

Emerging adulthood and prospective depression: A simultaneous test of cumulative risk theories

By: Joseph R. Cohen, Kari N. Thomsen, Anna Racioppi, Sergi Ballespi, Tamara Sheinbaum, [Thomas R. Kwapil](#), and Neus Barrantes-Vidal

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Abstract:

Past research indicates that a history of depression and exposure to abuse and neglect represent some of the most robust predictors of depression in emerging adults. However, studies rarely test the additive or interactive risk associated with these distinct risk factors. In response, the present study explored how these three risk factors (prior depression, abuse, and neglect) synergistically predicted prospective depressive symptoms in a sample of 214 emerging adults ($M_{\text{age}} = 21.4$ years; $SD_{\text{age}} = 2.4$; 78% females). Subtypes of maltreatment and lifetime history of depression were assessed through semi-structured interviews, and depressive symptoms were assessed annually for three years via self-report measures. The results indicated that for both males and females, a lifetime history of depression, abuse, and neglect-exposure uniquely conferred risk for elevated depressive symptoms. Furthermore, the interaction between neglect and prior depression forecasted increasing depressive symptoms, and a history of abuse also predicted increasing depressive symptoms, but only in females. These findings are contextualized within extant developmental psychopathology theories, and translational implications for trauma-informed depression prevention efforts are discussed.

Keywords: Maltreatment | Depression | Emerging adulthood | Longitudinal data analysis

Article:

Introduction

Emerging adulthood is a critical period within the developmental lifespan. It is an important time for self-discovery, as many individuals will live independently for the first time, attend college, begin a career, and engage in formal romantic relationships during this developmental stage

(Arnett 2014). Although traditionally viewed as a respite from earlier adolescent “storm and stress” (Galambos et al. 2006), for many, patterns of depressive symptoms persist or emerge during young adulthood (Reed-Fitzke 2019). As depression in emerging adulthood confers significant impairment and distress (Schwartz 2016), examining how pre-existing risk factors synergistically forecast emotional distress during this developmental stage is important from a translational perspective.

A history of depression (Kovacs et al. 2016) and exposure to childhood maltreatment (Liu 2017) are conceptualized as potent risk factors for depression in emerging adulthood. Both depression onset and maltreatment-exposure can cause developmental reorganizations (see Cicchetti and Toth 2009) that manifest in maladaptive cognitive styles (Gibb 2002; Monroe and Harkness 2005), impaired interpersonal networks (Liu 2017; Shih et al. 2018), and dysregulated biological stress response systems (Liu 2017; Hamilton and Alloy 2016) that leave one vulnerable to emotional distress across the lifespan. The presence of overlapping pathways suggests that once depression emerges in response to maltreatment, the depressogenic effects of these adversities may begin to fade. This position is supported by past research that posits the influence of external events on depression may be stronger in adolescence compared to adulthood (La Roque et al. 2014). However, the majority of studies suggest that past maltreatment-exposure forecasts depression outcomes independently of depression history during young adulthood (Liu 2017). These findings are consistent with a cumulative risk perspective (Gutman et al. 2019) in which depression history and past maltreatment exposure represent correlated, but unique, risk factors for depression in emerging adulthood. Understanding how intrapersonal (e.g., depression history) and environmental risk factors (e.g., exposure to maltreatment) combine to predict mental health across the lifespan is central to a developmental psychopathology approach (Smith et al. 2015) and necessary for informing prevention services for vulnerable individuals (Ialongo et al. 2015). Thus, the current approach is different from other research (e.g., Felitti et al. 1998), which uses a cumulative risk approach within the narrow context of childhood adversities.

There are two prominent theoretical models that explain how independent risk factors may confer depression risk in emerging adulthood. Most research assumes an additive framework, in which the number of risk factors corresponds to increased risk (O’Hara et al. 2015; Smith et al. 2015). This approach has been substantiated within multiple longitudinal studies examining the cumulative impact of risk factors from childhood and adolescence on depression in young adulthood (e.g., Chapman et al. 2004). The consequences of an additive model can be linear in nature or non-linear suggesting that multiple traumas may exacerbate or attenuate risk (i.e., a steeling effect; Hammen et al. 2000). Interactive hypotheses, meanwhile, test if additive risk is not merely incremental, but best understood within the context of other risk factors (Rosen et al. 2018). Pertinent to the present study, interactive hypotheses suggest that the impact of childhood maltreatment on future depression may vary on whether more proximal depression responses to maltreatment occurred. For instance, the onset of depression may elevate maltreatment-related negative cognitive styles (Gibb 2002), heightening depression risk. Alternatively, it is possible that risk factors linked with depression overlap to the point that maltreatment-exposure’s influence on emerging adulthood depression is best captured in the absence of past depression. This latter example is consistent with a “sleeper effect” (Vu et al. 2016) sometimes reported in the developmental trauma literature.

