



Published in final edited form as:

*J Affect Disord.* 2016 August ; 200: 133–141. doi:10.1016/j.jad.2016.04.037.

## Comorbid Trajectories of Postpartum Depression and PTSD among Mothers with Childhood Trauma History: Course, Predictors, Processes and Child Adjustment

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### Abstract

**Background**—Both postpartum depression and posttraumatic stress disorder (PTSD) have been identified as unique risk factors for poor maternal psychopathology. Little is known, however, regarding the longitudinal processes of co-occurring depression and PTSD among mothers with childhood adversity. The present study addressed this research gap by examining co-occurring postpartum depression and PTSD trajectories among mothers with childhood trauma history.

**Methods**—177 mothers with childhood trauma history reported depression and PTSD symptoms at 4, 6, 12, 15 and 18 months postpartum, as well as individual (shame, posttraumatic cognitions, dissociation) and contextual (social support, childhood and postpartum trauma experiences) factors.

**Results**—Growth mixture modeling (GMM) identified three comorbid change patterns: The *Resilient* group (64%) showed the lowest levels of depression and PTSD that remained stable over time; the *Vulnerable* group (23%) displayed moderately high levels of comorbid depression and PTSD; and the *Chronic High-Risk* group (14%) showed the highest level of comorbid depression and PTSD. Further, a path model revealed that postpartum dissociation, negative posttraumatic cognitions, shame, as well as social support, and childhood and postpartum trauma experiences differentiated membership in the *Chronic High-Risk* and *Vulnerable*. Finally, we found that children of mothers in the *Vulnerable* group were reported as having more externalizing and total problem behaviors.

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**Limitations**—Generalizability is limited given sample of mothers with childhood trauma history and demographic risk.

**Conclusions**—The results highlight the strong comorbidity of postpartum depression and PTSD among mothers with childhood trauma history, and also emphasize its aversive impact on the offspring.

### Keywords

Depression; PTSD; Comorbidity; Postpartum Trajectories; Maternal Childhood Maltreatment; Dissociation; Posttraumatic Cognitions; Shame; Child Outcomes

## 1. Introduction

The postpartum transition is a period wherein mothers undergo significant changes that increase vulnerability for psychopathology, including depression (Studd & Nappi, 2012) and Posttraumatic Stress Disorder (PTSD; Ross & McLean, 2006). Postpartum depression and PTSD occur in approximately 13%, and between 3.6–6.3% of women (Alcorn, O'Donovan, Patrick, Creed, & Devilly, 2010; Studd & Nappi, 2012). These disorders impact mothers' postpartum adaptation (Alcorn et al., 2010; Seng et al., 2013), placing the offspring at risk for socio-emotional problems (Campbell, Matestic, von Stauffenberg, Mohan, & Kirchner, 2007). Mothers with childhood trauma history may be particularly vulnerable to develop postpartum PTSD and depression (Lev-Wiesel, Daphna-Tekoah, & Hallak, 2009) because stress surrounding peripartum may trigger recollection of past trauma (Onoye et al., 2013). Therefore, mothers with childhood trauma merit attention in research and clinical contexts.

In addition to the noted correlates and consequences of depression and PTSD, researchers demonstrated high cross-sectional comorbidity of these two disorders (e.g., Ginzburg, Ein-Dor, & Solomon, 2010). A study examining PTSD and depression among healthy adults showed a greater prevalence of PTSD (81.9% of those with PTSD) and a higher comorbidity rate (84.4%) among women with childhood abuse (Spinhoven, Penninx, van Hemert, de Rooij, & Elzinga, 2014). Few studies examined longitudinal peripartum symptomatology of PTSD and/or depression and found an overall declining trend of both conditions from 37 weeks gestation to 6 weeks postpartum in community samples (Onoye et al. 2013; Muzik et al., 2016), noting considerable variability in longitudinal symptom progression. To capture such variation in co-occurring changes of postpartum depression and PTSD, a simultaneous, group-based trajectory analysis is warranted to identify subgroups with similar change patterns (e.g., joined linear decline, incline, no change, or mixed on both). This allows determination of whether or not one disorder dominates or drives the other disorder. *Yet, no study has examined co-occurring illness patterns during the postpartum period among mothers with childhood trauma history.*

Beyond trajectory patterns, we sought to identify factors explaining variations in these co-occurring trajectories. Research modeling postpartum depression and PTSD separately has demonstrated contextual and individual factors may account for distinct patterns (Campbell et al., 2007; Seng et al., 2013). Contextual factors including childhood trauma and trauma during pregnancy are risks for postpartum depression and/or PTSD (Berntsen et al., 2012;

Cerulli, Talbot, Tang, & Chaudron, 2011; Onoye et al., 2013; Muzik et al., 2016). Social support is also found to facilitate symptom prognosis (Pietrzak et al., 2010) and postpartum adjustment (Montmasson, Bertrand, Perrotin, & El-Hage, 2012). In fact, social support may aid resiliency for trauma survivors because it provides needed social, emotional, and physical provisions (Gjerdingen, McGovern, Attanasio, Johnson, & Kozhimannil, 2014; Leahy-Warren, McCarthy, & Corcoran, 2012).

In addition, individual factors may facilitate adaptation processes. Shame and posttraumatic cognitions (e.g., self-blame and negative view of world) are common among survivors of childhood trauma (Bennett, Sullivan, & Lewis, 2005; Ginzburg et al., 2009), are correlated with PTSD and depressive symptoms (Lanius, Brand, Vermetten, Frewen, & Spiegel, 2012; Shin, Cho, Lee, & Chung, 2014), and predict stability of depression (Zhang & Jin, 2014) and PTSD (Oktedalen, Hoffart, & Langkaas, 2014; Shin et al., 2014). Dissociation, another potential consequence of trauma exposure, has also been associated with PTSD (Ginzburg et al., 2009; Wolf et al., 2012), and comorbid PTSD and depression (for review see Lanius et al., 2012).

Finally, mothers' postpartum depression and PTSD is detrimental to their young children's developmental outcomes (Vesga-López et al., 2008). Few studies, however, have charted longitudinal impact of comorbid postpartum depression and PTSD on children. For example, Bosquet et al. (2011) found a significant association between PTSD at 6 months postpartum and greater child internalizing symptoms at 13 months. Campbell et al. (2007) identified distinct trajectories of depressive symptoms, showing that mothers with moderate or high depression trajectories rated their children as having more internalizing and externalizing problems at school entry compared to mothers with low symptom trajectories. Interestingly, mothers who started with low but had increasing symptoms over time, reported significantly more problems when their children were school age compared to mothers who had stable moderate depression over time. These results suggest that trajectory patterns, not the absolute level, are predictive of mothers' ratings of their children's problem behavior.

