AAR) symptoms (American Psychiatric Association, 2013). PTSD typologies (i.e., latent distinct subgroups of individuals based on endorsed response patterns) have been identified with person-centered approaches of latent class (LCA; categorical indicators) and latent profile (LPA; continuous indicators) analyses (Dalenberg et al., 2012; Contractor et al., 2017b). Rarely explored are typologies characterized by PTSD and reckless and self-destructive behaviors (RSDBs) despite their established theoretical and empirical relations. Thus, the current study examined the nature and construct validity of the best-fitting class solution in categorizing participants based on PTSD symptom and RSDB endorsement.

Theoretically, the *disinhibition* viewpoint suggests that individuals with PTSD symptoms may engage in RSDBs when perceiving rewarding situations (Casada and Roache, 2005); the *negative/positive reinforcement* viewpoint highlights the functional role of RSDBs in reducing/escaping negative affect and/or eliciting/maintaining/increasing positive affect (Baker et al., 2004; Simpson et al., 2014); and the *cognitive explanation* indicates that a narrow attention span and information processing capacity post-TE increases RSDBs (Ben-Zur and Zeidner, 2009). Unsurprisingly, empirical evidence indicates a strong link between PTSD and diverse RSDBs such as substance use (Strom et al., 2012; Weiss et al., 2018), gambling (Scherrer et al., 2007), problematic technology use (Contractor et al., 2017d; Schimmenti et al., 2017), disordered eating (Forman-Hoffman et al., 2012), risky sexual behaviors (Weiss et al., 2013), aggression (Lusk et al., 2017), illegal behaviors (Pat-Horenczyk et al., 2007), reckless driving (Stecklov and Goldstein, 2004), and suicidal behaviors (Pat-Horenczyk et al., 2007; Weiss et al., 2015a).

To account for the role and salience of RSDBs, a new E2 symptom was added to the *DSM-5* criteria for PTSD (American Psychiatric Association, 2013). Existing research on PTSD's externalizing and

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impulsive typologies provides preliminary evidence for a reckless behaviors subtype of PTSD. For instance, subgroups with greater PTSD severity and impulsivity (personality trait related to RSDBs; Stanford et al., 1996) report greater RSDBs such as substance use and aggression, distinct mental health outcomes, differing coping styles, and unique genetic risk factors compared to subgroups reporting greater/lower PTSD severity and lower impulsivity (Miller, 2003; Miller et al., 2004; Flood et al., 2010; Wolf et al., 2010; Castillo et al., 2014; Contractor et al., 2016a; Contractor et al., 2018c). Additionally, research indicates that individuals with comorbid PTSD and RSDBs report worse treatment outcomes (Ouimette et al., 1998) and more severe mental health correlates than individuals with only PTSD or RSDBs (Saladin et al., 1995). Overall, comorbid PTSD and RSDBs is associated with worse psychosocial functional impairment and poorer treatment outcomes (Tull et al., 2015).

However, the existence and nature of a reckless behaviors subtype of PTSD (individuals endorsing higher PTSD severity and more RSDBs compared to other subgroups) has been explored in a limited manner. First, person-centered research has focused on singular constructs of either PTSD (e.g., Breslau et al., 2005; Dickstein et al., 2010) or RSDBs (e.g., Mueller et al., 2010; Carragher and McWilliams, 2011; Connor et al., 2014; Elhai and Contractor, 2018). Second, PTSD's externalizing and impulsive subtypes (Miller et al., 2004; Flood et al., 2010; Wolf et al., 2010; Contractor et al., 2016a; Contractor et al., 2018c) are determined based on endorsed PTSD symptoms and personality traits (related to RSBDs), rather than based on engagement in RSDBs. Hence, these personality-based typologies have limited conceptual overlap with a reckless behaviors subtype of PTSD; however support its investigation. Third, limited research has examined PTSD in combination with RSDBs, and these studies have focused on specific and singular RSDBs vs. considering the impact of several RSDBs simultaneously (e.g., Anderson et al., 2017). However, RSDBs often co-occur; engagement in one RSDB increases the likelihood of other RSDBs (White and Hansell, 1998; Cooper, 2002). Fourth, limited research has examined relations between PTSD clusters and different RSDBs, which may influence the categorization and heterogeneity (and thereby utility and meaning) of PTSD-RSDB typologies. For example, research indicates that PTSD's intrusion symptoms relate to substances such as depressants and cannabis (Khoury et al., 2010; Avant et al., 2011; Contractor et al., 2016b), aggressive behaviors (Hellmuth et al., 2012), and non-suicidal self-injury (NSSI; Weierich and Nock, 2008); PTSD's numbing/avoidance symptoms relate to substances such as depressants, heroine, and sedatives (Tull et al., 2010; Avant et al., 2011; Dworkin et al., 2018) and NSSI (Weierich and Nock, 2008); PTSD's NACM symptoms associate with suicidal ideation/attempts (Pietrzak et al., 2015; Guina et al., 2017), problematic smartphone use (Contractor et al., 2017a), and NSSI (Weierich and Nock, 2008); and PTSD's arousal symptoms associate with aggression (Hellmuth et al., 2012), suicidal ideation/attempts (Pietrzak et al., 2015), and risky sexual behaviors (Weiss et al., 2013). Thus, heterogeneity in PTSD clusters needs to be considered in relation to different RSDBs.

Addressing the aforementioned limitations, we examined the heterogeneity in PTSD and RSDBs. We identified the nature and construct validity of the best-fitting latent class solution in categorizing participants based on endorsed PTSD symptoms and diverse RSDBs. Based on past research (e.g., Breslau et al., 2005; Dickstein et al., 2010; Contractor et al., 2017b; Contractor et al., 2018c), we hypothesized finding an optimal three- or four-class solution (lower PTSD severity and RSDBs; higher PTSD severity and RSDBs; primarily PTSD severity and/or RSDBs). Further, we examined the covariates of age, gender, depression severity, number of trauma types, and RSDB-related functional impairment to establish the construct validity of the optimal class solution. Consistent with extant research, we hypothesized that greater PTSD severity classes would have more females (Tolin and Breslau, 2007), and greater RSDB classes would be younger (Jonah, 1990; Chen and Kandel, 1995; Kessler et al., 2005) and have more males (Brady and Randall, 1999; Nolen-Hoeksema, 2004; Pat-Horenczyk et al., 2007). Additionally, we hypothesized that classes characterized by greater PTSD severity (e.g., Contractor et al., 2018a; Contractor et al., 2018b) and more RSDBs (Davis et al., 2002; Briere et al., 2010) would report more trauma types. Further, we expected that classes characterized by greater PTSD severity (Rytwinski et al., 2013; Bonde et al., 2016) and more RSDBs (Becona et al., 1996; Swendsen and Merikangas, 2000) would report greater depression. Finally, we hypothesized that classes with greater PTSD severity and more RSDBs would report greater impairment (Read et al., 2004; Olino et al., 2012).

