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Research report

Co-occurring posttraumatic stress and depression symptoms after sexual assault: A latent profile analysis

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ABSTRACT

Background: Symptoms of posttraumatic stress disorder (PTSD) and depression frequently co-occur, but their distinctiveness following trauma remains unclear. We examined patterns of PTSD and depression symptoms after sexual assault to evaluate the extent to which assault survivors primarily reported symptoms of both disorders or whether there were meaningfully distinct subgroups with discordant PTSD and depression symptoms.

Methods: Latent profile analysis was used to examine self-reported PTSD and depression symptoms among 119 female sexual assault survivors at 1-, 2-, 3-, and 4-months post-assault.

Results: At all time points, a 4-class solution fit the data best, revealing four subgroups with *low*, *low-moderate*, *high-moderate*, *and severe* levels of both PTSD and depression symptoms. Within each subgroup, PTSD symptom severity co-occurred with comparable depression symptom severity. At no time point were there reliable subgroups with discordant PTSD and depression symptom severities. Emotional numbing, hyperarousal, and overall PTSD symptom severity reliably distinguished each class from the others. Class membership at 1-month post-assault predicted subsequent class membership and functional impairment.

Limitations: Additional research is needed to evaluate predictors of class membership, temporal stability of classes, and generalizability to other trauma populations.

Conclusions: Co-occurring and comparably severe PTSD and depression symptoms are pervasive among female sexual assault survivors. The absence of a distinct subset of individuals with only PTSD or depression symptoms suggests that PTSD and depression may be manifestations of a general posttraumatic stress response rather than distinct disorders after trauma. Integrated treatments targeting both PTSD and depression symptoms may therefore prove more efficient and effective.

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1. Introduction

The majority of individuals experience one or more potentially traumatizing events in their lifetime (Kessler et al., 1995). While most trauma survivors maintain healthy functioning or gradually recover (Bonanno, 2004), depending on the nature of the event, approximately 8% to 54% experience long-term distress, impairment, and mental disorders such as posttraumatic stress disorder (PTSD; Breslau et al., 1998; Bryant et al., 2010; Kessler et al., 1995). Although PTSD is the most commonly researched trauma disorder, major depression occurs at a similar rate after trauma and frequently co-occurs with PTSD (Bryant et al., 2010; Shalev et al., 1998).

Clarifying the relationship between PTSD and depression in the aftermath of trauma has important conceptual, diagnostic, and treatment implications. Some researchers have proposed that PTSD and depression co-occur at high rates after trauma because they are manifestations of a single, underlying posttraumatic psychopathology (Norman et al., 2011; O'Donnell et al., 2004). Supporting this hypothesis, studies have found that PTSD and post-traumatic depression share nearly identical risk factors and follow a similar time-course (Brewin et al., 2000; Bromet et al., 1998; deRoon-Cassini et al., 2010; Kendler et al., 2002; Norman et al., 2011; O'Donnell et al., 2004). However, there is also evidence that depression may occur as a distinct disorder with

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unique risk factors in the initial months after trauma (O'Donnell et al., 2004). Given the lack of clear findings and the over-reliance on cross-sectional designs, additional studies are needed to understand how co-occurring symptoms change over time.

It is also unclear whether the relationship between PTSD and depression differs according to type of trauma. Co-occurring PTSD and depression has mostly been studied among accident survivors. As such, relatively little is known about the relationship between PTSD and depression among survivors of other trauma types, notably interpersonal trauma, such as sexual assault. Unfortunately, most studies on sexual assault survivors have also been cross-sectional and have focused on those seeking treatment for PTSD (e.g., Taft et al., 2009).

Another methodological concern is that much of the research on co-occurring PTSD and depression has evaluated comorbidity in a narrow manner, relying on categorical diagnoses only (e.g., Ikin et al., 2010; Kessler et al., 1995). Dichotomizing caseness fails to take into account clinically significant subthreshold symptoms and may underestimate the co-occurrence of symptoms and misrepresent the relationship between PTSD and depression (Backenstrass et al., 2006; Grubaugh et al., 2005). A few studies have used factor analysis to characterize the latent constructs underlying PTSD and depression symptoms. Two factor analytic studies found that PTSD loads onto the same higher-order factor as depression (Cox et al., 2002; Slade and Watson, 2006). In contrast, other factor analyses found that only some PTSD symptoms load onto a depression factor, while most PTSD and depression symptoms load onto two distinct but highly correlated factors (Gros et al., 2010). Factor analysis, however, may overlook differences in factor structure among heterogeneous groups of individuals.