In summary, using an innovative hybrid approach, the present study is the first to examine such co-occurring illness patterns in the postpartum period, addressing current research gaps. First, we identify distinct comorbid (i.e., depression and PTSD symptom) trajectories across postpartum among mothers with childhood trauma history. Second, we test a path model that encompasses both contextual and individual factors to uncover the mechanisms by which factors are directly and indirectly related to the distinct trajectories of co-occurring postpartum depression and PTSD. Finally, we examine how mothers' comorbid postpartum depression and PTSD trajectory patterns (not the level at a certain time point) differentiated children's behavioral outcomes at 18 months postpartum, accounting for the longitudinal exposure of comorbid psychopathology on children's development.

## 2. Method

### 2.1. Participants

*Study participants (N=177) were drawn from the Maternal Anxiety during the Childbearing Years (MACY) study approved by the Institutional Review Board at the local university,*

which investigated the effects of mothers' psychopathology and parenting on children in a cohort of mothers' oversampled for exposure to childhood trauma. These 177 mothers endorsed trauma that placed them above the severity cut-off for presence of abuse on the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998), allowing acceptable power (Gebring & Anderson, 1985). Participants were recruited for MACY as postpartum follow-up to a parent study or through community advertisement (previously reported in Martinez-Torteya et al., 2014). Eligible families were: (1) Maternal age of 18 years or older; (2) community referrals (i.e., not referred through mental health clinics but through obstetrics, primary care or resource centers for pregnant and postpartum women such as Women, Infants, Children (WIC) food program), and (3) English-speaking. Exclusion criteria included maternal active use of drugs in past 3 months, history of bipolar and psychotic illness, child prematurity (<36 weeks term), or child developmental disability or severe illness. At six months postpartum, maternal age ranged from 18–45 years ( $M = 29$ ,  $SD = 5.9$ ), 53.5% were Caucasian and 30.6% African American. Participants reported a mean annual income of \$45–\$49k. The majority of women were partnered (73.6%) with a bachelor's degree or higher (48.2%; Table 1).

## 2.2. Procedures

Participants provided verbal assent at a 4-month telephone interview with additional telephone interviews at 12, and 18 months postpartum; written consent was obtained at the first of two home visits at 6 months postpartum. A playroom visit was held at 15 months postpartum.

## 2.3. Measures

**2.3.1. Demographics**—Mothers completed a 28-item questionnaire to report socioeconomic status at 6 months postpartum. A SES demographic risk index ( $M = .99$ ,  $SD = 1.20$ ) was computed by summing five risk factors including maternal education (0 = > high school; 1 = < high school education), age (0 = > 21; 1 = < 21 years old), marital status (0 = partnered; 1 = single), minority race status (0 = Caucasian; 1 = Minority), and family household income (0 = > 15K; 1 = < 15K annual income) as recommended by Sameroff and colleagues (Sameroff, Seifer, Baldwin, & Baldwin, 1993).

**2.3.2. Depressive symptoms**—Mothers reported postpartum depression symptoms on the *Postpartum Depression Screening Scale (PDSS)* (Beck & Gable, 2002), a 35-item scale at all contacts. Items (i.e., “During the past 2 weeks, you felt like your emotions were on a roller coaster”) are rated from 1 (strongly disagree) to 5 (strongly agree), and the scale yields a total score from 35 to 175 with scores greater than 80 indicating a depression diagnosis (Beck & Gable, 2000). Cronbach's alphas ranged from .95–.97 across time points.

**2.3.3. PTSD symptoms**—*The National Women's Study PTSD Module* (Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993) assessed symptoms and diagnosis of PTSD in relation to specific traumatic events. In our sample we asked to specify whether a particular symptom was present due to “childhood-trauma” or due to “childbirth-trauma”. This measures all 17 symptoms (i.e., “Since the last interview, you felt you had to stay on guard much of the time”) of PTSD for lifetime and current occurrence. It yields a DSM-IV

diagnosis (at least 1 symptom of re-experiencing, 3 symptoms of avoidance, and 2 symptoms of hyperarousal) and continuous symptom count (0–21). Cronbach's alphas ranged from .83–.91 across time points.

### 2.3.4. Contextual Factors

**2.3.4.1. Childhood Trauma:** The *Childhood Trauma Questionnaire* (CTQ; Bernstein & Fink, 1998) assessed mothers' self-reports on their childhood experiences. This 28-item measure was administered at 4 months using a 5-point Likert scale ranging from 1 (never true) to 5 (very often true; i.e., "When I was growing up, I didn't have enough to eat"). The total CTQ score indicated trauma severity.

**2.3.4.2. Postpartum Trauma:** The shortened 13-item *Life Stressors Checklist* (LSC; (Wolfe & Kimerling, 1997) assessed mother's trauma experiences including environmental (e.g., car accident) and interpersonal (e.g., domestic abuse) life events between all study time points. Scoring was binary ('yes, happened to me' or 'no, did not happen to me'). A total score was computed by summing the items each time point (ranged from 0–13). A composite score was created by averaging the total scores across all the time points.

**2.3.4.3. Family & Partner Social Support:** The 5-item *Family Adaptation, Partnership, Growth, Affection, and Resolve (FAPGAR) Scale* (Smilkstein, 1982) assessed perceived maternal social support from family and her partner at 4 months postpartum. Items (i.e., "Mom is satisfied she can turn to her family for help when something is troubling her") are rated on a 5-point Likert scale ranging from 0 (Never) to 4 (Always) and summed for a total score. Cronbach's alpha was .845.

### 2.3.5. Individual Process Factors

**2.3.5.1. Shame:** The *Shame Attributions Questionnaire* (SAQ) and *Shame Picture Questionnaire* (SPQ; Feiring & Taska, 2005) were used to assess shame at 6 months postpartum. The SAQ is an 8-item self-report of shame (i.e., "What happened to me makes me feel dirty"). For the SPQ, participants were asked to identify with five pictures of shame postures while thinking about their abuse (i.e., figure standing with head down). The SAQ and SPQ were rated on a scale of 1–5, and the scores are totaled, with higher total scores indicating more abuse-related shame (range from 13–65). Cronbach's alphas for were .911 and .747, for SAQ and SPQ respectively.