2. Method

2.1. Procedure/participants

We recruited participants through Amazon's Mechanical Turk (MTurk) platform. We described the study as a 45–60 min survey to develop a novel measure assessing posttrauma risky behaviors. Inclusionary criteria included being 18 years or older, residing in North America, having a working knowledge of English, and experiencing a traumatic event (Primary Care PTSD Screen; Prins et al., 2015). Eligible participants who provided informed consent and completed the survey hosted on Qualtrics were compensated $1.25. The Institutional Review Board of a U.S. university approved this study.

2.2. Exclusions and missing data

We implemented several steps to ensure data quality and integrity. The original sample included 862 participants; we excluded 18 participants who attempted to answer the questionnaire multiple times, 150 participants not meeting inclusionary criteria, 122 participants who failed to pass validity checks to ensure attentive responding and comprehension (Meade and Craig, 2012; Thomas and Clifford, 2017), 97 participants missing data on all measures, and 11 participants not endorsing a TE/most distressing TE on the Life Event Checklist for *DSM-5* (LEC-5; Weathers et al., 2013a). Finally, we excluded 47 participants missing more than 30% item-level data on the PTSD Checklist for *DSM-5* (≥6 items; PCL-5; Weathers et al., 2013b) or the Posttrauma Risky Behaviors Questionnaire (≥5 items; PRBQ; Contractor et al., in review). This subsample of 47 participants did not differ significantly from the final sample of 417 participants on age, years of schooling, gender distribution, ethnicity status, racial status, income distribution, relationship status, and employment status (independent samples *t* tests for continuous variables and chi-square analyses for categorical variables). The final sample of 417 participants averaged 35.92 years (SD = 11.14), with approximately 56.60% being female (n = 236). Table 1 provides descriptive information. Further, 42 and 77 participants were missing one and two PRBQ items respectively (none were missing PCL items). Table 2 provides frequencies of PRBQ item responses.

2.3. Measures

2.3.1. Demographic information

Information regarding age, gender, income, educational level, employment status, relationship status, and racial/ethnic status was obtained.

2.3.2. Life Event Checklist for DSM-5 (LEC-5; Weathers et al., 2013a)

The LEC-5 is a 17-item self-report measure assessing TEs with a 6-point nominal scale (*happened to me, witnessed it, learned about it, part of my job, not sure, does not apply*). Endorsed trauma reflected one of the first four responses consistent with *DSM-5* Criterion A (American Psychiatric Association, 2013). We summed up the total number of endorsed TEs to be used as a covariate in the analyses.

Table 1
Descriptive information on demographic and psychopathology constructs for the entire sample and subclasses

	Full Sample (n = 417) Mean (*SD*)	Class 1 (n = 243)	Class 2 (n = 124)	Class 3 (n = 50)
Age	35.92 (11.14)	38.62 (11.75)	33.69 (9.60)	28.46 (5.84)
Years of schooling	15.27 (2.38)	15.20 (2.36)	15.28 (2.40)	15.55 (2.48)
PCL-5 intrusion score	6.67 (5.50)	3.13 (3.08)	11.72 (4)	11.34 (4.52)
PCL-5 avoidance score	2.99 (2.55)	1.56 (1.86)	5.17 (1.93)	4.54 (2.05)
PCL-5 NACM score	8.48 (7.72)	3.43 (4)	15.20 (5.78)	16.34 (6.28)
PCL-5 AAR score	5.13 (4.51)	2.26 (2.45)	9.10 (3.64)	9.22 (3.44)
PRBQ 14-item total score	6.13 (9.07)	1.54 (2.16)	6.44 (4.70)	27.64 (6.55)
PRBQ impairment score	0.77 (0.86)	0.28 (0.48)	1.15 (0.84)	1.57 (0.94)
PHQ-9 score	7.20 (6.51)	3.56 (3.88)	11.13 (6.03)	15.04 (5.19)
Number of trauma types	7.18 (4.65)	6.59 (4.41)	7.20 (4.39)	10.02 (5.41)
n (% within column)[a]				
Gender				
Female	236 (56.60%)	139 (57.40%)	79 (63.70%)	17 (64%)
Male	174 (41.70%)	102 (42.1%)	40 (32.30%)	32 (64%)
Female to Male	4 (1%)	1 (0.40%)	2 (1.60%)	1 (2%)
Male to Female	1 (0.20%)	0 (0%)	1 (0.80%)	0 (0%)
Transgender	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gender Queer	0 (0%0	0 (0%)	0 (0%)	0 (0%)
Other	2 (0.50%)	0 (0%)	2 (1.60%)	0 (0%)
Employment Status				
Part time	65 (15.60%)	37 (15.20%)	20 (16.10%)	7 (14%)
Full time	297 (71.20%)	164 (67.50%)	90 (72.60%)	43 (86%)
Unemployed	34 (8.20%)	24 (9.90%)	10 (8.10%)	0 (0%)
Unemployed Student	8 (1.90%)	5 (2.10%)	3 (2.40%)	0 (0%)
Retired	13 (3.10%)	12 (4.90%)	1 (0.80%)	0 (0%)
Relationship Status				
Not dating	66 (15.80%)	36 (14.90%)	21 (16.90%)	8 (16%)
Causally dating	31 (7.40%)	16 (6.60%)	9 (7.30%)	6 (12%)
Seriously dating	104 (24.90%)	60 (24.80%)	28 (22.60%)	16 (32%)
Married	183 (43.90%)	111 (45.70%)	56 (45.20%)	16 (32%)
Divorced	18 (4.30%)	10 (4.10%)	5 (4%)	3 (6%)
Separated	8 (1.90%)	5 (2.10%)	2 (1.60%)	1 (2%)
Widowed	7 (1.70%)	4 (1.70%)	3 (2.40%)	0 (0%)
Racial Status (could endorse more than one category)				
White	320 (76.70%)	202 (83.10%)	86 (69.40%)	31 (62%)
Asian	45 (10.80%)	18 (7.40%)	17 (13.70%)	10 (20%)
African American	40 (9.60%)	20 (8.20%)	15 (12.10%)	5 (10%)
American Indian or Alaskan Native	19 (4.60%)	8 (3.30%)	7 (5.60%)	4 (8%)
Native Hawaiian/other Pacific Islander	3 (0.70%)	0 (0%)	2 (1.60%)	1 (2%)
Unknown	7 (1.70%)	4 (1.70%)	3 (2.50%)	0 (0%)
Ethnicity				
Hispanic or Latino	56 (13.40%)	19 (7.80%)	22 (17.70%)	14 (28%)
Not Hispanic or Latino	354 (84.90%)	220 (90.50%)	98 (79%)	36 (72%)
Unknown	7 (1.70%)	3 (1.20%)	4 (3.20%)	0 (0%)
Income				
Less than $15,000	41 (9.80%)	16 (6.60%)	18 (14.50%)	7 (14%)
$15,000 - $24,999	54 (12.90%)	30 (12.40%)	16 (12.90%)	8 (16%)
$25,000 - $34,999	64 (15.30%)	33 (13.60%)	19 (15.30%)	12 (24%)
$35,000 - $49,999	58 (13.40%)	32 (13.20%)	17 (13.70%)	7 (24%)
$50,000 - $64,999	79 (18.90%)	48 (19.80%)	21 (16.90%)	10 (20%)
$65,000 - $79,999	37 (8.90%)	22 (9.10%)	10 (8.10%)	4 (8%)
$80,000 and higher	86 (20.60%)	61 (25.20%)	23 (18.50%)	2 (4%)
Most distressing trauma endorsed on the Life Events Checklist for *DSM-5*				
Natural disaster	57 (13.70%)	28 (11.50%)	21 (16.90%)	8 (16%)
Fire or explosion	20 (16.30%)	11 (4.50%)	3 (2.40%)	6 (12%)
Transportation accident	68 (16.30%)	44 (18.20%)	16 (12.90%)	7 (14%)
Serious accident at work, home, or during recreational activity	15 (3.60%)	7 (2.90%)	2 (1.60%)	6 (12%)
Exposure to toxic substance	2 (0.50%)	1 (0.40%)	1 (0.80%)	6 (12%)
Physical assault	40 (9.60%)	22 (9.10%)	12 (9.70%)	0 (0%)
Assault with a weapon	13 (3.10%)	7 (2.90%)	5 (4%)	1 (2%)
Sexual assault	54 (12.90%)	27 (11.20%)	23 (18.50%)	4 (8%)
Other unwanted/uncomfortable sexual experience	10 (2.40%)	6 (2.50%)	1 (0.80%)	3 (6%)
Combat or exposure to a war-zone	5 (1.20%)	3 (1.20%)	2 (1.60%)	0 (0%)
Captivity	2 (0.50%)	1 (0.40%)	1 (0.80%)	0 (0%)
Life-threatening illness or injury	30 (7.20%)	21 (8.70%)	8 (6.50%)	1 (2%)
Severe human suffering	7 (1.70%)	4 (1.70%)	1 (0.80%)	2 (4%)
Sudden violent death	28 (6.70%)	23 (9.50%)	5 (4%)	0 (0%)
Sudden accidental death	32 (7.70%)	18 (7.40%)	11 (8.90%)	3 (6%)
Serious injury, harm, or death	7 (1.70%)	4 (1.60%)	2 (1.60%)	1 (2%)

