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Depressive Symptoms and their Association With Adverse Environmental Factors and Substance Use in Runaway and Homeless Youths

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Abstract

We used diathesis-stress and stress-sensitization models to determine whether family maltreatment, street-related traumatic events, stressful life events, and substance use were associated with depressive symptoms in runaway and homeless youths (RHY) in Los Angeles. Greater severity of depressive symptoms was significantly related to family maltreatment, being exposed to more traumatic stressors during homelessness, and current substance use compared to no substance use. Family maltreatment was also found to moderate the relationship between traumatic stressors and depressive symptoms. Importantly, cumulative exposure to the investigated risk factors at varying levels was associated with more severe depressive symptoms. Using a trauma-informed approach to screen for RHY at risk of depression may pave the way for secondary prevention of major depression in RHY.

Keywords

depression; runaway homeless youths; family maltreatment; trauma; substance use

The prevalence of major depressive disorder (MDD) varies between settings and populations; however, findings from cross-sectional and cohort studies have suggested that MDD is more prevalent among runaway and homeless youths (RHY) relative to housed youths (Bender, Ferguson, Thompson, Komlo, & Pollio, 2010; Tyler, Whitbeck, Hoyt, & Johnson, 2003; Unger, Kipke, Simon, Montgomery, & Johnson, 1997; Whitbeck, Hoyt, & Bao, 2000; Whitbeck, Johnson, Hoyt, & Cauce, 2004). The disorder has a lifetime prevalence of 16.6% among adults (Kessler et al., 2005) and 11.7% among adolescents (Merikangas et al., 2010). In cross-sectional studies of homeless youths in the United States, Bender et al. (2010) and Tyler et al. (2003) found that 30% of their samples met criteria for major depression. In a multisite longitudinal diagnostic study of homeless and runaway adolescents, Whitbeck et al. (2004) reported a lifetime prevalence of approximately 30% and concluded that this rate is two times higher than that found in the same-age general population. Another multisite cross-sectional study found that 23% of homeless adolescent boys and 39% of homeless adolescent girls experience depressive symptoms sufficiently severe to meet the diagnostic criteria for clinical depression (Whitbeck et al., 2000).

Depression in RHY is clearly of special concern; therefore, research to understand factors correlated with the development of depression in RHY is both necessary and beneficial to facilitating the development of preventive mental health programs for this vulnerable population.

The preponderance of depression in RHY might be attributable to exposure to environmental risk factors associated with MDD. MDD is recognized as a multifactorial disorder that results from the complex interplay among genetic and environmental factors, with 60% of the variance in the risk of developing the disorder explained by nonshared environmental factors (Sullivan, Neale, & Kendler, 2000). The evidence base for the relationship among experiential factors and environmental adversities and MDD in RHY is considerable. Studies have found that depression in RHY is associated with a history of family abuse (e.g., Bao, Whitbeck, & Hoyt, 2000), interaction with deviant peers (Bao et al., 2000), stressful life events (e.g., Votta & Manion, 2003), and street victimization (e.g., Whitbeck et al., 2000).

Although a host of factors can render RHY especially vulnerable to MDD, the focus of this study was the relationship between depression and environmental risk factors prevalent among RHY, namely family abuse, stressful life events, and traumatic experiences associated with street life. Family maltreatment is a common precipitating factor of early independence in RHY (Ferguson, 2009; Yoder, Whitbeck, & Hoyt, 2001). Moreover, exposure to traumatic stressors is a widely endorsed hazard of homelessness (Coates & McKenzie-Mohr, 2010). Street life also exposes RHY to multiple and prolonged stress stemming from the lack of basic necessities such as food, shelter, and safety (Coates & McKenzie-Mohr, 2010). Research has found that substance use is associated with exposure to adverse environmental events. The link between substance use and history of childhood maltreatment (Douglas et al., 2010) and exposure to traumatic stressors (Kilpatrick et al., 2003) is well documented. Considering the prevalence of trauma in RHY, this study also examined the relationship between substance use and depression.

Childhood Maltreatment

The relationship between childhood maltreatment and depression has been extensively investigated, with studies producing empirical evidence of an unequivocal link in adolescents and adults (Chapman et al., 2004; Heneghan et al., 2013). Given that the experience of maltreatment in their family of origin is a common contributory factor to leaving home among youths, the impact of family abuse on depression in RHY has been widely examined, with research finding that RHY who experienced abuse—physical, sexual, neglect, or some combination—by a family member reported higher levels of depressive symptoms (Ryan, Kilmer, Cauce, Watanabe, & Hoyt, 2000; Whitbeck et al., 2004). Additionally, the experience of family abuse increased the risk of later victimization (Tyler, Hoyt, & Whitbeck, 2000), and the impact of sexual victimization during homelessness on the development of posttraumatic stress disorder (PTSD) was greater in RHY who experienced sexual abuse in their family of origin (Whitbeck, Hoyt, & Yoder, 1999). Less is known, however, about whether the experience of family abuse amplifies the negative impact of exposure to other environmental adversities and precipitates the development of depressive symptomatology in RHY.