In order to conceptualize whether the relation between child maltreatment and depression history is additive or interactive, it may be critical to distinguish between maltreatment subtypes. Recently, McLaughlin (McLaughlin 2016; McLaughlin et al. 2014) and others (e.g., O'Hara et al. 2015) suggested differentiating between experiences defined by threat (e.g., abuse) and deprivation (e.g., neglect) as opposed to examining individual examples of adversity in isolation (e.g., multiple subtypes of abuse). According to the Dimensional Model of Adversities and Psychopathology (DMAP) model (McLaughlin 2016; Miller et al. 2018), experiences of threat result in disrupted regulation for fear-provoking stimuli whereas deprivation-exposure contributes towards underdeveloped cognitive maturation, and subsequent difficulties in learning. Differences in the "latent vulnerabilities" (McCrory et al. 2017) associated with abuse and neglect experiences may explain how certain maltreatment experiences are additive or interactive within the context of depression history. For instance, as neglect is associated with learning deficits (McLaughlin et al. 2017), it may be challenging for these individuals to be resilient following depression onset. Therefore, neglect may predict depression in young adulthood, especially for people with a history of clinical depression. Alternatively, as abuse confers risk via threat processing (McLaughlin et al. 2014) and depression is more linked with deficits associated with loss (Woody and Gibb 2015), the effects of each adversity may be independent, and best understood via an additive framework.

In addition to distinguishing between types of adversities, it may be critical to examine potential gender differences. Females are nearly twice as likely to experience depression beginning in adolescence due in part to increased sensitivity to stressors (Hankin et al. 2015). Yet, despite these robust findings, gender differences in response to maltreatment are less clear, with some research finding that females are more vulnerable (e.g., Hagbora et al. 2017), but other studies showing invariant results in response to maltreatment (e.g., Arnow et al. 2011; Cohen et al. 2019). Recent meta-analyses examining the effect of childhood maltreatment on adult depression reflects this ambiguity. For instance, the depression risk associated with exposure to physical and sexual abuse, while higher for females, was not significantly different compared to males (Gallo et al. 2018). Further, another meta-analysis initially found that the depressogenic effects of neglect-exposure, but not abuse-exposure, was higher in females compared to males. However, this finding was attenuated to marginal significance once accounting for study quality (Mandelli et al. 2015). Inconsistent findings may be due to different conceptualizations of adversity-exposure. For instance, a strength of the DMAP model is that it proposes more consistent patterns of specificity can be identified by taking a cumulative approach to experiences of threat and deprivation (McLaughlin 2016). Thus, by measuring the breadth of abuse and neglect experiences within respective indices, a more consistent pattern of findings may emerge as to whether females are uniquely vulnerable to either domain of child adversity.

Developmental trauma theories for adulthood depression can be difficult to test from a methodological perspective. Prior depression and adversities are typically measured using adversity and/or symptom checklists. However, using self-report inventories for retrospective assessments has two main limitations: (a) it does not provide information on the context in which the adversity or depressive episode occurs, and (b) these inventories may be uniquely subject to recall biases. These weaknesses may lead to *criterion contamination* (Garb 2003) as one's current mood may lead to over reporting of past adversities and distress (Hardt and Rutter 2004).

There are two ways to address this methodological issue. First, it is best to use semi-structured interviews for retrospectively assessing maltreatment (Thabrew et al. 2012) and past depression (Ingram et al. 2009). This may be especially critical for non-discrete forms of maltreatment (e.g., neglect), which may be particularly important for predicting depression in young adulthood (Infurna et al. 2016) but uniquely challenging to measure using self-report methods.

Second, prospective measurement of depressive symptoms can help determine the impact of past risk factors. Multi-wave, longitudinal studies are well-positioned to test whether the association between retrospective reports and depressive symptoms significantly weaken over time (i.e., regression to the mean; Barnett et al. 2005) possibly signaling criterion contamination at the first assessment. Multiple assessments during emerging adulthood can also help characterize how pre-existing risk factors impact depression at this developmental stage. For instance, it may be that prior depression and maltreatment exposure exert a chronic depressive effect during young adulthood. Alternatively, as maltreatment and prior depression impact maturational processes related to autonomy (e.g., trust, emotional regulation; Cicchetti and Toth 2009; Bifulco et al. 2002), these risk factors may predispose one to increasing symptoms as one navigates new developmental challenges. Multiple assessments paired with an appropriate longitudinal data analytic approach (e.g., hierarchical linear modeling), can explicate how prior depression and maltreatment impact the levels (i.e., intercept) and trajectory (i.e., slope) of depressive symptoms during this critical developmental stage.

The Present Study

The present study was conducted with a sample of emerging adults (ages 18–25). Semi-structured interviews for maltreatment-exposure (Lobbestael et al. 2009) and prior depression (First et al. 1995) were conducted at baseline, and an adult depression measure (Beck et al. 1996) was completed three times in a three year span. Both interactive and additive hypotheses concerning cumulative risk were explicitly tested. Overall, it was hypothesized that neglect would interact with both past depression and abuse, to predict elevated levels and increased trajectories of depressive symptoms. This hypothesis was supported by past research that demonstrated neglect may uniquely lead to impaired learning (McLaughlin 2016), and therefore, reduce growth and resilience in response to other domains of risk. Next, it was hypothesized that the effects of abuse and depression history would be best conceptualized as additive. This hypothesis is supported by past theoretical models that suggest that abuse and prior depression may differentially impact risk pathways leading to depression (McLaughlin et al. 2014; Woody and Gibb 2015). Finally, based on inconsistent findings for gender differences concerning the relation between adult depression and childhood maltreatment-exposure (e.g., Gallo et al. 2018; Mandelli et al. 2015), analyses concerning the moderating role of gender were considered exploratory in the present study.