Latent class analysis (LCA) is a person-centered method that accounts for heterogeneity among individuals and may therefore shed additional light on co-occurring symptom presentations after trauma. While factor analysis describes how variables group together, LCA is used to determine how individuals naturally group together into latent classes, based on shared symptom patterns (McCutcheon, 1987). LCA also utilizes the full range of symptoms instead of relying on categorical diagnoses. One type of LCA – latent profile analysis (LPA) – has the additional advantage of using continuous indicators of symptom severity, rather than dichotomous indicators reflecting the presence or absence of each symptom. Recent LCA of PTSD symptoms identified three distinct classes: no disturbance, intermediate disturbance, and pervasive disturbance, with elevated emotional numbing distinguishing the pervasive class from the intermediate class and predicting functional impairment (Breslau et al., 2005). Although LCA has been used to investigate other co-occurring symptom presentations (e.g., van Lang et al., 2006), to our knowledge it has not been used to examine co-occurring PTSD and depression symptoms among trauma survivors.

We used LPA to examine the distinctiveness of PTSD and depression after sexual assault and to identify subgroups that may be differentiated based on symptom profiles. We hypothesized that LPA would reveal distinct subgroups with different levels of co-occurring symptom severity but would not find subgroups with primarily PTSD or depression symptoms without comparable levels of the other. To assess the relationship between specific PTSD sub-clusters and depression symptoms, we analyzed PTSD symptoms based on a well-validated 4-factor model that groups symptoms into four categories: re-experiencing, avoidance, numbing, and hyperarousal (Asmundson et al., 2000; King et al., 1998).

Our second aim was to investigate whether the number or quality of latent profiles changes over time, which would suggest that the relationship between PTSD and depression symptoms is dynamic. To this end, we assessed PTSD and depression symptoms at four time-points (1, 2, 3, and 4 months post-assault) and compared LPA results from each point. Previous research on trauma survivors suggests that depression may be distinct from PTSD in the early months post-trauma, but that the distinction between these symptom presentations may fade over time (O'Donnell et al., 2004). If a similar pattern is found, a greater number of latent classes might emerge at earlier time points compared to later time points. We also examined whether individuals tend to remain in the same latent class or change classes over time. We expected to see moderate stability in class membership over time, since prior research with the study sample described below found that some individuals experience enduring PTSD symptoms while most gradually recover (Steenkamp et al., 2012).

Our third aim was to test whether different profiles of PTSD and depression symptoms prospectively predict meaningful differences in functional impairment at the final follow-up interval. If specific latent profiles of PTSD and depression symptoms 1-month after assault predict functional impairment three months later, this would have implications for identifying and intervening early with sexual assault survivors who are most likely to experience long-term functional impairment.

2. Method

2.1. Participants and procedure

Secondary analyses were conducted on data from a study of sexual assault survivors (Steenkamp et al., 2012). Participants ($N=119$) were adult females recruited via Craigslist advertisements (88%) or Boston Area Rape Crisis Center advocates. Participants met inclusion criteria if they were at least 18 years of age and reported being sexually assaulted in the past month. Age ranged from 18 to 65 years ($M=33.0$ years; $SD=10.55$). Participants self-identified as Caucasian (63%), African American (20%), Hispanic (8%), Asian American (6%), and other race/ethnicity (3%). 19% had graduated from high school, 39% had received some college education, and 42% had obtained at least a bachelor's degree. Modal annual household income was $50,000–$100,000. Mean number of days since assault was 19 ($SD=5.54$). 45% reported a history of previous sexual assault.

Potential participants completed a phone screen to ensure they met inclusion criteria. To encourage accurate reporting of assault history, potential participants were told that the study was recruiting both those who had and had not been sexually assaulted. Individuals reporting no assault were told the (non-existent) non-assaulted group was full. Eligible participants were directed to the confidential, secure study website where informed consent was obtained. Participants completed online self-report questionnaires, approximately 1, 2, 3, and 4 months post-assault (Month 1, 2, 3, and 4, respectively). They received a small monetary compensation for completing the questionnaires at each time point. The Boston VA Healthcare System IRB approved all study procedures and materials. Of enrolled participants, 55% completed all four assessments, 28% completed three, 8% completed two, and 9% completed one. Additional details on the sample and recruiting procedure can be found elsewhere (Steenkamp et al., 2012).

2.2. Measures

PTSD symptom severity was assessed with the 17-item *PTSD Checklist* (PCL-Civilian), a widely-used measure with favorable psychometric properties (Blanchard et al., 1996; Weathers et al., 1993).

Total PCL score was calculated, along with subscores for re-experiencing, avoidance, numbing, and hyperarousal, based on the 4-factor model of PTSD (Asmundson et al., 2000; King et al., 1998). Internal consistency was strong across time points in the current sample (Cronbach's alphas: Total PCL=0.93–0.95; re-experiencing=0.86–0.92; avoidance=0.68–0.87; numbing=0.80–0.93; hyperarousal=0.89–0.90).