[a] All reported percentages are *valid percentages* to account for missing data; PCL-5 is PTSD Checklist for DSM-5; NACM is negative alterations in mood and cognitions; AAR is alterations in arousal and reactivity (total AAR score excludes scores on items 15 and 16); PRBQ is Posttrauma Risky Behaviors Questionnaire; Class 1 is Low PTSD-RSDBs; Class 2 is High PTSD-Low RSDBs; Class 3 is High PTSD-RSDBs.

Table 2
Frequencies of response options to PRBQ items (n = 417)

PRBQ Items	n (%)[a] Never (0)	Rarely (1)	Occasionally (2)	Frequently (3)	Very Frequently (4)
Problematic alcohol use	266 (63.80%)	53 (12.70%)	56 (13.40%)	32 (7.70%)	10 (2.40%)
Problematic drug use	308 (73.90%)	38 (9.10%	35 (8.40%)	19 (4.60%)	17 (4.10%)
Problematic gambling	334 (80.10%)	43 (10.30%)	22 (5.30%)	13 (3.10%)	5 (1.20%)
Problematic technology use	222 (53.20%)	66 (15.80%)	84 (20.10%)	34 (8.20%)	11 (2.60%)
Impulsive/risky sexual behaviors	335 (80.30%)	37 (8.90%)	26 (6.20%)	15 (3.60%)	4 (1%)
Problematic eating behaviors	237 (56.80%)	74 (17.70%)	65 (15.60%)	23 (5.50%)	18 (4.30%)
Illegal behaviors	351 (84.20%)	24 (5.80%)	22 (5.30%)	14 (3.40%)	6 (1.40%)
Reckless spending	255 (61.20%)	69 (16.50%)	61 (14.60%)	23 (5.50%)	9 (2.20%)
Physically aggressive behaviors	339 (81.30%)	34 (8.20%)	24 (5.80%)	18 (4.30%)	2 (0.50%)
Verbally aggressive behaviors	290 (69.50%)	51 (12.20%)	48 (11.50%)	19 (4.60%)	9 (2.20%)
Property destruction	349 (83.70%)	32 (7.70%)	19 (4.60%)	13 (3.10%)	4 (1%)
Reckless driving	327 (78.40%)	47 (11.30%)	22 (5.30%)	13 (3.10%)	8 (1.90%)
Non-suicidal self-injury	343 (82.30%)	25 (6%)	22 (5.30%)	19 (4.60%)	8 (1.90%)
Suicidal behaviors	352 (84.40%)	27 (6.50%)	23 (5.50%)	12 (2.90%)	3 (0.70%)

[a] All reported percentages are *valid percentages* to account for missing data.

2.3.3. PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013b)

The PCL-5 is a 20-item self-report measure assessing PTSD severity for the past month referencing the most distressing TE endorsed on the LEC-5. Response options range from 0 (*not at all*) to 4 (*extremely*). The PCL-5 has excellent psychometric properties (Blevins et al., 2015; Bovin et al., 2016; Wortmann et al., 2016). Cronbach's alphas of the PCL-5 intrusions, avoidance, NACM, and AAR symptom clusters in the present study were 0.91, 0.87, 0.92, and 0.90, respectively.