Method

Participants and Procedure

The present investigation is part of the Barcelona Longitudinal Study of Schizotypy (BLISS; see Barrantes-Vidal et al. 2013), an ongoing longitudinal study examining risk for severe mental

illness. Participants were initially screened and recruited from undergraduate psychology courses at a Spanish university using measures of positive and negative schizotypy Relevant to the present study, positive schizotypy is correlated with clinical depression in young adults (Kwapil et al. 2008) and predicted the development of major depressive episodes in a ten-year longitudinal study (Kwapil et al. 2013). Furthermore, positive and negative schizotypy are associated with maltreatment history (Velikonja et al. 2015). Therefore, the present study oversampled emerging adults who scored one standard deviation above the cutoff on one of the screening measures to increase the variance associated with trauma-exposure and mental health outcomes in the sample (see Barrantes-Vidal et al. 2013 for more details). The final sample resulted in 214 emerging adults ($M_{\text{age}} = 21.4$ years; $SD_{\text{age}} = 2.4$; 47 males and 167 females), in which 123 (57%) of the participants had elevated scores on the schizotypy measures at the screening stage. Overall, 33.7% of emerging adults had at least one parent graduate from a university, while 80.4% of participants had at least one parent graduate from high school. Only 7.5% of participants reported being first generation immigrants, signaling the majority of participants were born in Spain. The average score on the global assessment for functioning scale (GAF; an assessment used in the larger study) was 86.53, suggesting the typical participant was functioning well across social, occupational, and school settings.

The present study consisted of three waves of data. At baseline, participants completed interviews for child maltreatment and lifetime depression history, as well as self-report measures of depression. Wave 2 (W2) occurred 17.2 months following baseline and Wave 3 (W3) occurred 15.8 months following W2. For these assessments, participants returned to the lab and completed depressive symptom inventories. Informed consent was obtained from all individual participants included in the study, and all procedures were approved by the host institution's institutional review board (IRB).

Measures

Lifetime history of depression. To assess lifetime history of depression, the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) Axis I disorders (SCID-I) depression module was administered at baseline. The SCID-I is a semi-structured interview for psychiatric diagnoses (Spitzer et al. 1992). The SCID-I is widely used and has good reliability/validity for assessing depressive disorders (Ventura et al. 1998; Sanchez-Villegas et al. 2008). In the current study, approximately 25% ($N = 54$) of participants reported a lifetime history of at least one major depressive episode.

Childhood maltreatment. The Interview for Traumatic Events in Childhood (ITEC), which evaluates sexual abuse, physical abuse, emotional abuse, emotional neglect, and physical neglect, was utilized to retrospectively assess past maltreatment experiences. ITEC is a semi-structured interview that assesses childhood maltreatment by following endorsements of adverse events with questions targeting contextual aspects of the experience (e.g., frequency, duration). The ITEC is designed to capture possible examples of maltreatment-exposure by asking behavioral specific examples of these subtypes, rather than asking participants if they experienced abuse or neglect. Questions on the ITEC include *you were hit with a stick or another object* (physical abuse), *you were verbally threatened* (emotional abuse), *there was no one in your family to defend you* (emotional neglect), and *you were not allowed to enter your house* (physical neglect).

Based on initial responses to these questions, and the frequency and duration of the events, the maltreatment experience is rated according to predefined answer categories that inform a composite score for each maltreatment subtype (Lobbestael and Arntz 2010). By comparison to other retrospective interviews (e.g., the Childhood Experience of Care and Abuse interview; Bifulco et al. 1994), the ITEC is more structured, such that interviewers merely have to score detailed and objective parameters of the events. The ITEC has demonstrated good internal reliability and is a valid indicator of adverse childhood events (Kremers et al. 2007).

Similar to past research with the ITEC (e.g., Cristóbal-Narváez et al. 2016), and consistent with developmental trauma models (e.g. McLaughlin 2016), physical and emotional neglect subscales formed a composite neglect score, and the physical and emotional abuse subscales to form an abuse composite score. As only 10 individuals endorsed sexual abuse (less than 5% of the sample), scores on this subscale were not included in the score or the analyses. As maltreatment is best conceptualized as a formative measure, as opposed to a reflective measure, traditional indices of internal reliability (e.g., Cronbach's alpha) are inappropriate (Bollen and Diamantopoulos 2017). Instead, qualitative assessments concerning the content of the questions and multicollinearity should be inspected (Diamantopoulos and Winklhofer 2001). Overall, the maximum variance inflation factor (VIF) items on both the abuse (VIF = 2.36) and neglect (VIF = 1.98) subscales were well below the cutoff of VIF < 10, suggesting that each item measured unique aspects of abuse and neglect in the present study.

Depressive symptoms. The Beck Depression Inventory (BDI) was used to assess depressive symptoms. The BDI includes 21 items rated from 0 (not present) to 3 (severe). Total scores for the BDI at baseline in the current study ranged between 0–33 ($M = 5.31$ $SD = 5.30$). The BDI is widely used and has good reliability/validity (Sprinkle et al. 2002). The BDI in the current study had excellent internal reliability ($\alpha = 0.86$ at baseline; $\alpha = 0.89$ at W2; and $\alpha = 0.90$ at W3).

Data Analytic Approach

Multilevel modeling was used to test the study's hypotheses. A random intercept mixed-level model (Singer et al. 2003) with an autoregressive heterogeneous Level 1 covariance structure was used for all analyses. Gender and age were entered as fixed effects to control for their influence on depressive symptoms. Models were initially created to establish the univariate relation between risk factors and depressive symptoms, and whether this relation varied as a function of gender. First, the influence of gender on depressive symptom trajectories (gender \times adversity \times time) and depressive symptom levels (gender \times adversity) were examined. If significant, relations were tested in males and females separately. If non-significant, relations were tested across the entire sample. For depressive symptom trajectories, if predictors varied as a function of time, post-hoc analyses were conducted to generate the predictive values for those exposed, and not exposed, to pre-existing risk factors and subsequently plotted on the y-axis as a function of time. Next, models tested the independent influence of risk factors on depressive symptom levels (i.e., risk factors entered as a main effect). If the interaction between time and risk factor was significant, but negative, models with depressive symptoms centered at the first and final time point were tested in an attempt to differentiate between a main effect and regression to the mean for the impact of risk factors on symptom levels.