**2.3.5.2. Posttraumatic Cognitions:** Using the 36-item *Posttraumatic Cognitions Inventory* (PTCI; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999) mothers reported their specific trauma-related cognitions about the self, the world, and trust in other relationships at 6 months postpartum. Each item is rated on a 7-point Likert scale from 1 (totally disagree) to 7 (totally agree) with higher total scores (range from 36 to 252) indicating stronger endorsement of negative cognitions (; i.e., "The world is a dangerous place."). Cronbach's alpha was .955.

**2.3.5.3. Dissociation:** The *Dissociative Experiences Scale Taxonomic Version* (DES-T; Waller, Putnam, & Carlson, 1996), an 8-item (i.e., "Some people have the experience of finding themselves in a place and having no idea how they got there. How often does this

happen to you?”) short form of the DES self-report questionnaire, assessed mothers' frequency of psychological dissociation from 1 (Never) to 5 (All the time) at 6 months postpartum (range from 8–40). Cronbach's alpha was .745.

**2.3.6. Child Outcomes—**Child behavior problems were rated by mothers at 18 months postpartum using the *Child Behavior Checklist (CBCL) 1.5 to 5 Years* (Achenbach & Rescorla, 2000). CBCL is a widely used measure of children's problem behaviors that included 99 items yielding internalizing (ranges from 0–74, i.e., “My child shows little interest in things around him/her”), externalizing (ranges from 0–48, i.e. “My child is disobedient”) and total problem behavior scales (ranging from 0–200). Cronbach's alphas for were .799, .903, .910 for internalizing, externalizing and total problem scales, respectively.

## 2.4. Data Analysis Strategies

**2.4.1. Growth mixture model with two-parallel processes—**To identify mothers' comorbid longitudinal trajectories of postpartum depression and PTSD, we first fit an unconditional latent growth curve model (LGCM) with two parallel processes (depression, PTSD) to test hypothesized linear and nonlinear growth trajectories from 4 months to 18 months postpartum. For each parallel process (i.e., depression, PTSD), time was centered at the 4-month time point, and paths from the latent intercept to the observed items were constrained to be 1 for each time point. The paths from the latent linear slope to the observed items were constrained to be 0, 1, 4, 5.5 and 7 to correspond to 4-, 6-, 12-, 15- and 18-month postpartum time points, respectively; the corresponding paths from the quadratic nonlinear slope to the observed items were also included in the models. Because the unconditional model indicated considerable variance around the intercept and linear slope, we further examined Growth Mixture Modeling (GMM) to identify person-centered, group-based trajectory patterns. The GMM included the fixed effects for intercept, linear slope and nonlinear quadratic slope, as well as the random effects for both intercept and linear slope. The fixed effects of the GMM (intercept, linear and nonlinear slopes) were freely estimated for each class, and the random effects of growth parameters were estimated and constrained to be equal across classes because of the advantage in model convergence (Wright, Hallquist, Beeney, & Pilkonis, 2013). To avoid local maxima, GMM models were run with increased random starts values until the model solutions were replicated with different start values (range of 500 – 1,000). Models were estimated in Mplus Version 7.0 (Muthén & Muthén, 1998–2014) using full-information likelihood (FIML) estimation. We estimated fit indices for 1(unconditional model)-to- $k+1$  class-solution models, and evaluated models based on the recommended standards (Masyn, 2013) for class enumeration and optimal model fitting. Because models with different numbers of classes were not nested, models were compared and evaluated based on the recommended standards for GMM models using a comprehensive set of fit indices, including the Bayesian Information Criterion (*BIC*; Schwarz, 1978), the sample size adjusted *BIC* (*SSA BIC*; Sclove, 1987), the Akaike Information Criterion (*AIC*; Akaike, 1987; with lower scores representing better fitting models), the Lo-Mendell-Rubin (*LMR*) likelihood ratio test of model fit, and the entropy measure (with higher scores reflecting better accuracy in classification of class membership), as well as fit with theory, parsimony, the smallest class size, and



interpretability (Masyn, 2013; Ram & Grimm, 2009). Once the optimal GMM model was selected, Wald z-tests were run to examine whether the differences in intercepts and slopes were statistically significant across classes.

**2.4.2. Path analysis**—We tested a path model that encompasses mothers' contextual (i.e., the severity of childhood trauma, postpartum trauma, social support), and individual process (i.e., posttraumatic cognitions, shame, dissociation) factors to predict mothers' trajectory pattern (class membership from GMM). The demographic risk index was included as a controlling covariate.

**2.4.3. Child Outcomes Analyses**—To examine the links between mothers' trajectory patterns and child behavior problems, we conducted ANOVAs with mothers' trajectory class membership as a between-group variable and child internalizing, externalizing, and total problems scales as dependent variables.

**2.4.4. Missing Data**—In the GMM with three-parallel processes, models were estimated in *Mplus version 7.0* using FIML estimation, which is found to be a robust estimator of results when up to 50% of data are missing completely at random, even in very small samples (Graham, 2009). Of the 177 mothers who were included in the GMM, the following data were missing in the path model: 13 women (7%) for demographics, 73 women (41%) for posttraumatic cognitions, 89 women (50%) for shame, 67 women (38%) for dissociation, and 85 women (48%) for maternal-reported child behavior; further analyses revealed no significant differences between those who had the missing data and those who did not for any of the demographic risk variables (i.e., maternal education, age, marital status, minority status, and family household income;  $F_s = .35\text{--}1.97$ , all  $p_s < .05$ ). Given the elevated risk status of the participants, the sample was highly transient and hard to retain despite staff efforts. Reasons for missingness included unable to recontact (71%), not interested/too busy (18%), or moved away (11%).

### 3. Results

#### 3.1. Classifying Comorbid Depression and PTSD Trajectory Groups during Postpartum

Based on the recommended standards for GMM models and fit indices, the three-class solution was considered the best fitting model (AIC = 7681.5, 7678.5, 7669.2; BIC = 7786.3, 7805.5, 7818.5; SABIC = 7681.7, 7678.9, 7669.6; Entropy = .85, .66, .70; LMR-LRT  $p$ -value = .112, .649, .740; size of smallest latent class as a percentage = 12.9%, 13.5%, 4.6% for 2-, 3- and 4-class models, respectively). The trajectory patterns for the three classes, which fit with prior research, are presented in Figure 1. The GMM parameter estimates are presented in Table 2. ANOVAs and Chi-square analyses examining demographic risk differences by class membership yielded no significance (Table 3).