2.3.4. Posttrauma Risky Behaviors Questionnaire (PRBQ; Contractor et al., in review)

The PRBQ is a 16-item self-report measure developed to assess PTSD's E2 criterion (RSDBs) in the past month post-TE(s). The first 14 PRBQ items assess the frequency of engagement in specific RSDBs with response options ranging from 0 (*never*) to 4 (*very frequently*). The last two supplemental items assess functional impairment and the relation of the RSDB frequency to the onset of the worst TE (start or get worse). Scores for the first 14 items are summed, with higher scores representing greater RSDB engagement. The 14-item PRBQ has demonstrated excellent internal consistency in the original validation study (α = 0.94 in the current study; Contractor et al., in review). Referencing convergent validity, the 14-item PRBQ has shown to positively and significantly correlate with external measures assessing aggression domains (r = 0.43–0.59; $p < 0.001$), alcohol misuse (r = 0.33; $p < 0.001$), drug misuse (r = 0.44; $p < 0.001$, compulsive spending (r = 0.57; $p < 0.001$), disordered eating domains (r = 0.31–0.39; $p < 0.001$), most problematic technology use domains (r = 0.18–0.27; $p < 0.01$), problematic gambling (r = 0.68; $p < 0.001$), suicidality (r = 0.12; p = 0.017), reckless driving (r = 0.68; $p < 0.001$), illegal behavior domains (r = 0.24–0.31; $p < 0.001$), NSSI (r = 0.32; $p < 0.001$), and most risky sexual behavior domains (r = 0.14–0.29; $p < 0.01$; Contractor et al., in review). Referencing construct validity, the 14-item PRBQ has shown to positively and significantly correlate with PTSD's E2 criterion score on the PCL-5 (r = 0.57; $p < 0.001$; Contractor et al., in review).

2.3.5. Patient Health Questionnaire-9 (PHQ-9; Kroenke and Spitzer, 2002)

The PHQ-9 is a 9-item self-report measure assessing depression symptoms over the past two weeks. The four response options range from 0 (*not at all*) to 3 (*nearly everyday*). It has good internal consistency (α = 0.91 in the current study), test-retest reliability, and construct/diagnostic validity (Kroenke et al., 2001).

2.4. Statistical analyses

PCL-5 items did not violate normality according to benchmarks of skewness >2 and kurtosis >7 (Curran et al., 1996). Most PRBQ (excluding items 1, 4, 6, 8, and 10) items violated normality. For the primary analyses, we conducted a latent profile analyses (LPA) using Mplus 8 to categorize participants into latent subgroups based on PTSD subscale-level scores (AAR subscale score did not include scores of items assessing RSDBs and aggression/irritability based on their conceptual overlap with the PRBQ) and PRBQ item-level scores; all were modeled as continuous indicators. Using PRBQ-item level scores enabled capturing greater heterogeneity and nuanced distinguishing characteristics of obtained typologies (Nielsen et al., 2016); the current sample size prevented us from using a similar approach with PTSD items. We used maximum likelihood estimation with robust standard errors (MLR) as the estimator to address non-normality (i.e., most PRBQ items) and to estimate missing data. One- through four-class models were analyzed based on prior research (e.g., Odgers et al., 2007; Klonsky and Olino, 2008; Contractor et al., 2015; Contractor et al., 2017b). According to the recommended fit indices, the optimal class solution would have the lowest Bayesian Information Criterion (BIC) values, lowest sample-size adjusted BIC (SSABIC) values, the last significant Adjusted Lo–Mendell–Rubin (LMR) Likelihood Ratio Test value, the last significant Bootstrapped Likelihood Ratio Test (BLRT) p value, higher entropy values, parsimony, and conceptual meaning (DiStefano and Kamphaus, 2006; Nylund et al., 2007a; Nylund et al., 2007b). A model with a 10-point lower BIC value has a 150:1 likelihood to be the better fitting model (Raftery, 1995).

Lastly, we examined the effects of demographic (i.e., age, gender), trauma-related (i.e., number of trauma types), and clinical (i.e., depression, functional impairment) covariates on latent class membership of the best-fitting class solution. We used the three-step approach (multinomial logistic regression) to estimate class membership in relation to these variables while accounting for misspecification bias (Vermunt, 2010; Asparouhov and Muthén, 2014). For the three-step approach, Mplus uses list-wise deletion to deal with missing data; thus reducing our sample to 335 participants for these additional analyses. The subsample of 335 participants scored significantly higher compared to the subsample of 82 participants on the PCL-5 intrusion severity score (t [415] = 5.10, $p < 0.001$), the PCL-5 avoidance severity score (t [415] = 3.45, $p < 0.001$), the PCL-5 NACM severity score (t [415] = 5.56, $p < 0.001$), the PCL-5 AAR severity score (t [415] = 5.23, $p < 0.001$), and the total PRBQ score (t [415] = 6.66, $p < 0.001$).

3. Results

PCL-5 intrusions, avoidance, NACM, and AAR cluster scores averaged 6.67 (range of 20), 2.99 (range of 8), 8.48 (range of 28), and 2.13

Table 3
Results of latent profile analyses

Model	AIC	BIC	SSABIC	Entropy	Adjusted Lo-Mendell –Rubin (*p*)	BLRT *p* value
1 class	25,657.962	25,803.15	25,688.915			
2 class	22,070.854	22,292.673	22,118.143	0.99	3593.757 ($p = 0.01$)	$p < 0.001$
3 class	**20,974.858**	**21,273.306**	**21,038.484**	**0.96**	**1124.188 ($p = 0.03$)**	**$p < 0.001$**

Note. AIC is Akaike Information Criterion, BIC is Bayesian Information Criterion, SSABIC is sample-size adjusted BIC, BLRT is Bootstrapped Likelihood Ratio Test.