Once the univariate relations were established, simultaneous models were examined. Specifically, models including three-way interactions (e.g., prior depression \times abuse \times time) were formed to predict depressive symptoms. If three-way interactions between prior depression and maltreatment were non-significant, variables as two-way interactions (e.g., depression history \times time and abuse \times time) were simultaneously entered and examined to see if both variables confer risk for increasing trajectories or elevated levels of depressive symptoms respectively. This process was then replicated for depressive symptom levels. If multiple predictors were significant, the relationship could be described as additive, as both variables confer unique variance in the absence of a significant interaction (Menon et al. 2018). As a final step, the linear nature of the relation between risk factors and depressive symptoms was examined. Specifically, the quadratic function of summed adversities, which were dichotomized as present (1) or not present (0) was entered as a predictor for depressive symptoms. If the quadratic function was not significant, it was tested whether the summed score exerted a main effect (Schilling et al. 2008). All analyses were conducted with SPSS 24.0.

Results

Preliminary and Missing Data Analyses

Descriptive statistics and bivariate correlations for all study variables are presented in Table 1. Of note, abuse, neglect, and depression history were associated with depressive symptoms at each wave. Next, the pattern of missing data was examined. Overall, 48% of the sample completed W2 ($N = 102$), and 87% of those that completed W2 also completed W3 ($N = 89$). Due to attrition across the approximate three years of the study, various approaches were taken to understand the nature of missing data in the study. First, correlation tables were formed to examine if any of the study's variables varied as a pattern of missingness. Overall, findings suggested that males ($r_s = -0.35, p < 0.001$) and emerging adults with a depression history ($r_s = -0.35, p = 0.05$) were more likely to miss follow-up assessments. All other bivariate correlations suggested there was no relation between the study measures and missing data ($r > 0.05$). In response to depression history correlating to the number of follow-ups missed, an interaction term was created to examine if the relation between depression history and current depressive symptoms and trajectories varied as a function of missing data (Hedeker and Gibbons 1997). The null hypothesis for this test suggests the relation between depression history and current depressive symptoms does not vary as a function of missing data. Findings suggested the interaction was not significant for predicting depressive symptom trajectories, $b = 1.46, SE = 4.11, t(125) = 0.36, p = 0.72$ nor levels $b = 0.02; SE = 0.82, t(205) = 0.02, p = 0.98$. Finally, the pattern of missing was examined using Little's Missing Completely at Random (MCAR) test, in which the null hypothesis suggests that data is missing completely at random. Age, abuse, neglect, and depressive symptoms were entered as continuous variables into the model, while gender and depression history were entered as categorical variables. Overall, findings suggested that this pattern of missing data did not vary as a function of any systematic pattern (i.e., the chi-square test for Little's MCAR was non-significant, $\chi^2(17) = 14.92, p = 0.60$).

As results concerning missing data analysis suggests that the pattern of data is not influential, two recommended methods that are robust for missing data were used for data analyses (Lang and Little 2018). First, data was imputed via the expectation maximization (EM) algorithm.

Next, analyses were conducted using maximum likelihood estimation (MLE). As these findings tend to produce similar results (Lang and Little 2018), for parsimony sake all results reported in the manuscript are with imputed data. However, it should be noted that all significant results were replicated using both approaches to missing data.

Table 1. Descriptive statistics for study variables

	Mean	SD	1	2	3	4	5	6	7
1. Abuse	4.88	6.30							
2. Neglect	3.11	5.41	0.45**						
3. Depress (BSL)	5.33	5.33	0.27**	0.19**					
4. Depress W2	6.17	6.80	0.44**	0.37**	0.52**				
5. Depress W3	5.64	6.59	0.39**	0.33**	0.54**	0.65**			
6. Past Depression	25% (<i>N</i> = 54)	0.30**	0.22**	0.31**	0.27**	0.42**			
7. Age	19.75	2.36	0.15*	0.13	-0.03	0.10	0.08	0.23**	
8. Sex			-0.11	0.04	0.01	0.00	0.16	-0.06	-0.23**

Note: Abuse = The physical and emotional abuse subscales of the Interview for Traumatic Events in Childhood (ITEC); Neglect = The emotional and physical neglect subscales on the ITEC. Depress = Scores on the Beck Depression Inventory (BDI). Baseline for the current study is Wave 2 of the larger study (Barrantes-Vidal et al. 2013). W2 and W3 are the two follow-up periods. Past Depression = Lifetime history of depression as determined by the Structured Clinical Interview for DSM-IV Axis I disorders (SCID-I) depression module. 25% reported a history of clinical depression

p* < 0.05; *p* < 0.01

Mixed-Level Modeling

First, it was examined whether any risk factor's relation with depressive symptoms varied as a function of gender. Overall, gender moderated abuse for predicting depressive symptom trajectories, $B = 0.11$; $SE = 0.05$; $t(231) = 2.40$, $p = 0.02$. All other findings were non-significant ($p > 0.05$). Thus, the impact of abuse was examined separately in females and males, and the effects of neglect and depression history across the sample. These results are presented in the top panel of Table 2. As shown, females with an abuse history exhibited an increased trajectory of depressive symptoms, whereas findings for males were non-significant. Neglect-exposure, meanwhile, predicted higher levels and increased trajectories of depressive symptoms. Finally, a history of depression corresponded to higher levels of depressive symptoms. Predicted levels of symptoms across these risk profiles are displayed in Fig. 1.