The first class represented 64% of the sample ( $n = 113$ ) and was labeled the *resilient* group. Despite having experienced childhood trauma, these mothers showed the lowest levels of depression and of PTSD that remained stable from 4 months to 18 months postpartum. These resilient mothers showed relatively high diagnosis rates of PTSD (0–21%) and depression (11–21%) from 4-to-18-months postpartum time span, and reported a high

prevalence of lifetime PTSD diagnosis (51%) prior to pregnancy. The second class was labeled the *vulnerable* group (23%,  $n = 40$ ), as women in this trajectory group displayed low-to-moderate levels of depression and PTSD at 4 month postpartum, with a significant linear increase in depression symptoms until 12 months with a significant quadratic deflection whereas their PTSD symptoms remained stable. The *Vulnerable* mothers displayed high prevalence rates of PTSD diagnosis (22 – 52%) and depression (33– 69%) from 4-to-18 months postpartum, and 86% of these women met lifetime PTSD diagnosis prior to pregnancy. Further *Wald z* tests revealed that mothers in the resilient and vulnerable classes had similar levels of depression and PTSD at 4 months postpartum ( $p > .05$ ); and also showed similar rates of change in PTSD over time ( $p > .05$ ). However, the vulnerable mothers showed a significantly steeper increase in depression slope, relative to the resilient mothers ( $Wald z = -2.36, p < .01$ ). Finally, a third and smallest class, the *chronic high-risk* group, (14%,  $n = 24$ ) displayed the highest levels of both depression and PTSD with a significant decrease followed by an immediate increase at 12 months postpartum. These *chronic high-risk* mothers had the highest rates of PTSD (56–89%) and depression (30– 67%) diagnoses across the 4-to-18-month postpartum time span. In addition, 95% of these mothers had met diagnosis for the lifetime PTSD prior to pregnancy. Chronic high-risk mothers showed the early-onset depression and PTSD with the highest level of depression at 4 months, relative to the resilient group ( $Wald z = 2.66, p < .01$ ), and the highest level of PTSD starting at 4 months, relative to both the resilient and vulnerable groups ( $Wald z = 7.36, p < .001; z = -3.12, p < .001$ ).

It is of interest to note that overall across all the 3 groups (resilient/vulnerable and chronic-high) a total of 44 women met diagnosis of PTSD at 4 months postpartum. Of those 44 women, only 3 women indicated that the PTSD symptoms (and diagnosis) were de-novo induced by “child-birth trauma”; the remaining 41 women with PTSD at 4 month postpartum related their symptoms to “childhood-trauma” triggers and as exacerbation of their lifetime PTSD.

### 3.2. Predicting Trajectory Groups

A path analysis tested direct and indirect processes of contextual and individual factors predicting the trajectory classes, while controlling for demographic risk. Given that class membership as the dependent variable in the path model was a categorical outcome variable, we utilized a multinomial logistic regression approach designating the largest *resilient* group as the reference class (Figure 2). Descriptive statistics for all variables in the path model are presented in Table 4.

Path analysis revealed that mothers with severe childhood and postpartum trauma, negative posttraumatic cognitions, and greater dissociation had a significantly greater probability of being in the *chronic high-risk* group, relative to resilient mothers. Mothers with severe childhood trauma were more likely to be in the *vulnerable* group, relative to the resilient mothers. In addition to direct predictions, childhood trauma severity and low social support predicted posttraumatic cognitions, which in turn differentiated group membership. Postpartum trauma significantly predicted shame, but shame did not directly predict group trajectory pattern. Of note, the individual processes of shame, posttraumatic cognitions, and



dissociation were highly correlated to one another, as were childhood trauma severity and postpartum trauma.

To better appreciate the characteristics of the three trajectory groups, we conducted ANOVAs on all variables in the path model (see Table 4). The results revealed significant group differences on all variables in the model; childhood trauma ( $F(2,165) = 11.12, p < .001$ ), postpartum trauma ( $F(2,172) = 10.29, p < .001$ ), social support ( $F(2,172) = 5.42, p = .005$ ), shame ( $F(2,85) = 5.07, p = .008$ ), posttraumatic cognitions ( $F(2,101) = 8.00, p = .001$ ), and dissociations ( $F(2,107) = 6.39, p = .002$ ). Mothers in the *resilient* group reported less childhood trauma severity, less shame, less dissociation, and fewer posttraumatic cognitions, relative to those in the *vulnerable* and *chronic* groups. In contrast, mothers in the *chronic high-risk* groups reported significantly more postpartum trauma and less social support relative to the *vulnerable* and *resilient* mothers.

### 3.3. Mothers' Trajectory Group Membership Predicting Children's Outcomes

Lastly, we examined associations between mothers' membership in the three trajectory groups and children's problem behaviors at 18 months. Children of mothers in the *vulnerable* group showed higher levels of CBCL total ( $F(2, 89) = 3.18, p = .047$ ) and externalizing problems ( $F(2,89) = 2.75, p = .09$ ) than those of *resilient* mothers. Children of mothers in the *vulnerable* and *chronic high-risk* groups also had marginally higher levels of CBCL internalizing problems compared to children from *resilient* mothers. Finally, children whose mothers had the *chronic high-risk* trajectory showed marginally high levels of CBCL total problems compared to children of *vulnerable* and *resilient* mothers (see Table 5).

## 4. Discussion

The present study is the first to test simultaneously co-occurring longitudinal trajectories of postpartum depression and PTSD among mothers with childhood maltreatment histories. We found evidence for both, *heterogeneity* in trajectories and *co-occurrence* in change patterns, uncovering three distinct change patterns: a *resilient*, *vulnerable*, and *chronic high-risk group* of mothers across postpartum. None of the groups showed a crossing or major divergence of the co-occurring depression and PTSD symptoms, indicating a strong comorbid parallel trajectory course, and additionally, showing differential onset at which depression and PTSD symptoms peaked and then continued to increase, or decrease, or remain stable.