(range of 16) respectively. Table 3 provides the LPA results. There were model convergence problems with the four-class solution attributed to the small sample size of one of the classes (only 13 observations). Overall, LPA fit indices indicated the three-class solution as the optimal model based on the available results. The LMR *p* value being 0.03 for the three-class solution may have been non-significant for the four-class solution, indicating an optimal three-class solution (DiStefano and Kamphaus, 2006; Nylund et al., 2007a). Second, although the BIC and SSABIC values may continue to decrease beyond the three-class solution, the difference in values began to plateau between the two- and three-class solutions (Raftery, 1995; DiStefano and Kamphaus, 2006). Third, none of the class sizes of the three-class solution comprised of less than 5% of the final sample size; one of the classes of the four-class solution included only 3% of the final sample which contributed to model convergence issues and may have reduced the accuracy of LPA findings (Hipp and Bauer, 2006). Finally, the three-class solution had interpretative value extrapolating from evidence indicating a different biopsychosocial profile of individuals endorsing greater PTSD severity and RSDBs/RSDB-related traits compared to those endorsing lower/greater PTSD severity and fewer RSDBs/RSDB-related traits (e.g., Miller, 2003; Wolf et al., 2010; Castillo et al., 2014; Contractor et al., 2018c). Relatedly, a three-class solution is supported by most existing literature on PTSD and other co-occurring conditions (Contractor et al., 2015; Contractor et al., 2017b; Contractor et al., 2018c), and most existing literature on RSDBs (Odgers et al., 2007; Carragher and McWilliams, 2011; Connor et al., 2014).

Fig. 1 provides a graphical depiction of the three-class solution. To define the classes, we examined between-class differences on the PCL-5 subscale-level scores and normally distributed PRBQ item-level scores using one-way ANOVA, partial eta square ($p\eta^2$) effect size estimates (Cohen's *d* for pairwise comparisons), and Tukey's post-hoc tests. We further computed Kruskal-Wallis H tests with Dunn's post-hoc tests and eta square (η^2) effect size estimates to examine between-class differences on the non-normal PRBQ item-level scores (see Table 4). Each class was described relative to response endorsements of other classes; for instance a description of "high" for one class reflected a higher endorsement of a behavior/attribute relative to other classes irrespective of how the endorsed level compared with the population/scale cut-off scores. Class 1 members ($n = 243$; 58.27%) had relatively lower PTSD subscale severity and RSDB frequency scores compared to Classes 2 ($n = 124$; 29.73%) and 3 ($n = 50$; 11.99%). Thus, Class 1 was labelled "*Low PTSD-RSDBs*." Class 2 members had relatively higher PTSD subscale severity compared to Class 1 but were indistinguishable from Class 3 on PTSD subscale severity (excluding AAR score). Class 2 members had relatively lower RSDB frequency scores compared to Class 3 members. Thus, Class 2 was labelled as "*High PTSD-Low RSDBs,*" and Class 3 was labelled as "*High PTSD-RSDBs.*"

See Table 5 for detailed results of the multinomial logistic regression analyses. PRBQ-assessed impairment ($B = 1.58$, $SE = 0.31$, $p < 0.001$, OR = 4.87) and depression ($B = 0.25$, $SE = 0.05$, $p < 0.001$,

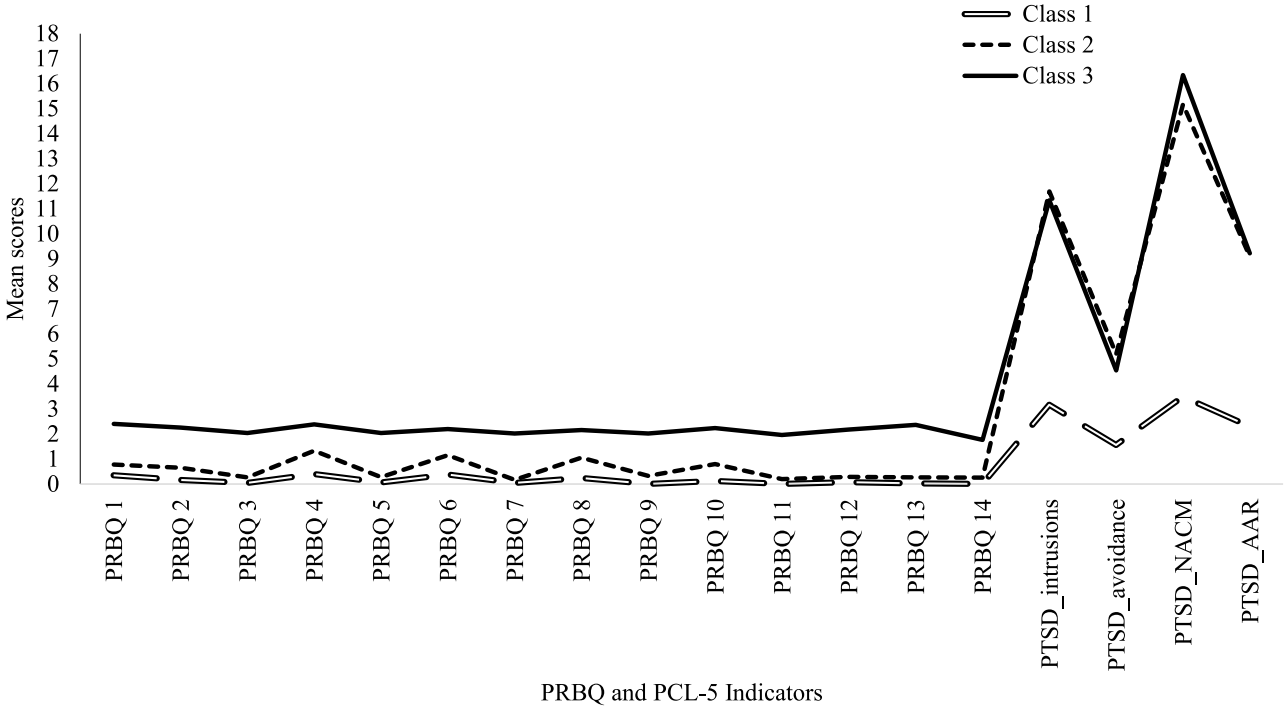

Fig. 1. Diagrammatic representation of the latent classes. Note. Class 1 is Low PTSD-RSDBs; Class 2 is High PTSD-Low RSDBs; Class 3 is High PTSD-RSDBs; PTSD is Posttraumatic Stress Disorder; NACM is negative alterations in cognitions and mood; AAR is alterations in arousal and reactivity; PRBQ 1 is problematic alcohol use; PRBQ 2 is problematic drug use; PRBQ 3 is problematic gambling; PRBQ 4 is problematic technology use; PRBQ 5 is impulsive/risky sexual behaviors; PRBQ 6 is problematic eating behaviors; PRBQ 7 is illegal behaviors; PRBQ 8 is reckless spending; PRBQ 9 is physically aggressive behaviors; PRBQ 10 is verbally aggressive behaviors; PRBQ 11 is property destruction; PRBQ 12 is reckless driving; PRBQ 13 is NSSI; PRBQ 14 is suicidal behaviors.