Depression symptom severity was assessed with the 7-item depression subscale of the *Depression Anxiety Stress Scale*-21 (DASS-21; Lovibond and Lovibond, 1995a). For both clinical and non-clinical samples, the DASS-Depression Scale (DASS-D) has shown good construct, discriminant, and convergent validity (Antony et al., 1998; Brown et al., 1997; Henry and Crawford, 2005). Correlating highly with other self-report measures of depression, the DASS-D has proven to be particularly suitable for discriminating between symptoms of depression and anxiety (Brown et al., 1997; Lovibond and Lovibond, 1995b). In the current sample, the DASS-D subscale showed excellent internal consistency (Cronbach's alpha=0.90–0.96 across time points).

Functional impairment in five occupational and social domains was measured at Month 4 with the 5-item *Work and Social Adjustment Scale* (WSAS; Mundt et al., 2002), which demonstrated excellent internal consistency (Cronbach's alpha=0.91).

2.3. Statistical analyses

At each time point, sum scores were calculated for the DASS-D and four PTSD factors: re-experiencing, avoidance, numbing, and hyperarousal. LPA was conducted on these five sum scores, rather than on the individual items, to minimize the number of indicators and facilitate model convergence, while maximizing the interpretability of different solutions. The five sum scores were converted to *T* scores for the LPA, since the PCL and DASS-D are scaled differently.

LPA was conducted using Mplus 6.0 full-information maximum likelihood estimation with robust standard errors (Muthén and Muthén, 2010). To determine the optimal number of latent classes fitting the data, 1- to 6-class solutions were evaluated and compared based on fit statistics, interpretability, and theoretical considerations (Vermunt and Magdison, 2002). The Bayesian Information Criterion (BIC) and Bootstrap Likelihood Ratio Test (BLRT) were the main indices used to statistically evaluate model fit. The BIC balances fit with parsimony, with decreases of 10-points or more suggesting improved fit (Raftery, 1995). The BLRT statistically compares model fit, with *P* values below 0.05 suggesting superior fit for a model with k classes versus $k-1$ classes. In a recent LCA simulation, the BIC and BLRT outperformed other indices for correctly and consistently identifying the true number of classes across a range of sample sizes (Nylund et al., 2007). Entropy was also evaluated for each solution; scores closer to 1 suggest improved classification accuracy but should not be evaluated in isolation.

Once the optimal number of classes fitting the data was determined at each time point, each participant was assigned to one of the classes based on latent conditional probabilities and the Mplus statistical estimate of most likely class membership. SPSS 20.0 was used for subsequent analyses. To examine the characteristics of each class, ANOVA was used to evaluate between-class differences in DASS-D scores, PCL total scores, the four PCL subscores, demographics (age, race, education, and household income), and prior sexual assault history. To evaluate functional impairment, ANOVA was used to test whether class assignment at Month 1 predicted WSAS score at Month 4. All significant ANOVAs were followed up with post-hoc pairwise comparisons using Dunnett's T3, which does not assume equal variances and is recommended for smaller samples (Maxwell and Delaney, 2003).

To examine the stability of class membership, we calculated the percentage of individuals from each class at Month 1 assigned to the same or to a different class at subsequent time points. Chi-square tests evaluated whether Month 1 class assignment was significantly related to class assignment at Months 2, 3, and 4.

3. Results

3.1. Descriptive analyses

Mean DASS-D and PCL scores are presented in Table 1 (Total Sample column). As previously reported (Steenkamp et al., 2012), based on a cutoff score of 44 (Blanchard et al., 1996), probable PTSD prevalence was 78% at Month 1, 67% at Month 2, 48% at Month 3, and 41% at Month 4. At each time point, DASS-D score correlated significantly with PCL score ($r=0.68-0.73$, $P<0.001$).

3.2. Identification and description of LPA model at Month 1

Table 2 presents the fit statistics for 1- to 6-class solutions at Month 1. A 4-class solution yielded the best fit for the data, resulting in the lowest BIC value and a significant BLRT *P*-value. Additional classes did not improve model fit, as indicated by non-significant BLRT *P* values. A 4-class solution resulted in high entropy, reflecting high classification accuracy. Strong discrimination between classes was evidenced by high mean probabilities for class membership (0.89–0.94).

Each of the four classes contained a substantial (11% or greater) percentage of the sample and was characterized by increasing severity of both PTSD and depression symptoms (Fig. 1a), reflecting *mild* (Class 1), *low-moderate* (Class 2), *high-moderate* (Class 3), and *severe* (Class 4) co-occurring symptoms. Within each class, depression symptom severity co-occurred with comparable PTSD symptom severity. None of the four classes reflected a high-PTSD/low-depression profile, or vice versa. Table 1 displays the percentage of participants assigned to each class, unstandardized PCL and DASS-D scores, and results from ANOVAs and pairwise comparisons. Significant between-class differences were found on each of the PTSD factors, total PCL score, and total DASS-D score.