Traumatic Stressors

The effects of exposure to extreme traumatic stressors and subsequent development of MDD have been well documented. Kilpatrick et al. (2003) reported that 62% of a nationally representative sample of adolescents with PTSD had a concurrent MDD, suggesting that exposure to traumatic stressors is associated with heightened risk of not only PTSD but also MDD. Kilpatrick et al. (2003) also found that adolescents who had been physically assaulted were 2.2 times more likely to experience a major depressive episode as adolescents who had no exposure to such a traumatic stressor. In another study of adolescents, lifetime exposure to parental and community violence and other traumatic events significantly increased the likelihood of experiencing a major depressive episode by an estimated factor of 4.5 and 1.4, respectively (Adams et al., 2013).

Regarding the impact of traumatic stressors on RHY, findings from prior studies have highlighted the perils of street life by demonstrating an unequivocal link between exposure to life-threatening events during homelessness and depression (e.g., Whitbeck et al., 2004). A limitation of previous studies has been a focus on the impact of direct exposure to traumatic stressors, which involve threats to physical integrity indicated by physical or sexual victimization; less is known about the impact of indirect exposure to or witnessing traumatic events, which were the most common forms of exposure in our sample. In this regard, it is important to assess the influence of these traumatic stressors on the mental health of RHY.

Stressful Life Events

The diathesis-stress model, one of the prevailing explanatory theories for the pathogenesis of MDD and other severe mental illnesses, considers stress a precipitating factor among individuals with preexisting vulnerability (Hankin & Abela, 2005). This theory has prompted substantial research on the impact of experiential stress via the experience of negative life events on different facets of MDD (e.g., Johnson, Whisman, Corley, Hewitt, & Rhee, 2012). Longitudinal studies have found that experiencing stressful life events is significantly associated with the onset of MDD in adolescence and adults (Johnson et al., 2012; McLaughlin, Conron, Koenen, & Gilman, 2010).

A small body of research has investigated the association between stressful life events and depression in RHY, yielding inconsistent findings that could be attributable to differences in measurement (Unger et al., 1998; Votta & Manion, 2003). Unger et al. (1998) found that stressful life events germane to homeless youths (e.g., having an abortion and being admitted to a hospital for psychiatric treatment) were positively associated with depression, whereas Votta and Manion (2003) did not find stressful events that commonly affect adolescents (e.g., not doing well on an exam) to be associated with depression in a sample of homeless adolescent boys. Clearly, additional studies are needed to substantiate the intuitive hypothesis that the experience of more life stressors would be associated with more severe depressive symptoms in RHY.

Substance Use

Heavy substance use has been reported to be significantly more prevalent in RHY relative to housed youths (Ensign & Santelli, 1998). The self-medication theory posits that substances are used to alleviate distressful psychological symptoms (Khantzian, 1985). However, the converse of this theory has also been substantiated by research demonstrating that substance use during adolescence is a risk factor for later MDD (e.g., Hallfors, Waller, Bauer, Ford, & Halpern, 2005). Notwithstanding the temporal ordering of depression and substance use, we expected to find an association between increased substance use and more severe depressive symptomatology in RHY.

Conceptual Models

The ecological model considers elements in an environment to be agents in the etiology of mental disorders, therefore providing a useful framework for understanding the link between adverse environmental events and occurrence of depression in RHY (Bronfenbrenner & Ceci, 1994). The diathesis-stress model and the stress-sensitization model focus on more specific parameters in an environment that increase the risk of later development of psychiatric disorders. The diathesis-stress model suggests that among individuals with preexisting vulnerability, the risk of mental disorder increases with the level of stress exposure (Hankin & Abela, 2005). According to the stress-sensitization model, early exposure to severe adversities such as childhood maltreatment creates a diathesis. The model posits that the experience of childhood maltreatment could damage the neurobiological system, thereby precipitating a vulnerability to later psychopathology. In response to subsequent experiential stressors of lesser intensity, the damaged system prompts aberrant neurochemical responses that manifest as psychological distress (Hammen, Henry, & Daley, 2000; Slavich, Monroe, & Gotlib, 2011).

The diathesis-stress model posits that RHY with a history of childhood maltreatment, and thus increased exposure to higher levels of experiential stressors including stressful life events and traumatic experiences, are more vulnerable to the development of psychological distress than RHY with fewer adverse exposures. The stress-sensitization model suggests that the experience of childhood maltreatment moderates the effects of experiential stressors on the development of psychological distress. Both the diathesis-stress model and the stress-sensitization model acknowledge the biological consequences of substance use in exacerbating an aberrant neurochemical response to experiential stressors. Despite the popularity of these theories and the high prevalence of MDD and depressive symptomatology in RHY, to our knowledge these theories have not been explicitly applied to investigate RHY.

Study Aims and Hypotheses

Although considerable research has been devoted to delineating the correlates of depression in RHY, these studies have tended to focus on select environmental risk factors independently, rather than the association between exposure to multiple environmental risk factors and susceptibility to depression in RHY. With the exception of studies by Whitbeck

et al. (2000, 2004) that investigated the direct and combined effects of family abuse and street victimization, other studies have typically examined the single influence of family abuse (e.g., Bao et al., 2000) and to a lesser extent stressful life events (Votta & Manion, 2003). Given the literature on the negative effects of cumulative adversities on mental health (e.g., Chartier, Walkder, & Naimark, 2010) and that the majority of RHY are exposed to multiple types of adverse environments, we expected that youths with more exposures would have poorer mental health.