Our findings add to prior literature suggesting that for postpartum mothers with childhood trauma history depression and PTSD are highly comorbid and co-occurring in parallel; neither does depression "drive" PTSD, nor vice versa. Our finding of PTSD/depression co-occurrence supports prior work that highlights overlapping symptoms (Shalev et al., 1998) and similar predictors that drive onset of both disorders (O'Donnell, Creamer, & Pattison, 2004).

The distinct patterns of our three depression/PTSD trajectory groups are consistent with prior work by Campbell and colleagues (2007), who reported few postpartum trajectory groups for depression; a low-risk, a moderate increasing, and a high-chronic group with

postpartum depression symptoms. We too found three distinct patterns of comorbid trajectories, with clear membership predictions based on pre-existing risk.

Surprisingly, the majority (64%) of our childhood trauma survivor mothers showed a resilient pattern, that is, despite historical childhood adversity their levels of PTSD/depression symptoms as a group were moderate over time. These resilient mothers showed, however, relatively high PTSD diagnosis rates of PTSD 4-to-18 months postpartum time span, and a high prevalence of lifetime PTSD (51%) prior to pregnancy, which resembles more at-risk economically disadvantaged community samples (Kim, Harrison, Godecker, & Muzyka, 2014). Similarly, their depression rates were comparable with the overall general population risk of 10–20% (Gavin et al., 2005). Thus, we found that a substantial group of women with childhood trauma histories are, contrary to expectation based on prior work (Lev-Wiesel et al., 2009), quite resilient to postpartum mental health problems, and show postpartum rates of depression and PTSD comparable to the broader community population. It is possible that our finding of these childhood trauma survivor mothers' resiliency evinces the protective role of posttraumatic growth in the resilient trajectory patterns.

Approximately a quarter of the childhood maltreatment survivor mothers (23%) displayed moderate levels of comorbid depression and PTSD across postpartum (*vulnerable* group), with some divergence in PTSD and depression symptoms over time. Whereas depression symptoms showed a significant nonlinear increase after 12 months postpartum, PTSD symptoms remained stable at a moderate level. This pattern of symptom divergence may reflect the episodic nature of depressive disorders (Solomon et al., 2000) and may be observable in the *vulnerable* group (as opposed to *chronic-high* group) because women in the vulnerable group were less chronically impacted by postpartum trauma allowing for natural symptom fluctuations. We speculate, that *vulnerable* mothers may be more susceptible to distress based on child-specific stressful events as their babies' developmentally shift toward greater independence at 12 months postpartum (i.e., greater locomotion), which may be reflected more accurately in self-ratings on depression than PTSD.

Finally, the smallest and most impacted group of survivor mothers (14%; *chronic-high* group) showed early-onset high depression and PTSD symptoms, which stayed high over the entire postpartum period. These mothers showed high levels of contextual adversity, with over 30% of them being in the lowest income bracket (<25k) and almost half being single, both factors potentially contributing to their symptoms due to lack of partner support. This *chronic-high* group highlights that cumulative economic stressors may interfere as women attempt to manage the care of a young infant. These *chronic-high* mothers, not surprisingly, also had the highest rates of PTSD and depression diagnoses across the 4-to-18 months postpartum time span. In addition, 95% of these mothers had met diagnosis for the lifetime PTSD prior to pregnancy, supporting previously reported notion that lifetime PTSD is a major risk factor for reoccurrence of PTSD symptoms in postpartum (Breslau, Peterson & Schultz, 2008; Muzik et al., 2016). PTSD often exhibits chronic course with fluctuating symptom severity that can be exacerbated by re-exposure to traumatic/stressful events (Breslau & Peterson, 2010). Thus, particularly the mothers with highest prevalence rates of

lifetime PTSD (95% in *chronic-high* and 86% in *vulnerable* group) may have been at increased risk for re-emergence of PTSD symptoms postpartum.

With respect to mechanisms predicting the distinct comorbidity trajectories, we confirmed several contextual and individual factors that shaped the trajectory patterns over time among these trauma survivor mothers. Severe childhood trauma, more postpartum traumatic events, low social support, and distressing individual processes (such as dissociation, shame and posttraumatic cognitions) significantly differentiated the *vulnerable* and *chronic-high* group mothers from the *resilient* mothers. These results are consistent with prior studies demonstrating how childhood trauma shapes early maladaptive schemas (Lumley & Harkness, 2007), creating a propensity for negative cognitions. Negative posttraumatic cognitions, in turn, increased the odds of having high, chronic levels of PTSD and depression (Zalta et al., 2014). Although social support did not directly differentiate the trajectory patterns, it was indirectly associated, such that, higher social support buffered negative cognitions. Dissociation significantly predicted membership to the *chronic high-risk* group, consistent with prior studies (McCanlies, Sarkisian, Andrew, Burchfield, & Violanti, 2014). Interestingly, trauma effects were indirectly related to dissociation via posttraumatic cognitions and shame. Prior work has highlighted the connection between these interrelated individual processes (Talbot, Talbot, & Tu, 2004), which is not surprising given the overlapping underlying negative self-bias of all three processes. Inconsistent with prior literature, there were no direct effects of shame on comorbid depression/PTSD (Harper & Arias, 2004). Shame in the current analyses was about the childhood trauma, whereas dissociation, and posttraumatic cognitions were regarding broader symptoms levels, suggesting shame influences trajectories “via” these broader processes rather than directly impacting the trajectories.

Finally, this study yielded novel findings that mothers’ comorbid depression and PTSD trajectory patterns were associated with these mothers’ ratings of children’s behavioral adjustment. As expected, children of *vulnerable* mothers reported their children having higher levels of externalizing and total problem behaviors, compared to the *resilient* mothers’ ratings of their children’s problem behaviors. It may be that, as discussed in the PTSD and depression literature, young children may act out aggressively in attempts to gain attention in response to maternal non-responsiveness in the face of maternal mental illness (Shaw & Vondra, 1995). Alternatively, mothers with more severe depression and PTSD during postpartum may also engage in less optimal or harsh parenting behaviors that exaggerates children’s externalizing problem behaviors over time (Cummings & Davies, 1994). It is also plausible that mothers with more severe depression and PTSD during postpartum may perceive their children as having higher levels of problem behavior. Additional research is clearly required to better understand the influence of mothers’ comorbid postpartum depression and PTSD on child outcome using objective measures such as clinical diagnoses and observations. Surprisingly, there was only marginal contrast in the expected direction between children of mothers in the *resilient* versus *chronic high-risk* group on internalizing and total problems. This may have been due to the low power from the small subsample size or because mothers with depression and PTSD show an under-or over-reporting bias regarding their children’s behavior problems (Chilcoat & Breslau, 1997).