Class 1 individuals reported depression symptoms in the normal range and the lowest PTSD symptom severity, falling below the probable PTSD cutoff. Those in Class 2 reported moderate depression and greater PTSD symptoms suggesting probable PTSD. Class 3 individuals reported severe depression and PTSD symptoms reflecting probable PTSD. Class 4 individuals reported the highest symptom severity, with extremely severe depression symptoms and PTSD scores well above the probable PTSD cutoff. No significant between-class differences on demographics or prior sexual assault history were found.

3.3. Identification and description of LPA model at Months 2, 3, and 4

To examine the stability of the latent profiles identified at Month 1, LPA was repeated for Months 2–4. At Month 2, LPA resulted in a similar model fit to Month 1 (Table 2). Again, a 4-class solution with *mild*, *low-moderate*, *high-moderate*, and *severe* levels of co-occurring PTSD and depression symptoms fit the data best (Fig. 1b), yielding the lowest BIC value and a significant BLRT *P*-value. All four classes differed significantly on numbing, hyperarousal, and PCL total score at Month 2 (Table 1). Re-experiencing, avoidance, and DASS-D discriminated less well

Table 1
Class Means for 4-Class Model.

Variable	Class 1 (mild)	Class 2 (low moderate)	Class 3 (high moderate)	Class 4 (severe)	Total sample	Group Comparisons (ANOVAs)	Post-hoc pairwise comparisons (Dunnett's T3)
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*		
Month 1:	*N*=16 (13%)	*N*=39 (33%)	*N*=51 (43%)	*N*=13 (11%)	*N*=119 (100%)		
Re-Experiencing	9.19 (2.59)	14.51 (3.32)	17.44 (4.00)	22.62 (3.55)	15.92 (5.02)	F (3, 114)=39.29, $P<0.001$	1 < 2 < 3 < 4
Avoidance	3.07 (0.96)	6.67 (1.75)	7.84 (1.57)	9.62 (0.77)	7.04 (2.30)	F (3, 114)=52.93, $P<0.001$	1 < 2 < 3 < 4
Numbing	7.80 (2.70)	11.36 (3.09)	16.92 (2.73)	22.15 (2.27)	14.48 (5.09)	F (3, 113)=89.13, $P<0.001$	1 < 2 < 3 < 4
Hyperarousal	9.56 (3.85)	14.26 (3.13)	20.45 (2.70)	24.38 (1.19)	17.42 (5.41)	F (3, 114)=97.09, $P<0.001$	1 < 2 < 3 < 4
PCL Total	29.29 (6.90)	46.79 (5.26)	62.45 (6.17)	78.77 (4.55)	55.02 (15.05)	F (3, 110)=215.71, $P<0.001$	1 < 2 < 3 < 4
DASS-D Total	7.00 (8.20)	14.86 (8.23)	24.46 (7.84)	38.15 (4.65)	20.46 (11.71)	F (3, 110)=49.46, $P<0.001$	1 < 2 < 3 < 4
Month 2:	*N*=8 (8%)	*N*=53 (50%)	*N*=25 (24%)	*N*=19 (18%)	*N*=105 (100%)		
Re-Experiencing	6.13 (1.36)	12.04 (2.73)	13.92 (2.94)	20.32 (3.04)	13.53 (4.61)	F (3, 101)=62.38, $P<0.001$	1 < (2 and 3) < 4
Avoidance	2.75 (0.89)	5.55 (1.81)	7.48 (2.04)	8.11 (1.63)	6.26 (2.30)	F (3, 101)=23.58, $P<0.001$	1 < 2 < (3 and 4)
Numbing	6.13 (0.99)	11.02 (2.97)	16.63 (2.50)	21.42 (2.83)	13.86 (5.35)	F (3, 99)=95.89, $P<0.001$	1 < 2 < 3 < 4
Hyperarousal	6.75 (1.28)	13.25 (3.10)	19.04 (2.84)	22.17 (2.20)	15.74 (5.21)	F (3, 98)=84.25, $P<.001$	1 < 2 < 3 < 4
PCL Total	21.75 (3.37)	42.10 (5.61)	57.04 (4.83)	72.00 (5.79)	49.44 (14.94)	F (3, 96)=227.37, $P<0.001$	1 < 2 < 3 < 4
DASS-D Total	3.71 (4.23)	12.67 (6.99)	26.00 (7.37)	29.05 (8.70)	18.30 (10.90)	F (3, 97)=42.12, $P<0.001$	1 < 2 < (3 and 4)
Month 3:	*N*=22 (22%)	*N*=48 (48%)	*N*=21 (21%)	*N*=9 (9%)	*N*=100 (100%)		
Re-Experiencing	7.55 (1.61)	11.13 (2.16)	14.90 (3.28)	22.75 (3.06)	12.19 (4.69)	F (3, 91)=85.98, $P<0.001$	1 < 2 < 3 < 4
Avoidance	3.27 (1.52)	5.34 (1.98)	6.81 (1.75)	8.44 (1.67)	5.47 (2.34)	F (3, 95)=22.74, $P<0.001$	1 < 2 < (3 and 4)
Numbing	5.52 (0.68)	10.63 (2.12)	17.39 (2.40)	22.13 (2.64)	11.77 (5.38)	F (3, 89)=190.43, $P<0.001$	1 < 2 < 3 < 4
Hyperarousal	7.73 (2.47)	13.57 (3.43)	17.58 (2.59)	23.67 (1.50)	13.97 (5.37)	F (3, 93)=75.09, $P<0.001$	1 < 2 < 3 < 4
PCL Total	24.47 (4.09)	40.67 (5.87)	56.65 (4.36)	77.71 (7.23)	43.20 (15.46)	F (3, 84)=211.25, $P<0.001$	1 < 2 < 3 < 4
DASS-D Total	4.38 (4.80)	13.46 (8.16)	25.20 (9.46)	37.75 (6.96)	15.92 (12.18)	F (3, 93)=47.51, $P<0.001$	1 < 2 < 3 < 4
Month 4:	*N*=28 (29%)	*N*=42 (44%)	*N*=20 (21%)	*N*=6 (6%)	*N*=96 (100%)		
Re-Experiencing	6.42 (1.24)	10.93 (2.93)	13.10 (3.16)	23.40 (2.30)	10.80 (4.68)	F (3, 88)=69.27, $P<0.001$	1 < (2 and 3) < 4
Avoidance	3.36 (1.45)	5.29 (2.02)	7.10 (1.21)	8.33 (1.97)	5.29 (2.28)	F (3, 92)=25.62, $P<0.001$	1 < (2 and 4) < (3 and 4)
Numbing	5.74 (1.10)	10.66 (2.74)	17.10 (2.49)	23.00 (2.10)	11.40 (5.50)	F (3, 90)=148.95, $P<0.001$	1 < 2 < 3 < 4
Hyperarousal	7.04 (2.24)	12.71 (3.46)	17.60 (2.95)	23.40 (2.30)	12.69 (5.41)	F (3, 90)=71.27, $P<0.001$	1 < 2 < 3 < 4
PCL Total	22.63 (4.72)	39.55 (6.38)	54.90 (6.13)	79.50 (4.65)	40.24 (15.47)	F (3, 84)=174.42, $P<0.001$	1 < 2 < 3 < 4
DASS-D Total	2.52 (2.69)	12.48 (8.25)	25.79 (8.69)	38.00 (4.73)	13.94 (12.36)	F (3, 90)=65.75, $P<0.001$	1 < 2 < 3 < 4