The aim of this study was to extend previous research by investigating the relationships among separate and cumulative environmental adversities (i.e., family maltreatment, traumatic stressors associated with street life, and stressful life events) and substance use, hereafter referred to as risk factors for depression, and severity of depressive symptoms in RHY. Although the experience of family maltreatment, particularly physical and sexual abuse, is considered a traumatic stressor, its association with depressive symptoms was assessed separately from other forms of trauma given the high prevalence rates in RHY and its unique and adverse effects on mental health.

Based on the diathesis-stress and stress-sensitization models, we tested the following hypotheses: (1) family maltreatment, traumatic stressors associated with street life, stressful life events, and substance use would be independently associated with more severe depressive symptoms; (2) the effect of experiential stressors including street-related traumatic experiences and stressful life events on severity of depressive symptoms would be greater for RHY with a history of family maltreatment; and (3) a dose-response relationship would exist between exposure to the investigated risk factors and severity of depressive symptoms in that more exposures would be associated with more severe depressive symptomatology in RHY. If confirmed, these results would provide evidence of the additive effects of environmental risk factors on susceptibility to MDD in RHY. These findings could facilitate the early identification of high-risk youths for preventive interventions that could preempt the disease progression and reduce the risk of chronic homelessness in RHY precipitated by psychiatric disability.

Methods

Sampling and Recruitment

Data for this study came from a convenience sample of 377 RHY aged 15 to 28 who participated in the first wave of a four-panel longitudinal study conducted in Los Angeles, California, designed to examine the impact of network ties on HIV risk-taking behaviors in RHY. Youths were eligible to participate if they met the following criteria: (1) were homeless or at imminent risk of homelessness as established by accessing services at one of two drop-in agencies selected for study involvement, and (2) ability to speak and write in English or Spanish. These drop-in agencies serve the largest number of homeless youths in their respective communities by engaging youths from a myriad of living conditions, and thereby served as gatekeepers to the RHY population. To be eligible for services, youths had to undertake an assessment administered by agency personnel to determine that they were homeless or were at imminent risk of homelessness, broadly defined as having no viable or stable residence. For this reason, every youth who was receiving services at either agency

was considered eligible for study participation based on the first criterion. This resulted in the recruitment of seven participants over the age of 25, of whom four were homeless before the age of 25 and three became homeless at the age of 26.

Youths were approached and invited to participate in the study by research staff members as they entered the agency for services (e.g., intensive case management services, meals, clothing). Eighty-three percent of eligible youths using services during the data collection period completed the interview. Two research staff members were consistently responsible for recruitment to prevent duplicate enrollment. The first wave of data collection ran from October 2011 to February 2012. Prior to any data collection, eligible participants were required to sign a study consent form. A waiver of parental consent was obtained for participants who were minors. After the informed consent process, participants were invited to complete a self-report research survey consisting of two parts: an audio computer-assisted self-interview (ACASI) and a face-to-face social network interview (F2F-SNI). The ACASI collected data on participants' sexual history and sex-related HIV risk behaviors, drug and alcohol behaviors, mental health, trauma history, homeless history, and living situation. The F2F-SNI, administered by master's-level and doctoral students and research staff members, collected data on the extent and quality of participants' social networks. Interviewers received approximately 40 hours of training on data collection. The informed consent process and research survey took approximately 90 minutes to complete and were conducted at the recruitment site or a public location in the agency neighborhood. Participants received a \$20 gift card for responding to the research survey. The study was reviewed and approved by the university's institutional review board.

Measures

Demographic characteristics collected for this study were age and gender. Gender was determined by asking participants whether they identified as male, female, or transgender (male to female or female to male). This variable was dichotomized into male (reference category) and female because no participants identified as being transgender.

History of family maltreatment was assessed with three self-reported items that asked participants whether they had ever experienced physical or sexual abuse in their family of origin: "Have you ever become homeless because you experienced physical abuse?" "Have you ever become homeless because you experienced sexual abuse?" and "Have you ever been hit, punched, or kicked very hard at home (do not include ordinary fights between brothers and sisters)?" The first two items came from a checklist adapted from a previous study by Milburn et al. (2009). The last item was drawn from the University of California, Los Angeles Posttraumatic Stress Disorder Reaction Index (UCLA-PTSD RI; Steinberg, Brymer, Decker, & Pynoos, 2004) and had three response categories: 1 (*no, this has never happened to me before*), 2 (*yes, this happened to me before I became homeless*), and 3 (*this happened to me since I have become homeless*). Respondents who answered affirmatively to at least one of the three items were coded as having experienced family maltreatment. Participants who had never experienced physical or sexual abuse comprised the reference group.