#### 4.1. Strengths and Limitations

Although there are several strengths, including a simultaneous investigation of both depression and PTSD trajectories and a process-oriented path analysis using the sample with an adequate power, there are also several limitations. First, the study sought to examine the comorbidity of psychopathology among vulnerable mothers with childhood trauma history as they made the postpartum transition. Thus, generalizability is limited given the unique populations of women with childhood trauma history and elevated demographic risk (i.e., minority and income risk). Given the measures were mothers' self-report, future studies would benefit from objective measures of trauma (verified cases), support, and child outcomes (clinical diagnoses, observations). Maternal mental health treatment is a potential confounding variable not assessed. Although our sample size likely exceeds necessary lower bounds, larger sample size may increase power to detect further group differences.

#### 4.2. Clinical Implications

Our study highlights that there are parallel, comorbid trajectories of PTSD and depression across postpartum, suggesting that assessment should be equally focused on PTSD and postpartum depression for mothers with histories of childhood trauma. Current standardized care protocol is to assign and focus treatment on a "primary" diagnosis (Clayton, 1990). With clinical and research focus heavily on postpartum depression, comorbid PTSD may be unduly ignored. In fact, recent intervention efforts on the treatment of comorbid depression and PTSD (Aderka, Gillihan, McLean, & Foa, 2013) found that focused reduction in PTSD symptoms resulted in subsequent reduction in depressive symptoms, more than vice versa. While previous assumptions have been that the postpartum period is a phase of 'normative vulnerability, adjustment, and adaptation' (Karney & Bradbury, 1995), during which symptoms naturally subside, these assumptions may not be met in higher risk contexts. Particularly, among mothers with highest prevalence rates of lifetime PTSD (such as the *chronic-high* and *vulnerable* group) there may be an increased risk for re-emergence of PTSD symptoms postpartum. Thus, diagnostic screening for lifetime PTSD during peripartum should be a standard-of-care.

Additionally, the present study sheds light on targeting specific contextual and individual factors to ameliorate mothers' depression and PTSD trajectories as these factors have clinically meaningful impact on treatment seeking (Stige, Træen, & Rosenvinge, 2013) and outcomes (Sayin, Candansayar, & Welkin, 2013). Interventions targeting social support, post-traumatic cognitions, dissociation and shame may aid in increasing mothers' coping (for a review see Keeshin & Strawn, 2014; Oktedalen et al., 2014) via Interpersonal Therapy (Grigoriadis & Ravitz, 2007), Cognitive Processing Therapy (CPT; Resick et al., 2008), and Dialectical Behavior Therapy (DBT; Harned, Korslund, & Linehan, 2014; Neacsiu, Lungu, Harned, Rizvi, & Linehan, 2014).

Finally, this study confirms the potential detrimental impact of high maternal symptom load on child outcomes. Prior literature suggested mediation through mothers' bonding and parenting impairments (Chemtob et al., 2010; Chemtob, Gudiño, & Laraque, 2013; Muzik et al., 2013) or mothers' distorted attributions towards their children (Schechter et al., 2015). Maternal receipt of effective and evidence-based interventions for depression and PTSD

symptoms, that also address these parenting challenges (e.g., Muzik et al., 2015; Schechter et al., 2015), may disrupt intergenerational patterns of risk transmission and prevent emergence of elevated child behavioral problems.

## Acknowledgments

This research was conducted at the University of Michigan supported by the National Institute of Health-Michigan Mentored Clinical Scholars Program awarded to M Muzik (K12 RR017607-04, PI: D. Scheingart); the National Institute of Mental Health -Career Development Award K23 (NIH, PI: Muzik); and the Michigan Institute for Clinical and Health Research (MICHHR, UL1TR000433, PI: Muzik). The authors have no financial disclosures to make.

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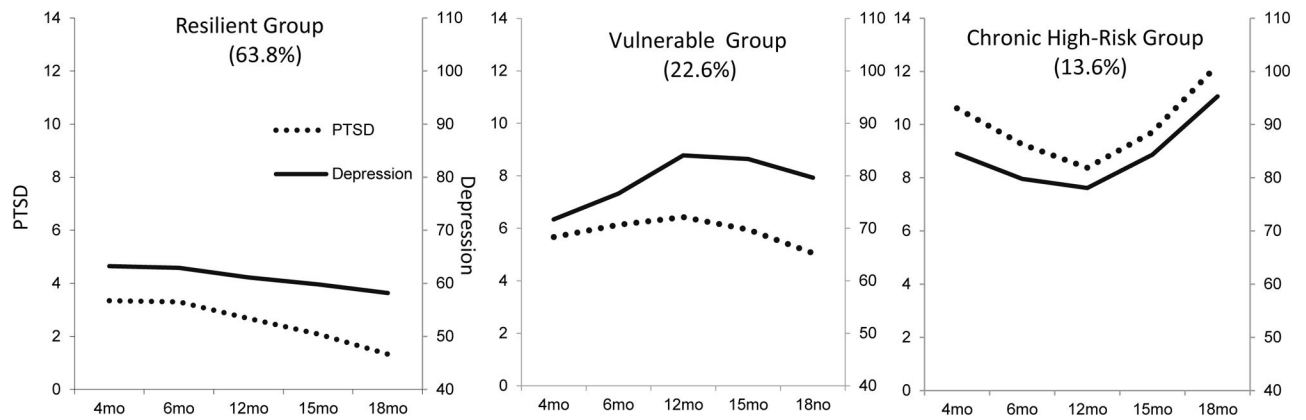
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**Highlights**