Note: *M*=unstandardized mean; SD=standard deviation; PCL=Posttraumatic Checklist; DASS-D =Depression Anxiety Stress Scale, Depression Subscale.

Table 2
Fit statistics for latent profile analyses.

Model	BIC	Entropy	BLRT *p* value
Month 1:			
1-class solution	4396.95		
2-class solution	4223.77	0.83	< 0.001
3-class solution	4181.40	0.84	< 0.001
4-class solution	**4178.86**	**0.83**	< **0.001**
5-class solution	4187.04	0.85	0.06
6-class solution	4200.06	0.87	0.16
Month 2:			
1-class solution	3882.13		
2-class solution	3707.58	0.90	< 0.001
3-class solution	3683.65	0.89	< 0.001
4-class solution	**3680.87**	**0.87**	< **0.001**
5-class solution	3694.44	0.85	0.33
6-class solution	3708.30	0.87	0.38
Month 3:			
1-class solution	3882.13		
2-class solution	3448.73	0.90	< 0.001
3-class solution	3382.77	0.87	< 0.001
4-class solution	**3359.90**	**0.88**	< **0.001**
5-class solution	3359.68	0.92	< 0.001
6-class solution	3360.19	0.92	< 0.001
Month 4:			
1-class solution	3538.85		
2-class solution	3364.71	0.89	< 0.001
3-class solution	3305.77	0.93	< 0.001
4-class solution	**3282.25**	**0.90**	< **0.001**
5-class solution	3276.60	0.92	< 0.001
6-class solution	3274.75	0.92	< 0.001

Note: Bold indicates best fit. Entropy and BLRT *P* value are not applicable to a 1-class solution. BIC=Bayesian information criterion, BLRT=bootstrap likelihood ratio test.

among the four classes, with similar re-experiencing severity reported by Classes 2 and 3 and similar avoidance and depression symptom severity reported by Classes 3 and 4.