Table 4
Latent class membership differences on PTSD and PRBQ indicators

Variables	Class 1 M (SD)	Class 2 M (SD)	Class 3 M (SD)	Class Comparisons	F(ηp^2)
Problematic alcohol use	0.36 (0.76)	0.76 (1.05)	2.40 (1.09)	1 < 2*(Cohen's d = 0.44) 1 < 3*(Cohen's d = 2.17) 2 < 3*(Cohen's d = 1.53)	107.11 (0.34)*
Problematic technology use	0.40 (0.78)	1.33 (1.19)	2.38 (0.70)	1 < 2*(Cohen's d = 0.92) 1 < 3*(Cohen's d = 2.67) 2 < 3*(Cohen's d = 1.08)	117.23 (0.36)*
Problematic eating behaviors	0.38 (0.77)	1.15 (1.30)	2.20 (0.95)	1 < 2*(Cohen's d = 0.73) 1 < 3*(Cohen's d = 2.13) 2 < 3*(Cohen's d = 0.92)	83.55 (0.29)*
Reckless spending	0.24 (0.58)	1.05 (1.11)	2.16 (0.98)	1 < 2*(Cohen's d = 0.91) 1 < 3*(Cohen's d = 2.38) 2 < 3*(Cohen's d = 1.06)	127.85 (0.38)*
Verbally aggressive behaviors	0.12 (0.39)	0.79 (1.04)	2.24 (1.08)	1 < 2*(Cohen's d = 0.85) 1 < 3*(Cohen's d = 2.61) 2 < 3*(Cohen's d = 1.37)	177.63 (0.46)*
PTSD intrusions	3.13 (3.08)	11.72 (4)	11.34 (4.52)	1 < 2*(Cohen's d = 2.41) 1 < 3*(Cohen's d = 2.12)	286.63 (0.58)*
PTSD avoidance	1.56 (1.86)	5.17 (1.93)	4.54 (2.05)	1 < 2*(Cohen's d = 1.90) 1 < 3*(Cohen's d = 1.49)	166.49 (0.45)*
PTSD NACM	3.43 (4)	15.20 (5.78)	16.34 (6.28)	1 < 2*(Cohen's d = 2.37) 1 < 3*(Cohen's d = 2.45)	310.79 (0.60)*
PTSD AAR	2.26 (2.45)	9.10 (3.64)	9.22 (3.44)	1 < 2*(Cohen's d = 2.20) 1 < 3*(Cohen's d = 2.33) 2 < 3*(Cohen's d = 0.32)	270.50 (0.57)*
Variables	M rank	M rank	M rank	Class Comparisons	χ^2 (η^2)
Problematic drug use	171.96	221.37	358.36	1 < 2*(η^2 = 0.09) 1 < 3*(η^2 = 0.60) 2 < 3*(η^2 = 0.34)	169.68 (0.41)*
Problematic gambling	174.05	212.63	369.87	1 < 2*(η^2 = 0.10) 1 < 3*(η^2 = 0.76) 2 < 3*(η^2 = 0.52)	226.11 (0.54)*
Impulsive or risky sexual behaviors	176.13	207.70	371.99	1 < 2*(η^2 = 0.07) 1 < 3*(η^2 = 0.75) 2 < 3*(η^2 = 0.54)	227.95 (0.55)*
Illegal behaviors	180.43	202.41	364.22	1 < 2*(η^2 = 0.05) 1 < 3*(η^2 = 0.74) 2 < 3*(η^2 = 0.57)	240.45 (0.58)*
Physically aggressive behaviors	172.30	216.06	369.84	1 < 2*(η^2 = 0.14) 1 < 3*(η^2 = 0.84) 2 < 3*(η^2 = 0.49)	223.47 (0.58)*
Property destruction	176.57	208.01	369.08	1 < 2*(η^2 = 0.10) 1 < 3*(η^2 = 0.84) 2 < 3*(η^2 = 0.55)	256.09 (0.62)*
Reckless driving	175.83	207.98	372.74	1 < 2*(η^2 = 0.06) 1 < 3*(η^2 = 0.70) 2 < 3*(η^2 = 0.54)	214.47 (0.52)*
Non-suicidal self-injury	175.31	206.52	378.90	1 < 2*(η^2 = 0.09) 1 < 3*(η^2 = 0.86) 2 < 3*(η^2 = 0.61)	267.27 (0.64)*
Suicidal behaviors	177.28	212.02	355.68	1 < 2*(η^2 = 0.11) 1 < 3*(η^2 = 0.79) 2 < 3*(η^2 = 0.43)	228.53 (0.55)*

Note. NACM is negative alterations in cognitions and mood; AAR is alterations in arousal and reactivity (total AAR score excludes PCL-5 item 15 and 16 scores); Class 1 is Low PTSD-RSDBs; Class 2 is High PTSD-Low RSDBs; Class 3 is High PTSD-RSDBs; M is Mean; SD is Standard Deviation; *$p < 0.001$.

Table 5
Results of multinomial logistic regression analyses

	Class 2 vs. 1[a] OR (95% CI)	Class 3 vs. 1[a]	Class 3 vs. 2[a]
Number of trauma types	0.97 (0.90 - 1.06)	1.10 (0.98 - 1.22)	**1.12 (1.02 - 1.23)$^{p=0.013}$**
PRBQ impairment	**4.87 (2.67 - 8.87)***	**6.82 (3.36 - 13.87)***	1.40 (0.87 - 2.26)
Gender (Female)	1.17 (0.53 - 2.59)	**0.32 (0.11 - 0.89)$^{p=0.03}$**	**0.27 (0.11 - 0.62)$^{p=0.002}$**
Age	0.94 (0.90 – 0.99)	**0.86 (0.81 - 0.92)***	**0.91 (0.87 - 0.97)$^{p=0.001}$**
Depression	**1.29 (1.17 – 1.42)***	**1.44 (1.28 – 1.63)***	**1.12 (1.03 – 1.22)$^{p=0.007}$**

Note. PRBQ is Posttrauma Risky Behaviors Questionnaire; Class 1 is Low PTSD-RSDBs; Class 2 is High PTSD-Low RSDBs; Class 3 is High PTSD-RSDBs;*$p < 0.001$.
[a] Indicates the reference class.