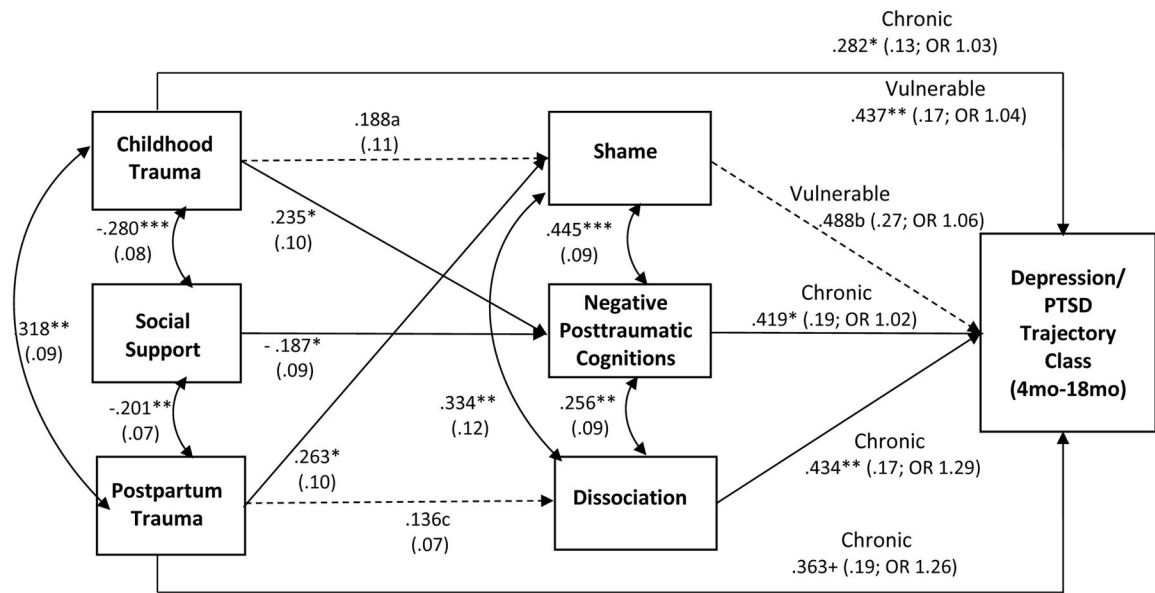
- Strong comorbidity of postpartum depression and PTSD trajectories is observed among mothers with childhood trauma history
- Trajectories of comorbid depression and PTSD showed heterogeneity in the onset, changes patterns over time, identifying the resilient, vulnerable and chronic high---risk groups.
- Processes of individual and contextual factors predicted the distinct trajectory patterns.
- Comorbid psychopathology of postpartum mothers evinces its aversive impact on their child adjustment.



**Figure 1.**

Fitted mean trajectories for 3-class model Growth Mixture Model with two parallel processes. Left Y axis: PTSD; Right Y axis: Depression. Resilient Group  $n=113$ ; Vulnerable Group  $n=40$ , 22; Chronic High-Risk Group  $n=24$ .





**Figure 2.**

Multinomial path model predicting mothers' comorbid trajectory class membership (*resilient* class as reference). Standardized parameter estimates with standard errors in parentheses shown. Demographic risk index was included as covariate. OR = Odds Ratio. Solid lines represent significant paths at  $\alpha = .05$ ; dashed lines represent marginally significant paths at  $\alpha = .10$ ; non-significant paths omitted for ease of presentation.

+  $p = .05$  \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ ; a  $p = .08$ , b  $p = .07$ , c  $p = .06$

**Table 1**

Demographic Characteristics of the Sample (n=177)

| Characteristic       | Category                         | % (Mean, SD) |
|----------------------|----------------------------------|--------------|
| Maternal Age (years) |                                  | (29.0, 5.9)  |
| Race                 | Caucasian                        | 53.7         |
|                      | African American                 | 30.9         |
|                      | Asian                            | 6.2          |
|                      | Hispanic                         | 3.5          |
|                      | Biracial                         | 2.5          |
|                      | Native American                  | 0.6          |
| Marital Status       | Other                            | 2.5          |
|                      | Partnered                        | 73.7         |
|                      | Single                           | 26.3         |
|                      | High School Diploma or Less      | 14.0         |
| Education            | Some college/AA/Technical Degree | 37.5         |
|                      | Bachelor's degree or higher      | 48.2         |
|                      | <\$25,000                        | 31.1         |
| Household Income     | \$25,000–49,999                  | 22.2         |
|                      | >\$50,000                        | 46.6         |

*Note.* SD = standard deviation. Sample size varies slightly due to missingness or refusal to answer.

**Table 2**

Parameter Estimates and Standard Errors for GMM Fixed Effects

| Parameters      | Resilient<br>(n=113)       |                             | Vulnerable<br>(n=40)         |                             | Chronic<br>(n=24)            |                              |
|-----------------|----------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|------------------------------|
|                 | Dep                        | PTSD                        | Dep                          | PTSD                        | Dep                          | PTSD                         |
| Intercept       | 63.235 <sup>*</sup> (2.81) | 3.347 <sup>***</sup> (0.45) | 71.685 <sup>***</sup> (7.11) | 5.668 <sup>***</sup> (1.32) | 84.532 <sup>***</sup> (7.49) | 10.617 <sup>***</sup> (0.88) |
| Linear Slope    | -0.266 (1.43)              | 0.008 (0.32)                | 5.597 <sup>**</sup> (2.03)   | 0.557 (0.47)                | -5.813 <sup>*</sup> (2.26)   | -1.617 <sup>***</sup> (0.36) |
| Quadratic Slope | -0.65 (0.18)               | -0.040 (0.04)               | -0.637 <sup>*</sup> (0.27)   | -0.092 (-0.07)              | 1.05 <sup>*</sup> (0.42)     | 0.264 <sup>***</sup> (0.06)  |

Notes. Standard errors in parentheses.

Dep = Depression.

Depression intercept random variance est. = 345.65,  $SE = 64.856$ ,  $p < .001$ ; Depression linear slope random variance est. = 3.575,  $SE = 1.65$ ,  $p < .05$ ; Depression nonlinear slope random variance was constrained as 0. PTSD intercept random variance est. = 7.932,  $SE = 2.06$ ,  $p < .001$ ; PTSD linear slope random variance est. = .06,  $SE = .05$ ,  $p > .05$ ; PTSD nonlinear slope random variance was constrained as 0.

<sup>\*</sup>  $p < .05$ ,

<sup>\*\*</sup>  $p < .01$ ,

<sup>\*\*\*</sup>  $p < .001$ .