Table 2. Parameter estimates for independent and interactive models

	<i>B</i>	<i>SE</i>	<i>T</i>	<i>R</i> _{effect size}
<i>Independent models</i>				
Effects on depression trajectory				
Past Depression	2.71	1.04	1.01	0.07
Neglect	0.06	0.03	2.28*	0.15S
Abuse (males)	0.01	.03	0.22	0.03
Abuse (females)	0.10	.03	3.31**	0.24S
Abuse (all)	0.06	0.02	2.54**	0.17S
Effects on depression levels				
Past Depression	3.46	0.72	4.80**	0.31M
Neglect	0.33	0.06	5.94**	0.38M
Abuse	0.37	0.04	8.14**	0.49M

<i>Interactive models</i>				
Effects on depression Trajectory				
Dep × Neg	0.14	0.06	2.54**	0.17S
Dep × Abuse	0.03	0.05	0.70	0.05
Neg × Abuse	0.00	0.00	0.10	0.01
Effects on depression levels				
Dep × Neg	0.14	0.11	1.30	0.09
Dep × Abuse	-0.04	0.09	-0.46	0.01
Neg × Abuse	0.01	0.01	1.66	0.11S

Note: Past Depression/Dep = Past Depression = Lifetime history of depression as determined by the Structured Clinical Interview for DSM-IV Axis I disorders (SCID-I) depression module; Neglect/Neg = The emotional and physical neglect subscales on the Interview for Traumatic Events in Childhood (ITEC); Abuse = The physical and emotional abuse subscales of the ITEC; Depression Trajectory = The slope of scores on the Beck Depression Inventory (BDI); Depression Levels = Intercept for the BDI in multilevel models. Independent Models = Predictors entered independently; Interactive Models = Interactions between predictors are tested
 S = small effect size ($r_{\text{effect size}}$: 0.10–0.29); M = medium effect size ($r_{\text{effect size}}$: 0.30–0.49); L = large effect size ($r_{\text{effect size}} \geq 0.50$)

* $p < 0.05$; ** $p < 0.01$

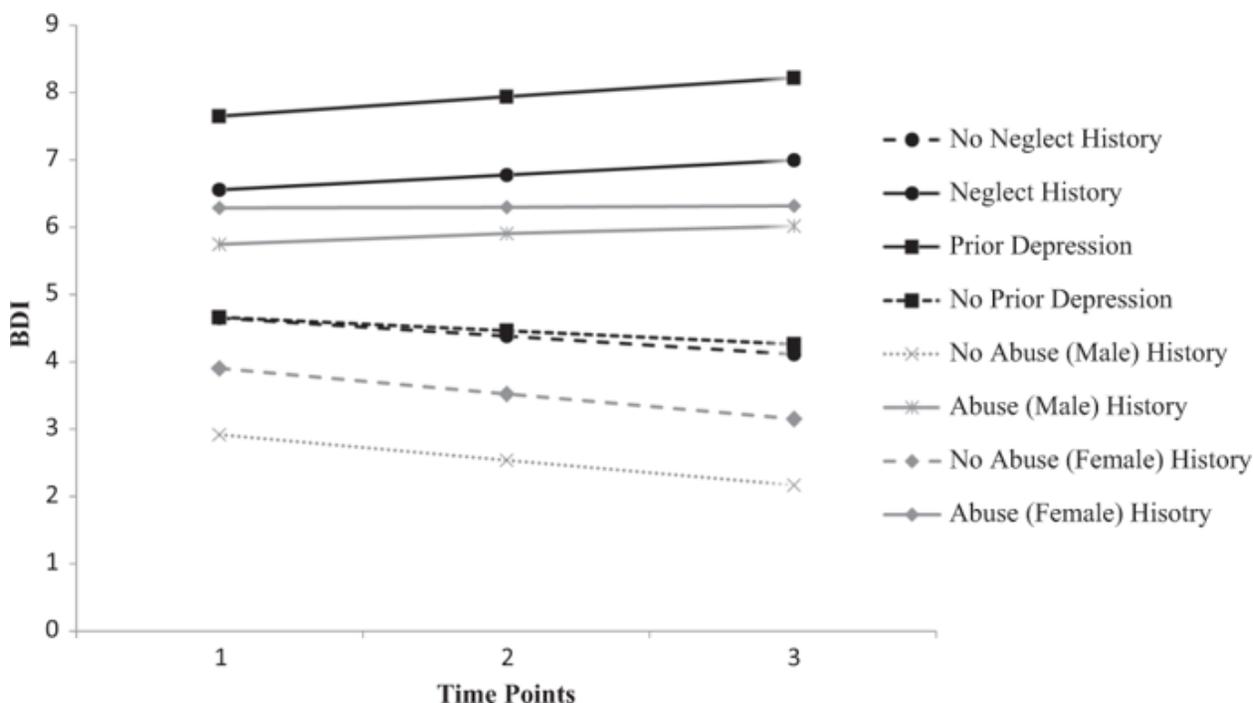


Fig. 1. Differences between the impact of subtypes of child maltreatment and prior depression on estimates depressive symptoms in emerging adults across 3 time points. Estimates are based on predictive values from hierarchical linear models. *Note.* BDI = Beck Depression Inventory (Beck et al. 1996); Time Points = years

Next, the interactive models were examined. No interactive models varied as a function of gender ($p > 0.10$). Overall, neglect interacted with depression history to predict depressive symptom trajectories, $B = 0.14$; $SE = 0.06$; $t(234) = 2.54$, $p = 0.01$. As shown in Fig. 2, individuals with a history of depression were only likely to experience an increasing symptom trajectory if they also had a history of neglect-exposure. No other interactive model was significant ($p > 0.10$).