Traumatic stressors associated with street life were assessed using the UCLA-PTSD RI (Steinberg et al., 2004). Participants were asked whether they had experienced any of the following traumatic events during homelessness: (1) seeing a family member being hit, punched, or kicked very hard at home; (2) being beaten up, shot at, or threatened to be hurt badly in your town; (3) seeing someone in your town being beaten up, shot at, or killed; (4) seeing a dead body in your town; (5) having an adult or someone much older touch your private body parts when you did not want them to; (6) hearing about the violent death or serious injury of a loved one; and (7) being physically forced to have unwanted sex. We examined the relationship between two dimensions of traumatic stressors (categories and count) and severity of depressive symptomatology. Regarding categories, we generated four binary indicators representing traumatic events that were experienced during homelessness either directly involving physical (item 2) or sexual (items 5 and 7) violence, indirectly by hearing about a traumatic event involving a family member or close friend (item 6), or witnessing an event in person (items 1, 3, and 4). Each of the newly generated variables was dichotomized as 1 (*yes*) to represent participants who experienced at least one of the traumatic events within the category or 0 (*no*) to represent participants who did not experience any of the assessed traumatic events in the category. To generate a count of traumatic events experienced during homelessness, the items were summed to produce a composite score that ranged from 0 to 7, with higher scores reflecting higher levels of traumatic exposure. We did not investigate the influence of traumatic stressors prior to homelessness because the variable was strongly and significantly correlated with family abuse, $r(332) = .50, p < .001$.

Stressful life events were measured as a count of 12 dichotomous items related to the experience of major nontraumatic events that are prominent in the lives of RHY. It is important to note that there is no universally applied definition of stressful life events in the RHY literature. Findings from a small body of research have suggested that measuring events that are commonly experienced by RHY is not only necessary but also beneficial to the development of prevention models for depression in this vulnerable population (Unger et al., 1998). Therefore, stressful events in the domains of physical health, jail or juvenile detention, educational achievement, family conflicts or adversities, and living circumstances were assessed. Participants were asked whether they had ever experienced the following: (1) tested positive for HIV or AIDS, (2) tested positive for a sexually transmitted infection or disease, (3) gotten pregnant or got someone pregnant, (4) got arrested, (5) got jailed, (6) were put on probation, (7) dropped out from school, (8) became homeless because of conflicts with parents, (9) became homeless because parents had financial problems, (10) became homeless due to differences in religious beliefs with parents, (11) became homeless due to sexuality or sexual identity, and (12) experienced literal homelessness for at least one night. We conceptualized stressful life events as the experience of major events that did not involve exposure to harm or threat to physical integrity to minimize collinearity with the variable of traumatic stressors.

Alcohol and substance use was assessed by asking participants how many times during the previous 30 days they used each of the following: alcohol, marijuana, methamphetamine, ecstasy, heroin, cocaine, prescription drugs, and a needle to inject illegal drugs. The response categories for all, except using a needle to inject illegal drugs, were *0 times*, *1 or 2 times*, *3*

to 9 times, 10 to 19 times, 20 to 39 times, and 40 or more times. For injecting illegal drugs, the response categories were 0 times, 1 time, and 2 or more times. Because the distributions had a severe right skew indicating no use or low levels of use, each of the items was dichotomized so that any use during the previous month, regardless of the frequency, was coded as 1 and no use was coded as 0. At the bivariate level, only methamphetamine, heroin, and injecting illegal drugs with a needle were significantly associated with severity of depressive symptoms, which is consistent with findings from a cross-sectional study that investigated patterns of drug use and depressive symptoms in RHY (Hadland et al., 2011). The dichotomized variables from the truncated list of substances (methamphetamine, heroin, and injecting illegal drugs) were then summed to derive a composite score, ranging from 0 to 3, which reflected the number of substances used during the previous month. Given the skewed distribution, this variable was further recoded as a categorical variable with three classifications: no substance use (reference category), use of one substance (monosubstance use), and use of two or more substances (polysubstance use). The mean severity of depressive symptoms was compared across the three categories to determine whether participants who reported monosubstance or polysubstance use were associated with more severe symptomatology compared to participants with no substance use.

Severity of depressive symptoms was measured using the shortened Center for Epidemiological Studies Depression Scale (CES-D10; Radloff, 1977). The CES-D10 has been shown to have good psychometric properties with adolescents (Bradley, Bagnell, & Brannen, 2010). The 10-item scale assessed the presence and frequency of the following experiences during the previous week: depressed mood, felt that everything was an effort, restless sleep, felt happy, felt lonely, felt that people were unfriendly, enjoyed life, felt sad, felt disliked by others, and difficulty initiating activities. Each item was rated on a 4-point Likert scale ranging from 0 (*less than 1 day or never*) to 3 (*5–7 days*). The items that assessed for positive affect, felt happy and enjoyed life were reverse coded. Guided by solutions generated using principal component factor analysis, we dropped items measuring positive affect (“I feel happy” and “I enjoy life”) and “I felt that everything that I did was an effort.” We reanalyzed the seven retained items and extracted one factor with an eigenvalue of 3.95. This factor had all seven items loading between .68 to .84 and explained 56.45% of the variance in the set of items. Given the improved internal consistency, the seven items were averaged to create a variable with an interval scale that ranged from 0 to 3, with higher scores reflecting more severe depressive symptoms. The mean, rather than the summation, of the items was computed to be consistent with the scale of the items and to minimize the number of cases that would have been excluded due to missingness from the CES-D10 items (Acock, 2012). By excluding the aforementioned three items, Cronbach's alpha for the scale improved from .80 to .86.