**Table 3**

## Participant Demographic Risk by Comorbid Trajectory Class Membership

| Demographics            | Resilient ( <i>n</i> =113) |      | Vulnerable ( <i>n</i> =40) |      | Chronic ( <i>n</i> =24) |      | ANOVA/ $\chi^2$ | <i>p</i> |
|-------------------------|----------------------------|------|----------------------------|------|-------------------------|------|-----------------|----------|
|                         | M (SD)                     | or % | M (SD)                     | or % | M (SD)                  | or % |                 |          |
| Mother Age              | 29.30(6.2)                 |      | 29.37(5.4)                 |      | 26.67(5.7)              |      |                 | .253     |
| < 22 years              | 10.3                       |      | 8.3                        |      | 20.0                    |      |                 | .460     |
| Education               |                            |      |                            |      |                         |      |                 |          |
| <= High School Degree   | 12.8                       |      | 13.9                       |      | 20.0                    |      |                 | .76      |
| Race                    |                            |      |                            |      |                         |      |                 |          |
| Not Caucasian           | 49.5                       |      | 37.5                       |      | 45.0                    |      |                 | .431     |
| Annual Household Income |                            |      |                            |      |                         |      |                 |          |
| <\$25,000               | 10.6                       |      | 11.1                       |      | 33.3                    |      |                 | .051     |
| Partner Status          |                            |      |                            |      |                         |      |                 |          |
| Not Partnered           | 24.1                       |      | 22.2                       |      | 46.7                    |      |                 | .154     |
| Demographic Risk Index  | .96 (1.16)                 |      | .86 (1.18)                 |      | 1.35 (1.42)             |      |                 | .331     |

Note. *n* varies with missingness

**Table 4**

Mean Scores and for Study Variables by Trajectory Group Membership

| Symptoms                 | Month | Time Point | Resilient ( <i>n</i> =113)<br>M (sd) | Vulnerable ( <i>n</i> =40)<br>M (sd) | Chronic ( <i>n</i> =24)<br>M (sd) | Group Comparisons<br><i>Post-hoc LSD</i> |
|--------------------------|-------|------------|--------------------------------------|--------------------------------------|-----------------------------------|--|
| PTSD                     | 4     |            | 3.09 (2.87)                          | 6.10 (3.47)                          | 11.04 (3.39)                      | R < V <sup>***</sup> < C <sup>***</sup>  |
|                          | 6     |            | 4.07 (3.93)                          | 7.24 (4.26)                          | 10.00 (3.85)                      | R < V <sup>***</sup> < C <sup>+</sup>    |
|                          | 12    |            | 2.59 (2.62)                          | 5.97 (3.17)                          | 7.87 (3.40)                       | R < V, C <sup>***</sup>                  |
|                          | 15    |            | 1.53 (1.64)                          | 6.17 (3.58)                          | 8.67 (4.36)                       | R < V <sup>***</sup> < C <sup>*</sup>    |
| Depression               | 18    |            | 1.36 (1.57)                          | 5.25 (2.23)                          | 12.22 (2.64)                      | R < V <sup>***</sup> < C <sup>***</sup>  |
|                          | 4     |            | 62.83 (19.60)                        | 75.23 (21.98)                        | 85.25 (30.20)                     | R < V <sup>***</sup> < C <sup>+</sup>    |
|                          | 6     |            | 62.78 (20.47)                        | 76.50 (25.45)                        | 75.45 (26.77)                     | R < C <sup>+</sup> , V <sup>***</sup>    |
|                          | 12    |            | 60.56 (18.02)                        | 81.03 (19.01)                        | 78.75 (33.80)                     | R < C <sup>*</sup> , V <sup>***</sup>    |
| Childhood Trauma         | 15    |            | 59.56 (18.03)                        | 86.65 (21.02)                        | 79.90 (32.06)                     | R < C <sup>***</sup> , V <sup>***</sup>  |
|                          | 18    |            | 56.53 (17.08)                        | 80.46 (20.60)                        | 91.22 (18.89)                     | R < V <sup>***</sup> , C <sup>***</sup>  |
|                          | 6     |            | 44.66 (14.68)                        | 55.51 (17.98)                        | 59.22 (21.27)                     | R < V <sup>***</sup> , C <sup>***</sup>  |
|                          | 6     |            | 1.89 (2.07)                          | 2.90 (2.83)                          | 4.63 (4.77)                       | R < V <sup>+</sup> < C <sup>*</sup>      |
| Postpartum Trauma        | 6     |            | 44.87 (27.52)                        | 52.05 (22.02)                        | 29.75 (26.19)                     | C < V <sup>***</sup> , R <sup>*</sup>    |
| Social Support           | 6     |            | 28.06 (10.32)                        | 36.00 (13.58)                        | 36.31 (13.57)                     | R < V <sup>***</sup> , C <sup>*</sup>    |
| Shame                    | 6     |            | 73.26 (28.84)                        | 92.61 (28.82)                        | 108.55 (49.30)                    | R < V <sup>***</sup> , C <sup>***</sup>  |
| Posttraumatic Cognitions | 6     |            | 9.97 (2.73)                          | 11.57 (3.16)                         | 13.00 (4.26)                      | R < V <sup>*</sup> , C <sup>***</sup>    |
| Dissociation             | 6     |            |                                      |                                      |                                   |  |

Note. Standard Deviation in Parentheses. mo = months. Sample size varies by time point. R = Resilient group. V = Vulnerable, C = Chronic High-Risk. Group comparisons indicate significant differences based on post-hoc LSD comparisons from ANOVAs.

<sup>+</sup>  $p < .10$ ,

<sup>\*</sup>  $p < .05$ ,

<sup>\*\*</sup>  $p < .01$ ,

<sup>\*\*\*</sup>  $p < .001$ .

Table 5

Mean Scores of Child Behavior Problems (CBCL) by Comorbid Trajectory Group

| CBCL          | Resilient     | Vulnerable    | Chronic       | Group Comparisons                  |
|---------------|---------------|---------------|---------------|------------------------------------|
| Internalizing | 6.28 (3.93)   | 8.57 (6.60)   | 9.78 (7.76)   | R < V, <sup>+</sup> C <sup>+</sup> |
| Externalizing | 11.75 (6.49)  | 15.33 (8.53)  | 15.33 (10.84) | R < V, * C                         |
| Total         | 28.68 (13.41) | 37.70 (21.20) | 39.44 (27.13) | R < V, * C <sup>+</sup>            |

Note. Standard Deviation in Parentheses. R = Resilient group, V = Vulnerable, C = Chronic High-Risk. Group comparisons indicate significant differences based on post-hoc LSD comparisons.

<sup>+</sup>  $p < .10$ ,  
\*  $p < .05$ ,  
\*\*  $p < .01$ ,  
\*\*\*  $p < .001$