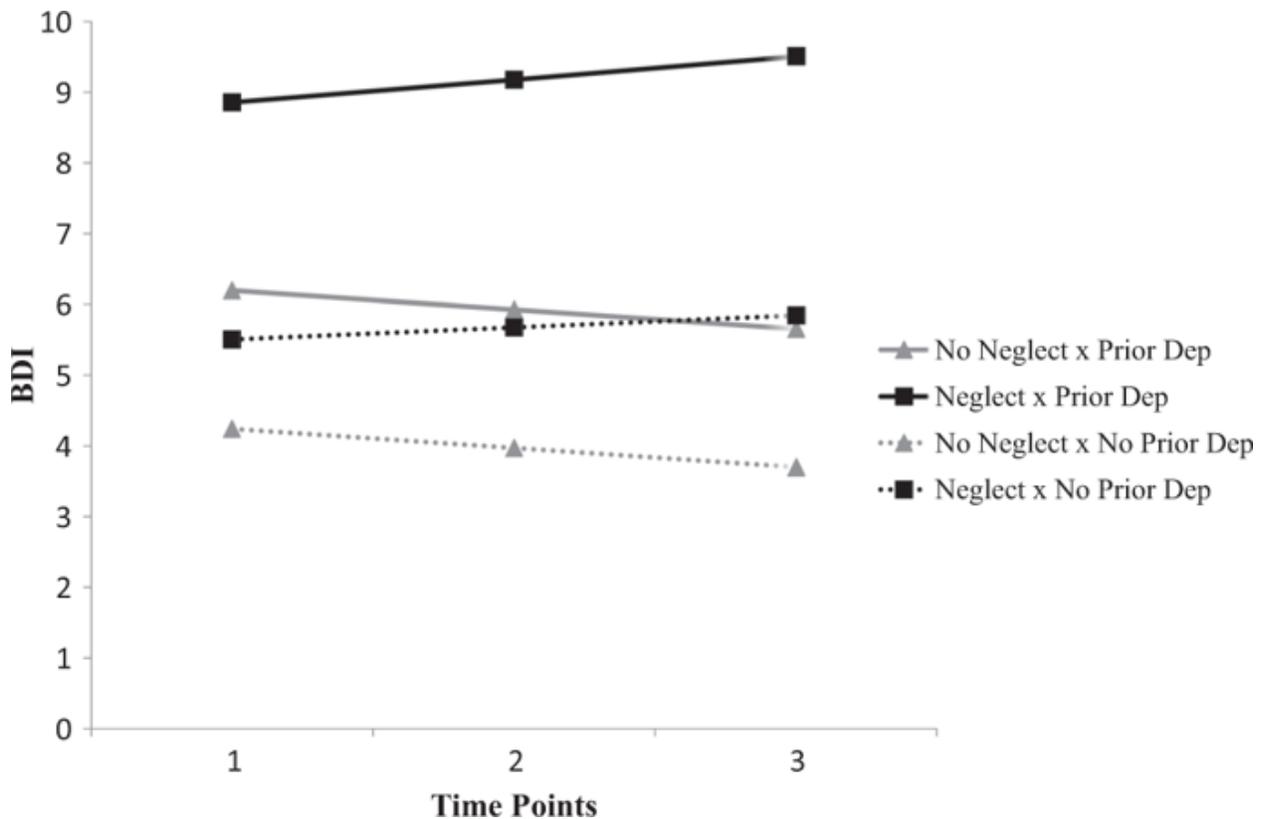


Fig. 2. Levels of estimated depressive symptoms in emerging adults across 3 time points as predicted by the interaction between histories of neglect and prior depression. Estimates are based on predictive values from hierarchical linear models. *Note.* BDI = Beck Depression Inventory (Beck et al. 1996); Time Points = years

Simultaneous models were next developed to determine whether the effects of each risk factor (or interaction term) may be additive (i.e., multiple adversities are significant), unique (i.e., one adversity is significant while the others are not), or shared (neither adversity is significant). As the effects on the depressive symptom trajectory of abuse were different for males and females, symptom trajectory models were tested separately. For females, both abuse, $B = 0.10$; $SE = 0.04$; $t(170) = 2.71$, $p < 0.01$, and the neglect-depression history interaction, $B = 0.15$; $SE = 0.07$; $t(170) = 2.36$, $p < 0.05$, maintained significance in the simultaneous model. Meanwhile, only the depression history-neglect interaction significantly predicted symptoms in males, $B = 0.33$; $SE = 0.12$; $t(47) = 2.68$, $p < 0.01$. For depressive levels, prior depression, $B = 2.14$; $SE = 0.64$; $t(210) = 3.33$, $p < 0.01$, neglect, $B = 0.18$; $SE = 0.06$; $t(210) = 3.16$, $p < 0.01$, and abuse, $B = 0.26$; $SE = 0.05$; $t(210) = 5.30$, $p < 0.01$, each conferred incremental risk.