OR = 1.29) were significant predictors of the High PTSD-Low RSDBs vs. the Low PTSD-RSDBs classes. With a one unit increase in PRBQ-assessed impairment, the odds of being in the High PTSD-Low RSDBs class was approximately 5 times the odds of being in the Low PTSD-RSDBs class. With a one unit increase in depression severity, the odds of being in the High PTSD-Low RSDBs class was 1.29 times the odds of being in the Low PTSD-RSDBs class.

Additionally, PRBQ-assessed impairment ($B = 1.92$, $SE = 0.36$, $p < 0.001$, OR = 6.82), age ($B = -0.15$, $SE = 0.03$, $p < 0.001$, OR = 0.86), being female ($B = -1.15$, $SE = 0.53$, $p = 0.03$, OR = 0.32), and depression severity ($B = 0.37$, $SE = 0.06$, $p < 0.001$, OR = 1.44) were significant predictors of the High PTSD-RSDBs vs. the Low PTSD-RSDBs classes. With a one unit increase in PRBQ-assessed impairment and depression severity, the odds of being in the High PTSD-RSDBs class was a respective 6.82 and 1.44 times the odds of being in the Low PTSD-RSDBs class. Further, a one unit increase in age was associated with a 14% decreased chance of being in the High PTSD-RSDBs class compared to the Low PTSD-RSDBs class. Lastly, being female decreased the chances of being in the High PTSD-RSDBs class by 68% compared to the Low PTSD-RSDBs class.

Lastly, number of trauma types ($B = 0.12$, $SE = 0.05$, $p = 0.01$, OR = 1.12), being female ($B = -1.30$, $SE = 0.42$, $p = 0.002$, OR = 0.27), age ($B = -0.09$, $SE = 0.03$, $p = 0.001$, OR = 0.91), and depression severity ($B = 0.11$, $SE = 0.04$, $p = 0.007$, OR = 1.12) were significant predictors of the High PTSD-RSDBs versus the High PTSD-Low RSDBs classes. With a one unit increase in number of trauma types and depression severity, the odds of being in the High PTSD-RSDBs class was 1.12 times the odds of being in the High PTSD-Low RSDBs class. Further, a one unit increase in age decreased the chances of being in the High PTSD-RSDBs class by 9% compared to the High PTSD-Low RSDBs class. Additionally, being female decreased the chances of being in the High PTSD-RSDBs class by 73% compared to the High PTSD-Low RSDBs class.[1]

4. Discussion

The current study examined the heterogeneity in patterns of PTSD symptoms and RSDBs. Study results provided support for three classes characterized by relatively (1) lower PTSD severity and RSDB frequency (Class 1), (2) higher PTSD severity and lower RSDB frequency (Class 2), and (3) higher PTSD and RSDB frequency (Class 3). Our findings thus offer preliminary evidence for a reckless behaviors subtype of PTSD (Class 3) consistent with some existing research (Guina et al., 2016). Our results add support to the inclusion of a new E2 symptom assessing RSDBs to the *DSM-5* diagnostic criteria for PTSD (American Psychiatric Association, 2013). Relatedly, clinically significant E2 levels have been shown to associate with greater PTSD severity and engagement in RSDBs (e.g., anger; Contractor et al., 2017d).

Notably, AAR severity distinguished the High PTSD-RSDBs class from the High PTSD-Low RSDBs class. This finding is not entirely surprising given that AAR symptoms are characterized, in part, by externalizing behaviors, including irritability or verbal/physical aggression and RSDBs. However, it warrants mention that there is ongoing debate regarding the inclusion of the RSDB criterion in the AAR subscale. For instance, confirmatory factor analyses suggest that the RSDB criterion has low factor loadings on PTSD clusters (Miller et al., 2013; Liu et al., 2014; Armour et al., 2016). Additionally, the E1 (anger/irritability) and E2 criteria seem to be distinct from other AAR symptoms, as they represent overt behaviors rather than internal cognitive/emotional processes and passive actions (Armour et al., 2015; Tsai et al., 2015). Thus, several researchers have proposed an externalizing latent factor comprising of E1 and E2 symptoms distinctly associated with impulse control deficits (Armour et al., 2015; Tsai et al., 2015). We need future research to better understand the relation of the RSDB criterion to AAR symptoms in particular.

Demographic, trauma-related, and clinical covariates differed significantly across classes providing support for their construct validity. Consistent with prior research using variable-centered approaches, individuals in classes characterized by high vs. low PTSD severity reported greater functional impairment (Olino et al., 2012) and depression severity (Rytwinski et al., 2013; Bonde et al., 2016). Further, the High PTSD-RSDBs class reported greater depression than the High PTSD-Low RSDBs class, in line with findings of Contractor et al., (2017c) who found greater depression severity among trauma-exposed individuals endorsing RSDBs. Individuals with greater PTSD/depression severity may be more likely to engage in RSDBs to modulate distress stemming from these symptoms (Weiss et al., 2012; Tull and Gratz, 2013; Weiss et al., 2015b); the short-term pleasure associated with RSDBs may alleviate/distract from PTSD and/or depression symptoms (Simpson et al., 2014). Additionally, our finding that the High PTSD-RSDBs class reported more trauma types than the High PTSD-Low RSDBs class supports evidence indicating greater posttrauma psychopathology with increasing count of TE types (Contractor et al., 2018b; Gerber et al., 2018), consistent with the *building block effect* theory (Schauer et al., 2003; Kolassa et al., 2010). Referencing demographic variables, the High PTSD-RSDBs class was more likely to be younger than the other classes supporting research indicating fewer RSDBs among older individuals (e.g., alcohol misuse, risk-taking propensity assessed in a laboratory setting; Mata et al., 2011; Grant et al., 2015). Additionally, the High PTSD-RSDBs class was more likely have males than the other classes; results are consistent with research indicating fewer RSDBs among women (e.g., alcohol misuse, physical aggression; Archer, 2004; Grant et al., 2015). Thus, clinical correlates of greater depression, impairment, and number of trauma types (and thus a more severe presentation), being male, and being younger may be associated with the reckless behaviors subtype of PTSD.

Finally, it warrants mention that a Low PTSD-High RSDBs class was not identified in our study. RSDBs may serve various functions, and many of these are unrelated to PTSD symptoms. For instance, research on alcohol use (Cooper, 1994) and sexual behavior (Cooper et al., 1998) provides support for four key motives: (a) enhancement (internally-driven positive reinforcement), (b) coping (internally-driven negative reinforcement), (c) social (externally-driven positive reinforcement), and (d) conformity (externally-driven negative reinforcement). One possible explanation for our study finding is that our sample comprised of trauma-exposed individuals among whom RSDBs may be more closely linked to PTSD symptoms. Future research is needed to explore whether similar classes are found in other clinically and demographically diverse trauma-exposed samples.