Statistical Analyses

Univariable analyses were conducted to derive descriptive statistics for the sample. Diagnostic statistics were calculated before and after the regression model was estimated to determine whether the data met the assumptions of multiple regression analysis. Frequency distributions and kernel density plots were generated to examine the normality of the variables' distributions. Bivariable correlations were calculated to assess the linearity of the

relationships between severity of depressive symptoms and the investigated risk factors. Following these regression diagnoses, multivariable ordinary least squares linear regression analyses were conducted to determine whether family maltreatment, stressful life events, traumatic exposures associated with street life (categories and count), and substance use were significantly associated with mean severity of depressive symptoms. Studies have documented that risk of depression increases with age (Saluja et al., 2004) and female gender (Garber, 2006); therefore, these demographic variables were included in the regression models as covariates to control for systematic differences in depression. Multivariable regression analysis was repeated with the separate addition of two interaction terms—between family maltreatment and stressful life events and between family maltreatment and count of traumatic stressors—to determine whether the relationship between stressful life events and traumatic stressors associated with street life and severity of depressive symptoms depended on family maltreatment. To check for multicollinearity, tolerance levels and variance inflation factors were generated. Normality of residuals was examined using kernel density plot and tested using the Shapiro-Wilk W test for normality, and diagnosis of heteroskedasticity was performed using White's test and the Breusch-Pagan test (University of California, Los Angeles Statistical Consulting Group, 2013). A priori two-tailed directional tests were performed with a significance level of $p < .05$. Analyses were performed with STATA 13.0 using data from participants who had complete information for all variables included in the analytic model ($n = 315$).

Results

Demographic and Clinical Characteristics

Table 1 provides the demographic information of the study participants. The average CES-D10 summative score for the sample was 11.08 ($SD = 6.69$, range = 0–30), which is above the suggested cutoff score of 10 for clinically significant depressive symptoms but below the more conservative score of 15 (Björgevinnsson, Kertz, Bigda-Peyton, McCoy, & Aderka, 2013; Bradley et al., 2010). The mean score of the seven items was 1.12 ($SD = 0.89$, range = 0–3), denoting that participants experienced the assessed depressive symptoms on average between 1 and 4 days during the prior week.

Prevalence of Environmental Risk Factors

Table 1 indicates that exposure to adverse environmental events was prevalent in this sample. Family maltreatment was reported by 50.43% of participants, with no significant gender differences ($\chi^2[1, 345] = 0.38$, $p = .54$). The majority of participants had been exposed to at least one traumatic stressor in their lifetime (75.86%), with an average of 1.52 exposures since leaving home ($SD = 1.75$). Female participants experienced significantly more traumatic stressors during homelessness than male participants (1.82 vs. 1.40, respectively; $t[340] = 2.01$, $p < .05$). Among those with traumatic exposures, the most commonly reported traumatic experience was witnessing an event that involved death or serious injury (42.90%). Additionally, gender differences were apparent for certain traumatic events; more girls than boys reported witnessing a family member being physically assaulted at home (23.08% vs. 14.51%, respectively; $\chi^2[1, 359] = 3.84$, $p = .50$), hearing about the violent death or serious injury of a loved one (38.61% vs. 25.59%, respectively; $\chi^2[1, 355] = 5.92$, $p < .05$),

experiencing sexual molestation (20.59% vs. 10.51%, respectively; $\chi^2[1, 359] = 6.41, p < .05$), and experiencing rape (26.92% vs. 5.10%, respectively; $\chi^2[1, 359] = 34.78, p < .001$). However, more boys than girls reported being physically assaulted or threatened with serious harm (27.45% vs. 16.67%, respectively; $\chi^2[1, 357] = 4.60, p < .05$).

The commonly encountered stressful life events in this sample included history of arrest, incarceration, probation, or some combination (78.14%); experiencing literal homelessness (63.66%); dropping out of school (36.12%); and family issues involving parental financial difficulties or conflicts with parents (36.12%). Male and female participants did not differ significantly in the number of stressful life events experienced (4.05 vs. 3.85, respectively; $t[375] = -0.89, p = .38$), but a significantly higher proportion of male participants reported a history of arrest, incarceration, probation, or some combination (80.09% vs. 70.19%, respectively; $\chi^2[1, 370] = 4.16, p < .05$).

Taking into account all assessed substances, polysubstance use was also prevalent in this sample (67.53%). The average number of substances used during the prior 30 days was 2.45 ($SD = 1.87$). The substances commonly used by the majority of participants were marijuana (73.24%) and alcohol (69.00%).

Bivariable Correlations

Table 2 shows that all independent variables were significantly correlated with depressive symptoms in the direction reported in previous studies and hypothesized in the conceptual model. These significant correlations suggest linearity between mean severity of depressive symptoms and the investigated risk factors.

Relative and Cumulative Effects of Risk Factors

As revealed in Table 3, when the set of risk factors was entered into the multivariable model, all except stressful life events were significantly associated with higher mean severity of depressive symptoms for a given age and gender (see Model 1). Experience of family abuse was significantly related to greater mean severity of depressive symptoms after allowing for the effects of gender, age, traumatic stressors, stressful life events, and substance use ($b = .26, t[314] = 2.42, p < .05$). Similarly, a higher count of traumatic stressors experienced during homelessness was statistically significant after controlling the effects of demographics and other risk factors ($b = .08, t[314] = 2.57, p < .05$). Regardless of levels of use, substance use compared to no use during the previous 30 days was also significantly associated with more severe depressive symptoms beyond the influence of demographics ($b = .32, t[314] = 2.54, p < .05$) and adverse environmental factors ($b = .44, t[314] = 3.00, p < .01$). The influence of stressful life events, however, was attenuated after allowing for the effects of family abuse, traumatic stressors, and substance use ($b = .04, t[314] = 0.98, p = .33$), but was statistically significant in the unadjusted model ($b = .10, t[363] = 3.57, p < .001$). Among the significant risk factors, polysubstance use exerted the greatest influence ($b^* = 0.17$), followed by exposure to traumatic stressors ($b^* = 0.15$).