At Months 3 and 4, LPA fit statistics indicated that 4-, 5-, and 6-class solutions produced comparable model fit and were superior to solutions with fewer than four classes (Table 2). BIC differences past a 4-class solution were less than 10, suggesting that 5- and 6-class solutions did not meaningfully improve model fit. Moreover, 5- and 6-class solutions resulted in classes containing 5% or less of the sample, raising questions of the interpretability, relevance, and robustness of these additional classes. For instance, a 5-class solution at Month 3 appeared to fit the data well and included a class (11% of the sample) reporting moderate-PTSD/severe-depression symptoms. However, at Month 4, this profile was no longer apparent. A 5-class solution at Month 4 revealed a class with low-PTSD/severe-depression symptoms, but this class contained only 3 individuals (3% of participants), limiting any meaningful interpretations and calling into question the relevance and generality of such a class. Balancing parsimony and interpretability, a 4-class solution was deemed to fit the data best at Months 3 and 4, resulting in classes that each contained more than 5% of the sample. Again, a meaningful low-depression/high-PTSD or low-PTSD/high-depression latent profile was not observed in the 4-class solution at either time point.

The four classes at Months 3 and 4 corresponded with *mild*, *low-moderate*, *high-moderate*, and *severe* co-occurring symptom severity levels (Fig. 1c and d). At Months 3 and 4, each class significantly differed from the others on numbing, hyperarousal, PCL total score, and DASS-D score. Re-experiencing and avoidance did not reliably discriminate the four classes from one another. No significant between-class differences in demographics or prior sexual assault history were found at Months 2, 3, or 4.

3.4. Stability of class membership

Table 3 shows the number and percentage of individuals classified into the same or different classes at subsequent time points, relative to Month 1 class assignment. Average concordance rates reflect the average percentage of individuals from Month 1 who were assigned to the same class at Months 2, 3, and 4. Chi-square tests revealed that class assignment at Month 1 was significantly related to class assignment at subsequent time points (Month 2: Chi-square (9, $N=105$)=60.44, $P<0.001$; Month 3: Chi-square(9, $N=100$)=41.90, $P<0.001$; Month 4: Chi-square (9, $N=96$)=35.80, $P<0.001$).

3.5. Early class membership as a predictor of subsequent functional impairment

Class membership at Month 1 was significantly related to WSAS scores at Month 4 ($F(3, 92)=6.58$, $P<0.001$). Using Month 1 class assignments, Mean WSAS scores at Month 4 were 6.87 ($SD=6.44$) for Class 1, 13.40 ($SD=10.98$) for Class 2, 16.15 ($SD=7.32$) for Class 3, and 22.17 ($SD=13.20$) for Class 4. Post-hoc pairwise comparisons indicated significant between-class differences such that individuals in Class 1 at Month 1 reported the least functional impairment at Month 4, those in Classes 2 and 3 at Month 1 reported similar levels of moderate functional impairment at Month 4, and Class 4 individuals at Month 1 reported severe functional impairment at Month 4.

4. Discussion

We used LPA to examine patterns in PTSD and depression symptoms across the first four months following sexual assault. Four distinct subgroups were identified at each time point, reflecting *mild*, *low-moderate*, *high-moderate*, and *severe* levels of co-occurring symptoms. Within each subgroup, the severity of PTSD and depression symptoms cohered tightly. The number of classes identified by LPA did not change over time, and at no point were there reliable subgroups containing individuals with primarily PTSD symptoms or primarily depression symptoms. These preliminary findings provide support for the indistinctiveness of PTSD and depression symptoms after sexual assault.

Across four months post-assault, only numbing, hyperarousal, and overall PTSD symptom severity reliably distinguished one class from another. Re-experiencing, avoidance, and depression scores reliably differentiated the *mild* severity class from the other classes but did not consistently differentiate among the *low-moderate*, *high-moderate*, and *severe* classes. This finding is consistent with previous evidence that emotional numbing distinguishes pervasive PTSD from cases with less distress (Breslau et al., 2005).

Class assignment was moderately stable over time. From Months 2 to 4, a substantial minority remained in the same class as in Month 1. This is consistent with an earlier study conducted with this group of assault survivors, which found that most individuals follow a *recovery* trajectory of high initial PTSD symptoms diminishing over time, while a smaller subset follow a *chronic* trajectory of PTSD symptoms that persist across time (Steenkamp et al., 2012).

Class membership differentially predicted occupational and social adjustment. Membership in the *severe* class at Month 1 predicted the highest levels of functional impairment at Month