Results should consider some study limitations. First, the cross-sectional nature of the data precludes determination of the precise direction of the relationships and the assessment of symptom chronicity, which may influence the obtained typologies; there is a need for prospective, longitudinal investigations. Second, person-centered approaches are limited by the nature of the sample including the frequencies of endorsed RSDBs in the current study. Although fewer RSDBs were endorsed at the “frequent” and “very frequent” levels, the differences across classes in those endorsements were statistically significant, indicating meaning and utility of the obtained typologies. To examine the clinical significance of such typologies (especially the reckless behaviors subtype of PTSD), future research can target samples with higher levels of and more variability in endorsements of RSDBs. Third, significant differences on PTSD subscale severity and PRBQ severity across the subsamples of 335 and 82 participants may have influenced the relation of the PTSD-RSDB typologies to the examined covariates. Fourth, our study relied on self-report measures, responses

[1] Re-running LPA and covariate analyses with PTSD's AAR cluster score including scores of PCL-5 items assessing RSDBs and aggression/irritability indicated similar result trends of an optimal three-class solution with the same nature of classes and similar relations of these classes with examined covariates.

to which may be influenced by an individual's willingness and/or ability to report accurately. Future research should integrate behavioral measures of risk-taking such as the Balloon Analogue Risk Task (Lejuez et al., 2002) and clinician-administered measures such as the Clinician-Administered PTSD Scale with better psychometric properties and an enhanced ability to minimize misinterpretations (Foa and Tolin, 2000; Weathers et al., 2017). Fifth, we did not include ethnicity/race as covariates despite their significant albeit mixed relations to PTSD severity and RSDBs (e.g., McNulty and Bellair, 2003; Wallace et al., 2003; Pole et al., 2008; Alcántara et al., 2013) given that majority of our sample identified themselves as Non-Hispanic White. Relatedly, given evidence for greater RSDBs among some trauma populations (e.g., classes characterized by interpersonal traumas; Weiss et al., 2017; Contractor et al., 2018b), future research would benefit from exploring the role of trauma type (e.g., motor vehicle accident versus sexual assault) in determining PTSD-RSDB typologies. Sixth, the four-class solution demonstrated model convergence problems attributed to a small class size; future research may benefit from using a larger sample.

Finally, collecting data using an online format may limit result generalizability due to sample biases (self-selection) and lack of control over the research environment (Kraut et al., 2004). That said, the MTurk platform is a notable strength of our study. MTurk's subject pool (1) is diverse compared to traditional internet-recruited samples; (2) represents the US population in demographic characteristics such as gender distribution, mean age, martial status, full-time employment status, and ethnicity data; (3) generates reliable data (Buhrmester et al., 2011; Shapiro et al., 2013; U.S. Census Bureau, 2016b, c; Mischra and Carleton, 2017); and (4) has demonstrated utility for trauma research by capturing individuals with PTSD severity in a cost and time-effective manner and with PTSD prevalence rates similar compared to epidemiological studies (van Stolk- Cooke et al., 2018). Our sample demographics were quite comparable to other MTurk trauma samples in gender distribution, mean age, number of individuals identifying as White, number of married/divorced individuals (Contractor et al., 2018d; van Stolk- Cooke et al., 2018), full/part-time employment status, and income distribution (Contractor et al., 2018d); and to the US population in gender distribution (49.20% male, 50.80% female; U.S. Census Bureau, 2016a), mean age (37.70 years; U.S. Census Bureau, 2016a), number of individuals identifying as White (73.30%; U.S. Census Bureau, 2016a), and number of married individuals (46.40–49.80%; U.S. Census Bureau, 2016c). Relatedly, while using validity checks and excluding individuals missing too much data improves MTurk data quality (Oppenheimer et al., 2009; Buhrmester et al., 2011; Aust et al., 2013) and the extent of our sample truncation (48%) is comparable to other MTurk trauma studies (57%; van Stolk-Cooke et al., 2018), a potential selection bias in our study may limit generalizability. Future research could use other quality checks such as restricting participation to MTurk workers with high reputation (> 95% approval ratings; Peer et al., 2014).

Despite these limitations, current study results extend research on PTSD and RSDBs, providing support for three PTSD-RSDB typologies differentiated by demographic, trauma-related, and clinical covariates. Our results underscore the need for conducting comprehensive assessments of (1) RSDBs for individuals reporting PTSD symptoms, and (2) PTSD symptoms for individuals reporting RSDBs. Moreover, our findings provide support for tailoring interventions to treat PTSD and RSDBs concurrently (for a review, see Roberts et al., 2015); some examples of relevant treatment protocols are Concurrent Treatment of PTSD and Substance Use Disorders Using Prolonged Exposure (Back et al., 2014), Seeking Safety (Najavits et al., 1998), and Dialectical Behavior Therapy Prolonged Exposure (Harned et al., 2012). Additionally, by indicating classes of trauma-exposed individuals characterized by high PTSD severity and by both high vs. low RSDBs (i.e., High PTSD-High RSDBs and High PTSD-Low RSDBs), our findings suggest that PTSD may be represented by both externalizing (e.g., RSDBs, low constraint) and internalizing (e.g., low positive affect) symptoms consistent with research on personality-based internalizing (high negative emotionality and low positive affect) vs. externalizing (high negative emotionality and low constraint) subtypes of PTSD (e.g., Miller, 2003; Wolf et al., 2012).

Lastly, our findings indicate the presence of a reckless behaviors subtype of PTSD (Guina et al., 2016). Future research is needed to examine its unique and distinguishing health correlates, etiological factors, and risk/protective factors. Potential variables identified in the literature include: trauma type (given evidence that sexual victimization is associated with a reckless behavior subtype of PTSD; Roth et al., 1997), emotion dysregulation (given evidence for its association with greater RSDBs among individuals with PTSD; Weiss et al., 2014), and psychophysiological responding (e.g., cortisol, heart rate variability, which have been found to differentiate other subtypes of PTSD; Dalenberg et al., 2012). Further, investigations are needed to explore the clinical utility and meaningfulness of a reckless behavior subtype of PTSD, including the benefit of identifying (via assessment) such individuals and offering modified PTSD interventions to address the PTSD-RSDB co-occurrence.

Conflicts of interest

Ateka Contractor and Nicole Weiss declare that they have no conflict of interest.

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