Finally, it was tested whether the additive effects on symptom levels were linear or non-linear; specifically, that additional risk factors compound risk in a manner that is greater than the “sum of its parts” as evidenced by a positive quadratic term, or a “stealing effect” occurs in which the adversities have a diminishing impact, as evidenced by a negative quadratic term (Schilling et al. 2008). Overall, there was not support for the quadratic effect ($p > 0.05$) and it was

subsequently eliminated. It was tested whether the cumulative risk score, which was significant, $t(210) = 7.00, p < 0.001$, suggesting the effects are linear on depressive symptoms.

Supplemental Analyses

Overall, there was partial support for the hypothesis that neglect-exposure moderated the effects of other risk factors in predicting depression trajectories. Specifically, it was identified for depression history, but not abuse history. An alternative explanation may be that depression history and neglect-exposure interacted with each other to predict depressive symptom trajectories because a history of depression confers a more severe history of neglect-exposure. Thus, it was examined whether those with depression and those without depression varied in levels of neglect-exposure. Independent samples *t*-tests suggested that those with a history of depression did experience higher levels of neglect, $t(212) = -2.52, p = 0.01$, suggesting the possibility of a threshold effect for this significant interaction.

Discussion

An organizational model of development (Cicchetti and Toth 2009) is commonly used to explain how exposure to risk factors early in life can contribute to mental health outcomes at subsequent developmental stages. Yet, a limitation of this literature is that tests of incremental validity (Johnston and Murray 2003) or interactions between risk factors (Rosen et al. 2018) are rarely tested. As presenting with multiple risk factors for depression is the norm, not the exception, contextualizing how the risk associated with maltreatment and depression history exposure impacts an individual is critical for explaining depression risk in young adulthood.

In response to this gap in the literature, the present study tested the independent and interactive effects of maltreatment and depression history on prospective patterns of depressive symptoms in emerging adults. Overall, results indicated (a) independent effects for prior depression, abuse and neglect on depressive symptom levels (support for an *additive model*), (b) that abuse and the interaction between depression history and neglect forecasts increasing depressive symptom trajectories for females (support for both an *additive* and *interactive model*), and (c) depression history and neglect interacted to predict increasing trajectories of depressive symptoms for males (support for an *interactive model*). Below, these findings are considered within guiding developmental (e.g., Cicchetti and Toth 2009) and trauma (e.g., McLaughlin 2016) theories. Finally, the translational importance for cumulative risk models that include intrapersonal and environmental risk factors are discussed with regard to trauma-informed assessment protocols and depression prevention programming for emerging adults.

An additive model supports prior findings that maltreatment and prior mental history independently influence young adult mental health (Liu 2017), as well as that neglect and abuse may correspond to distinct “latent vulnerabilities” (McCrorry et al. 2017). Although emerging models of developmental trauma support the independent effects of abuse and neglect via unique risk pathways (McLaughlin et al. 2014), the concept of “scarring” (Post 1992), which is similar to the concept of “latent vulnerabilities”, is not integrated into these theories. Scarring hypotheses have received mixed support in the past within the depression literature; however, a recent re-conceptualization of the process maintains that the lasting consequences of a depressive

episode could leave one more vulnerable to prospective depressive symptoms (see Wichers et al. 2010). Alternatively, it could be that the pre-existing vulnerability that led to the initial depressive episode (e.g., rumination; Cohen et al. 2018b) uniquely contributes to subsequent emotional distress (Wichers et al. 2010). Regardless, these findings may suggest that factors associated with an affective pathway predict depressive symptoms during this developmental stage independent of maltreatment experiences.

The findings concerning an additive model for depression levels is congruent with several trauma-informed protocols. For example, the Adverse Childhood Experiences (ACE) study, sums the number of adversities experienced to generate a risk score (Felitti et al. 1998). The underlying assumption of this model is that each adversity incrementally corresponds to a heightened risk for maladaptive functioning. That gender did not moderate any symptom-*level* models, suggests taking a similar screening approach with males and females, and integrating intrapersonal risk factors (e.g., depression history), is warranted. Yet, while these screening protocols may be valid for identifying who may be in need of intervention, they may be limited for calibrating risk for prevention efforts. Specifically, primary screening protocols are best suited for targeting the risk factors responsible for an increasing trajectory of symptoms (Costello et al. 2008). For predicting problematic trajectories in young adulthood, an additive approach may not adequately address the interactive nature of risk factors, along with potential gender differences.

For both males and females, the interaction between neglect-exposure and depression history forecasted increasing symptoms. This was congruent with the study's hypotheses that due to the deficits in learning associated with neglect-exposure (McLaughlin 2016), youth with a history of depression may be less resilient later on in life. Although the significant interaction lends support to this hypothesis, it was also believed these same deficits would exacerbate the depressive effects of abuse, which was not found. One possibility for this null finding is that neglect may amplify the consequences of abuse for other forms of distress. For instance, childhood abuse is a risk factor for trajectories of anxiety, posttraumatic stress, and substance use in young adulthood (Norman et al. 2012).