When the associations between different categories of traumatic stressors and mean severity of depressive symptoms were examined in the multivariable model (see Model 2 in Table 3), only direct exposure to physical violence was statistically significant after controlling for

demographics and other environmental risk factors ($b = .40$, $t[299] = 3.05$, $p < .01$). The relationship between other investigated risk factors, namely family maltreatment and substance use, and mean severity of depressive symptoms remained statistically significant in this multivariable model that included the different categories of trauma.

Regarding the cumulative effects of the investigated risk factors, the estimated model also demonstrated a dose–response relationship. As seen in Figure 2, more exposures to the investigated risk factors were associated with higher mean severity of depressive symptoms. Specifically, participants with low levels of exposure—defined as the experience of family maltreatment, exposure to one traumatic event, experience of one stressful life event, and use of one substance—were predicted to experience depressive symptoms 1 to 2 days during the prior week on average. However, participants with higher levels of exposure—defined as the experience of family maltreatment, exposure to all assessed traumatic events and stressful life events, and polysubstance use—were predicted to experience depressive symptoms more than 3 to 4 days during the prior week on average.

Interaction Effects

Model 3 in Table 3 shows that family abuse moderated the influence of traumatic stressors ($b = .15$, $t[314] = 2.29$, $p < .05$). As the count of traumatic stressors increased, the rate of increase in mean severity of depressive symptoms was significantly greater for RHY with a history of family maltreatment than for RHY without past maltreatment exposure, keeping constant demographics and exposure to other risk factors. The influence of stressful life events on mean severity of depressive symptomatology, however, did not depend on family abuse ($b = .05$, $t[314] = 0.94$, $p = .35$).

Discussion

This study extended previous research by investigating the separate and cumulative relationships among multiple dimensions of adverse environmental factors, substance use, and severity of depressive symptoms in RHY. Compared to previous studies, the present study represents an investigation of a broader range of adverse environment factors that include family maltreatment, stressful life events, and traumatic exposure associated with street life. Overall, the hypotheses were confirmed. Regarding the influence of the investigated risk factors, we found that history of family maltreatment and higher levels of exposure to traumatic stressors during homelessness were independently associated with more severe depressive symptoms in RHY. Additionally, we found that direct exposure to traumas involving physical violence was significantly related to more severe symptomatology. Substance use was also associated with more severe depressive symptoms, with polysubstance use being related with greater severity of symptomatology than monosubstance use. Our results also lend support to the diathesis-stress and stress-sensitization models by showing that the influence of traumatic stressors on severity of depressive symptomatology was greater for RHY with a history of family maltreatment, indicating that the experience of maltreatment might have heightened vulnerability to the development of psychological distress. Importantly, our results confirmed the dose–response relationship between exposure to the investigated risk factors and severity of depressive

symptoms by demonstrating that RHY who had more exposures experienced more severe symptomatology than RHY with fewer exposures. Taken together, these findings indicate that adverse environmental conditions and substance use, and their cumulative effects, are important determinants of depression in this sample of RHY.

The finding that history of family maltreatment was significantly associated with more severe depressive symptoms is consistent with previous studies that measured family abuse as the experience of physical or sexual abuse (Bao et al., 2000; Whitbeck et al., 2004). Bao et al. (2000) found that family abuse exerted a direct effect on depressive symptoms in RHY even when controlling for gender, ethnicity, social support, and time spent homeless. In another study, Whitbeck et al. (2004) found a history of family abuse significantly increased the risk of clinical depression for RHY while controlling for other negative family characteristics; however, the effect of family abuse disappeared when history of street victimization, engagement in street risk behaviors, and extent of early independence were accounted for in the model, suggesting that the direct effects of family abuse on depression could be mediated by other environmental risk factors. Applying a similar definition as previous studies, we found that the experience of family maltreatment was directly associated with greater severity of depressive symptomatology beyond the influence of experiential stressors and substance use, thus underscoring the unique and robust effect of family abuse on the mental health of RHY.

Additionally, we extended the results of previous studies by demonstrating that the experience of family maltreatment amplified the negative effects of street-related trauma on depressive symptoms for RHY in that for a given number of traumatic stressors experienced, RHY who were victims of physical or sexual abuse in their family of origin reported more severe depression symptomatology compared to RHY who have never experienced physical and sexual abuse. According to the stress-sensitization model, this finding suggests that the experience of family abuse might have created a vulnerability to developing depression such that RHY with a history of family maltreatment were more susceptible to the negative effects of street-related trauma compared to RHY who had never experienced physical or sexual abuse. Findings from studies by Whitbeck, Hoyt, and Ackley (1997), Tyler et al. (2000), and Chen, Tyler, Whitbeck, and Hoyt (2004) offered an alternative explanation for the diathesis effect of family maltreatment by demonstrating that the experience of family abuse placed RHY on a trajectory for more negative street experiences that directly affected their mental health. In other words, RHY who experienced family abuse were more likely to be depressed due to their increased exposure to negative street experiences. However, our finding that family maltreated exerted a direct influence on depression beyond the influence of experiential stressors lead us to contend that the experience of family maltreatment may have precipitated a neurobiological vulnerability to depression in accordance with the stress-sensitization hypothesis.