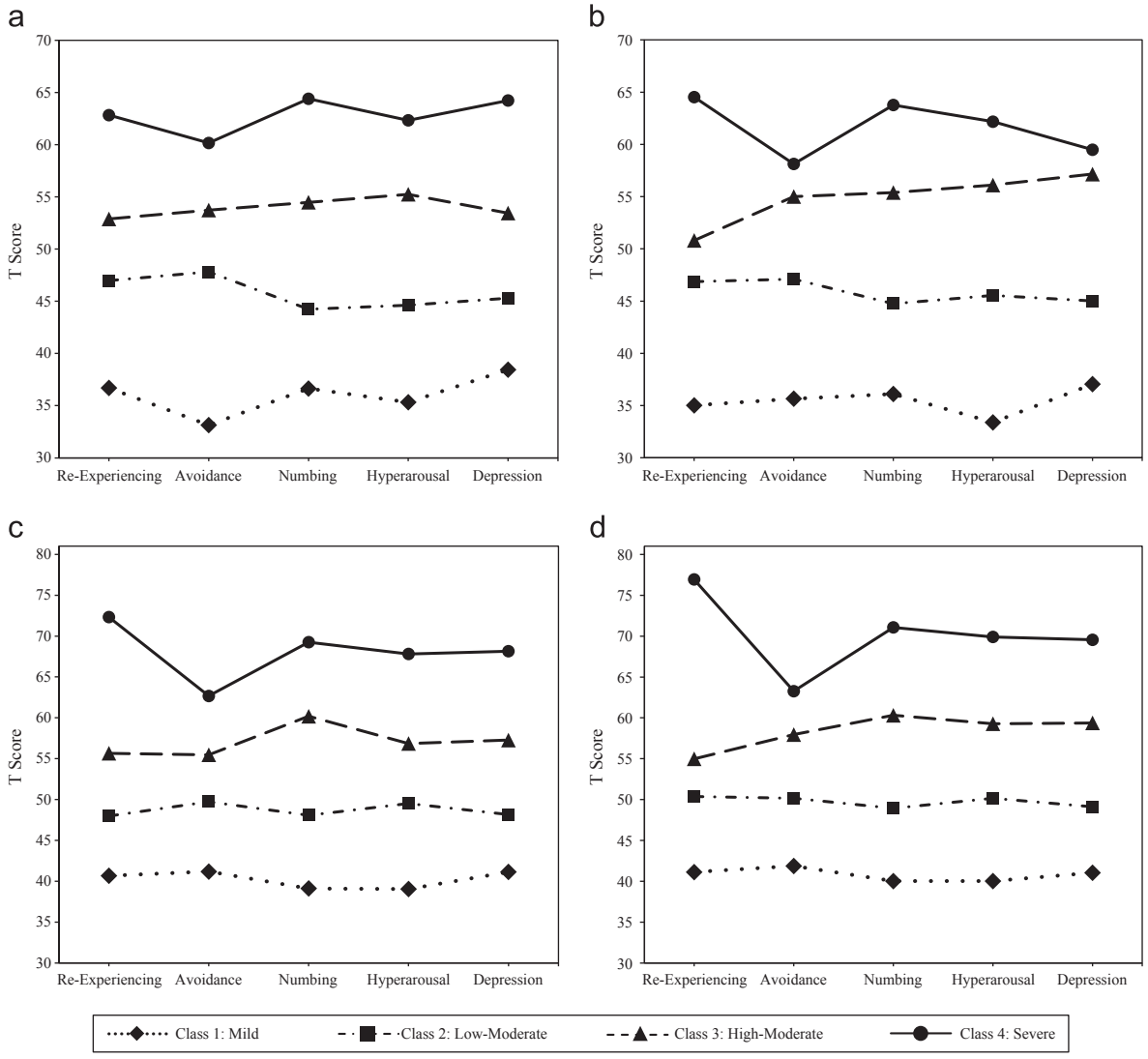

Fig. 1. PCL and DASS-D standardized subscores by latent class at Month 1 (a), Month 2 (b), Month 3 (c) and Month 4 (d) after sexual assault.

4. The *high-moderate* and *low-moderate* classes at Month 1 predicted significantly elevated functional impairment relative to the *mild* severity class. This suggests that individuals with less severe co-occurring PTSD and depression symptoms nevertheless experience significant impairment. Identifying and treating these individuals early on, regardless of whether they meet diagnostic criteria, may reduce long-term impairment.

The lack of a class with mainly PTSD or mainly depression symptoms is consistent with previous studies suggesting that PTSD and depression symptoms reflect a general posttraumatic response rather than distinct disorders (Norman et al., 2011; O'Donnell et al., 2004). Although previous studies found a subset of individuals with either PTSD or depression in the absence of the other, many of those individuals had noteworthy subthreshold symptoms (Ikin et al., 2010; Shalev et al., 1998). The different levels of co-occurring symptom severity in this study suggest a continuum of general posttraumatic distress associated with increasing functional impairment, which may be overlooked with current diagnostic systems that classify individuals as cases and non-cases. It is also possible that depression without PTSD is more common in populations exposed to non-assaultive trauma, such as motor vehicle accidents. Further research is needed to evaluate whether the latent classes found in this study extend to other trauma populations.