An alternative rationale for these findings is that past depression reactions may serve as the threshold for neglect-exposure. This hypothesis was supported by supplemental analyses that found that a history of depression diagnoses was associated with significantly higher levels of neglect. From an organizational perspective, each developmental period is beset with its own salient tasks that youth have to learn and master (Cicchetti and Toth 2009). Therefore, neglect-exposed adolescents may be at-risk to experience depression as they struggle with emerging interpersonal challenges that are unique to adolescence (Rudolph and Flynn 2009). If these youth do not experience a depressive episode, it may indicate that neglect-exposure did not reach a level that impacts cognitive maturation and subsequent depression patterns, or that they had a sufficient number of buffering protective factors. These findings have interesting methodological implications, and suggest that using theoretically-informed retrospective external validity tests may be useful when assessing non-discrete forms of childhood maltreatment in which " sleeper effects" (Vu et al. 2016) may be counterintuitive. Importantly, however, they depart from a cumulative risk hypothesis (Smith et al. 2015) as it suggests that depression history is only incrementally valid because it helps communicate a qualitatively distinct form of neglect.

Finally, a history of abuse only predicted increasing symptoms of depression for women. Past research has been inconsistent concerning how the relation between maltreatment and depression varies across gender (e.g., Hagborg et al. 2017; Cohen et al. 2019). One reason support was found for gender differences in the present study, as opposed to past research, may have been that abuse and neglect were treated as discrete forms of adversities. Past meta-analytic research, for instance, when examining subtypes of abuse (i.e., physical and sexual abuse separately), found that females reported higher levels of depressive symptoms compared to men, but the finding did not reach statistical significance (Gallo et al. 2018). By examining subtypes of abusive experiences separately one is not measuring the breadth of shared threatening experiences, and important differences between threatening and deprivation experiences may be missed (McLaughlin 2016). Future research should investigate the depressogenic, dynamic pathways unique for abuse experiences that may make females more vulnerable within a DMAP framework. For instance, as threatening experiences are more closely linked to avoidant coping styles compared to deprivation experiences (McLaughlin 2016), rumination (a form of avoidant coping; Hilt and Nolen-Hoeksema 2013) may be uniquely linked to abuse experiences. In support of this hypothesis, exposure to abuse predicts a ruminative cognitive style (Paredes and Calvetes 2014) and the relation between abuse and depression is mediated by rumination in emerging adults (Raes and Hermans 2008). As of today, these relations have not been established with regard to neglect-exposure. Thus, as females are more likely to cope with stress via a ruminative coping style as an adult (Johnson and Whisman 2013), females exposed to abuse may be uniquely at-risk for increasing depressive symptoms in young adulthood.

The present study had several strengths, including its use of clinical interviews for assessing risk factors, and its multi-wave, longitudinal design. However, the study is not without limitations. First, study attrition existed across the follow-up period. Although multiple analytic approaches that are robust to missing data were utilized (e.g., EM, MLE) in response to this issue, it cannot be ruled-out that missing data impacted the final models. Thus, it is important for these findings to be replicated in other multi-wave longitudinal studies, especially gender difference findings due to the relatively small number of males ($N=47$) recruited for the study. Ideally, these studies will be conducted outside the context of a sample originally derived from a university sample to better understand whether these findings replicate across individuals transitioning from adolescence to adulthood.

Second, the study hypothesized that increases in depressive symptom trajectories were due to difficulties adjusting to developmentally salient tasks. Ideally, this hypothesis would be tested within a diathesis-stress model, in which increasing symptoms are in response to developmentally-relevant stressors (La Rocque et al. 2014). Third, a more comprehensive measure of a depression outcome, ideally clinical interviews that capture distress and impairment (McKnight and Kashdan 2009), should be used to better understand the impact of risk factors during this developmental period. Finally, the present study only examined variable-centered hypotheses (i.e., additive and interactive risk). However, a person-centered approach can also provide insight into the profile of risk factors most salient for depression-risk (see Newcomb-Anjo et al. 2017 for an example).

Conclusion

Emerging adulthood is a critical period within the developmental lifespan. For many, it will represent the first time living away from home, removing them from important networks of familial and peer support, and increased vulnerability to emotional distress (Arnett 2014). Thus, for settings that seek to promote the well-being of emerging adults (e.g., mental health clinics, universities), it is important for us to understand depression risk during this developmental stage. By simultaneously examining pre-existing maltreatment and depression-exposure using contextual interviews, the present study was able to provide a robust test of cumulative risk theory (Gutman et al. 2019), and provide insight into how integrative risk factors contribute to depressive symptom levels and trajectories in emerging adults. The integration of depression history into trauma-informed conceptualizations of depression has important clinical implications. In recent years, researchers have advocated that different interventions may be necessary for attenuating emotional distress that emerges specifically within the context of maltreatment-exposure (McCrory et al. 2017). These recommendations are largely based on findings that examine the psychobiological differences between depressed adults with and without a history of maltreatment (e.g., Teicher and Samson 2016), and propose different mechanisms of risk between the two patient groups. Yet, these studies do not include depression history in their explanatory models. Findings from the present study, specifically that a history of depression leads to additive risk for levels of depressive symptoms and exacerbates risk for increasing symptoms in emerging adults with a neglect history, suggest that depression history could confer unique risk for emotional distress during this developmental stage. Thus, integrating mental health history into risk algorithms that only query pre-existing environmental risk factors (e.g., the ACE Study; Feletti et al. 1998) and disentangling the mechanisms of risk stemming from depression history and subtypes of maltreatment-exposure, are important translational aims for future research. Given the impairment associated with depression during this formative developmental stage (Reed-Fitzke 2019) being able to operationalize and target risk in emerging adulthood has important implications in promoting well-being across the lifespan.

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Ethics declarations

Conflict of Interest. The authors declare that they have no conflict of interest.

Ethical Approval. This present study was conducted in compliance with the specific requirements of the United States and Spain for retrospective studies. All procedures performed in this study were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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