Regarding the impact of traumatic experiences on depression in RHY, previous research has documented that more frequent street victimization involving experiences of physical and sexual assault was significantly associated with heightened risk of a major depressive episode (Whitbeck et al., 2000; Whitbeck et al., 2004). Our finding that greater severity of depressive symptoms was significantly associated with higher levels of traumatic exposure is

consistent with previous studies. A limitation of the extant studies has been a focus on the impact of traumatic stressors that involve threats to physical integrity; however, little is known about the influence of other forms of traumatic exposures delineated in the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013). We circumvented this methodological limitation by assessing indirect exposure, such as hearing about a traumatic event involving a family member or close friend or witnessing a traumatic event in person, and found that direct exposure to physical violence during homelessness was significantly associated with severity of depression symptomatology beyond other categories of trauma. This finding suggests that when considering the impact of trauma on the development of depression in RHY, it is important to consider the form of exposure. The finding that sexual violence was not significantly associated with more severe symptomatology is in contrast to findings from previous studies (e.g., Unger et al., 1997). Given that less than 18% of participants reported direct exposure to sexual violence during homelessness, it is possible that the small range in values limited the detection of a significant effect.

Despite our attempts to measure stressful life events that were commonly experienced by RHY, results from the present study did not support the hypothesis that the experience of more life stressors would be associated with more severe depressive symptoms in RHY. Although the variable was significant in the unadjusted model, it attenuated when the effects of other investigated risk factors were controlled, suggesting that the combined influence of family maltreatment, street-related trauma, and substance use eclipsed the impact of life stressors. The diathesis-stress model considers stress a precipitating factor in the development of mental health problems. Our findings indicate that it would be important to differentiate between the types of stressors when considering the function of stress in precipitating depression in RHY, given that traumas that involve the experience of physical or sexual abuse in an individual's family of origin and exposure to traumatic stressors during homelessness were more predictive of depression than stressful life events in this sample of RHY.

Previous research on substance use in RHY has tended to emphasize the relationship between frequency of use and different facets of depressive symptoms (Hadland et al., 2011; Whitbeck et al., 2000). Findings from cross-sectional studies have suggested that the effect of frequency of substance use on depression could be mediated by psychosocial risk factors (Hadland et al., 2011; Whitbeck et al., 2004). For example, Whitbeck et al. (2000) examined the effects of family characteristics, early independence, street victimization, and street risk behaviors including frequency of substance use on risk of depression in a cross-sectional study. Frequency of substance use was not a significant predictor in the multivariate model for RHY, although it was significantly correlated with depressive symptoms at the bivariate level, suggesting other investigated factors played mediating roles. In a separate study, Whitbeck et al. (1999) reported that frequency of substance use had a direct effect on severity of depressive symptoms for male RHY, but an indirect effect via deviant subsistence strategies and victimization for female RHY. In contrast to these findings, we found that there was a significant relationship between polysubstance use and severity of depressive symptoms, thus demonstrating the presence of a direct effect.

Limitations

Some methodological limitations of the present study must be acknowledged. First, the results of this cross-sectional study cannot be taken as evidence of causality between the investigated risk factors and depression. It is possible that more severe depressive symptoms led to increased substance use. Second, the CES-D10 is not a diagnostic instrument because the measure is symptom based; however, the measure has served well as a screening instrument for depression in adolescents (Bradley et al., 2010). The use of self-report items as the basis of data collection is another noteworthy limitation. Participants could have underreported certain information such as frequency of substance use and history of family maltreatment. To minimize the probability of reporting bias, data on participants' drug and alcohol behaviors, mental health, and trauma history were gathered using an ACASI instead of face-to-face interviews. When available, responses to the questions relevant to this study were cross-checked with other items in the survey. Finally, the finding that the set of risk factors explained less than 18% of the variance in mean severity of the assessed depressive symptoms attests to the presence of uninvestigated etiological and protective factors.

Several recommendations for future research are evident. First, longitudinal studies are needed to identify the predictors of onset of MDD in RHY. Second, given that epidemiological studies have reported significant differences in prevalence and severity of depression across major racial and ethnic groups in the United States, research is needed to investigate whether these differences are evident in RHY. Similarly, research is needed to examine whether there are gender differences in the factors that influence onset of depression in RHY. Our findings indicate significant gender differences in exposure to the investigated risk factors. Preliminary multivariable ordinary least squares regression analyses by gender further revealed that the set of risk factors explained about 27% of the variance in mean severity of depressive symptomatology in female RHY but less than 14% in male RHY. Whereas findings from previous studies of children and youths served by child protective services have shown that the mental health needs of victims of abuse vary by type of maltreatment (Burns et al., 2004), research with RHY has tended to examine the aggregated impact of maltreatment. Accordingly, it would be beneficial to determine whether RHY who experienced more severe types of maltreatment such as sexual abuse have a heightened risk of developing depression and other mental health needs compared to RHY who experienced less severe forms of maltreatment such as neglect.