The pervasiveness of co-occurring PTSD and depression symptoms across all four classes has treatment implications for sexual assault survivors. Current treatments typically target either PTSD or depression, with the tacit assumption that they are distinct disorders requiring different interventions. Focusing on treating depression symptoms in those diagnosed with major depression after trauma may neglect subthreshold PTSD symptoms, and vice versa. Recent research has found that PTSD treatments that address depression symptoms, such as excessive guilt, produce better outcomes even among individuals who do not meet criteria for major depression (Nishith et al., 2005). Further research is needed to develop and evaluate the efficiency and effectiveness of integrated treatments that target both PTSD and depression symptoms.

The strengths of this study include the use of LPA, the longitudinal design, and dimensional indicators that capture a broad continuum of symptom severity. In addition, all participants were exposed to severe interpersonal trauma and were recruited regardless of their current distress or interest in treatment. Evaluating PTSD and depression symptoms in a dimensional manner, rather than using categorical diagnoses, made it possible to examine the full range of PTSD and depression symptom severity. However, the findings may not generalize to clinical samples.

Table 3
Stability of class membership.

	Month 1 class assignment								% average concordance
	Class 1 (mild) $N=16$		Class 2 (low-moderate) $N=39$		Class 3 (high-moderate) $N=51$		Class 4 (severe) $N=13$		
	N	%	*N*	%	*N*	%	*N*	%	
Month 2:									
Class 1 (mild)	6	**37.5**	1	2.6	0	0	1	7.7	48.0
Class 2 (low-moderate)	7	43.8	21	**53.8**	23	45.1	2	15.4	
Class 3 (high-moderate)	0	0	8	20.5	16	**31.4**	1	7.7	
Class 4 (severe)	1	6.3	4	10.3	5	9.8	9	**69.2**	
Total	14	87.5	34	87.2	44	86.3	13	100.0	
Month 3:									
Class 1 (mild)	8	**50.0**	8	20.5	5	9.8	1	7.7	37.3
Class 2 (low-moderate)	6	37.5	13	**33.3**	25	49.0	4	30.8	
Class 3 (high-moderate)	0	0	9	23.1	10	**19.6**	2	15.4	
Class 4 (severe)	0	0	0	0	3	5.9	6	**46.2**	
Total	14	87.5	30	76.9	43	84.3	13	100.0	
Month 4:									
Class 1 (mild)	8	**50.0**	9	23.1	9	17.6	2	15.4	37.1
Class 2 (low-moderate)	6	37.5	15	**38.5**	18	35.3	3	23.1	
Class 3 (high-moderate)	1	6.3	6	15.4	11	**21.6**	2	15.4	
Class 4 (severe)	0	0	0	0	1	2.0	5	**38.5**	
Total	15	93.8	30	76.9	39	76.5	12	92.3	

Note: Bold indicates the percentage of individuals at Month 1 who were assigned to the same class at each subsequent time point. All percaaaaentages reflect column percentages.

There are several noteworthy methodological limitations. The study was not powered to evaluate stability of class membership over time using multi-level modeling. Future research, with a larger sample, should use latent transition analysis to empirically examine changes in class membership. In addition, at Months 3 and 4, 5- and 6-class solutions were not optimal since the additional classes contained too few participants to be reliable. Although the majority of individuals in this study had co-occurring PTSD and depression symptoms, it is possible that groupings of less common but reliable symptom presentations could emerge with larger samples. Furthermore, participants with greater symptom severity at Months 3 and 4 may have been over-represented among those who dropped out of the study. However, since the total number of assessments completed was not significantly related to PTSD or depression symptom severity at Months 1 or 2 (data not shown), there is little indication that individuals who dropped out would have exhibited a different symptom profile. Nonetheless, these preliminary findings should be interpreted cautiously, given the dropout rate and relatively small sample size. Sample size considerations also precluded a thorough examination of predictors of class membership. Demographic variables and previous sexual assault history were not associated with class membership but additional research is needed to examine other potential predictors. Another limitation was the lack of formal assessment or structured interview for diagnosing PTSD or major depression. Although we focused on co-occurring PTSD and depression symptoms and not on comorbid PTSD and major depression diagnoses, future studies would do well to include data from clinical interviews. The self-report measures also contained some overlapping content, although previous studies found that high rates of co-occurring PTSD and depression remain after accounting for symptom overlap (Taft et al., 2009). Finally, since our participants were a self-selected sample, they may not have been representative of sexual assault survivors as a whole. Future studies should examine the generalizability of our findings to other clinical and non-clinical populations.

The methodological concerns notwithstanding, the findings highlight the pervasiveness of co-occurring PTSD and depression symptoms, which has not been studied extensively among sexual assault survivors. The absence of a distinct subset of individuals with PTSD symptoms but without depression symptoms, or vice versa, is consistent with the notion that PTSD and depression may be manifestations of a more general posttraumatic stress response. These findings have important implications for how we conceptualize, diagnose, and treat PTSD and depression symptoms after trauma.

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Conflict of interest

The authors have no conflicts of interests to report.

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