Conclusion

The dictum “an ounce of prevention is worth a pound of cure” holds true for severe mental illnesses such as MDD. In fact, one goal of the National Institute of Mental Health (2008) strategic plan is to develop a more complete understanding of the genetic and environmental risk factors of severe mental illnesses so that mental health scientists and clinicians can better predict which individuals are at risk of developing a disease and develop interventions that can interrupt the disease process. Findings from this study demonstrated the influence of family maltreatment and traumatic stressors associated with street life on the risk of developing depression in RHY. Indeed, these empirically verified risk factors could inform the use of a trauma-informed approach to identify individuals at elevated risk of MDD for preventive intervention (Hawkins, Catalano, & Arthur, 2002). Multiple-gate screening has

been used to identify youths at risk of psychosis for preventive interventions (McGorry, Yung, & Phillips, 2003) but has not been implemented for the detection of RHY at risk of MDD. Using a tiered approach, multiple-gate screening begins with the use of inexpensive and unobtrusive tools, followed by successively intrusive methods to reduce the number of false positives (Bell, 1992). Therefore, an individual must meet several criteria to be considered at risk (Bell, 1992). To effectively apply multiple-gate screening for the detection of RHY at risk of MDD, adverse environmental factors, in particular the experience of trauma related to family maltreatment and street-related physical violence, could be used as the initial screening criteria. Consequently, clinicians who identify RHY with exposure to multiple traumatic experiences could consider conducting a more thorough mental health assessment. Using a trauma-informed approach to screen for RHY at risk of depression may pave the way for secondary prevention of major depression in RHY.

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Fig. 1.

Linear prediction of mean severity of depression, with 95% confidence interval indicated, as a function of history of family maltreatment and number of traumatic stressors experienced during homelessness, keeping other risk factors and covariates constant.

Note. The vertical axis displays the mean severity of depressive symptomatology (range = 0–3) and the horizontal axis displays the centered value of traumatic stressors.

Fig. 2.

Mean severity of depressive symptoms by levels of exposure to the investigated risk factors.

Note. The vertical axis displays the mean item score of the CES-D10, which ranges from 0 to 3. Level 1 represents participants with no exposure to any of the investigated environmental risk factors. Level 2 represents participants who have a history of childhood maltreatment, exposure to one traumatic stressor during homelessness, and experienced one stressful life event. Level 3 represent RHY with a history of childhood maltreatment, have been exposed to an average of 1.52 number of traumatic stressors (sample mean), and experienced an average of 3.99 number of stressful life events (sample mean). Level 4 depicts mean severity of depressive symptoms in RHY who have been exposed to the highest level of environmental risk.

Table 1
Sociodemographic Descriptors of Participants

Age in years, <i>M</i> (<i>SD</i>)	22.01	(2.12)
Male, <i>n</i> (%)	269	(71.35)
Ethnicity, <i>n</i> (%)		
European American	138	(36.80)
African American	107	(28.53)
Mixed race	58	(15.47)
Latino	57	(15.20)
Other ^a	15	(4.00)
Age first homeless, <i>M</i> (<i>SD</i>)	16.29	(4.20)
Time spent homeless in months, <i>M</i> (<i>SD</i>)	32.85	(32.49)
History of family maltreatment, <i>n</i> (%)	174	(50.43)
History of CPS or FC involvement, <i>n</i> (%)	148	(41.81)
Traumatic stressors during homelessness, <i>M</i> (<i>SD</i>)	1.52	(1.75)
Categories of traumatic stressors, <i>n</i> (%)		
Direct physical violence	87	(24.37)
Direct sexual violence	61	(17.43)
Indirect exposure	104	(29.30)
Witnessing in person	148	(42.90)
Stressful life events, <i>M</i> (<i>SD</i>)	3.99	(1.94)
Types of stressful life events ever experienced, <i>n</i> (%)		
Tested positive for HIV or AIDS	8	(2.82)
Tested positive for STI or STD	38	(16.67)
Gotten pregnant or got someone pregnant	168	(45.53)
Got arrested, jailed, or put on probation	286	(78.14)
Dropout from school	134	(36.12)
Became homeless because of conflicts with parents	113	(31.04)
Became homeless because of parents' financial problem	39	(10.71)
Became homeless because of differences in religious beliefs with parents	25	(6.87)
Became homeless because of sexuality or sexual identity	20	(5.49)
Experienced literal homelessness for at least one night	240	(63.66)
Substance use, <i>n</i> (%)		
No use	245	(67.31)
Monosubstance use ^b	69	(18.96)
Polysubstance use ^c	50	(13.74)
Severity of depression symptoms, <i>M</i> (<i>SD</i>) ^d	1.12	(0.89)

Note. (N = 377) CPS = child protective services; FC = foster care. Column totals do not equal 100% due to missing data.

^aIncluded American Indian or Alaska Native, Asian, Native Hawaiian, and other Pacific Islander.

^bUse of one substance during previous 30 days.

^cUse of two or more substances during previous 30 days.

^dDependent variable was generated by averaging 7 items from the CES-D10 and was not transformed.

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Table 2
Bivariate Correlations Between Independent Variables and Severity of Depressive Symptoms

DV	1	2	3	4	5	6	7	8	10
<i>Depression (DV)</i>									
1. Male	.050								
2. Age	.092 [†]	.039							
3. Family maltreatment	.265***	-.055	.011						
4. Traumatic stressors ^a	.203***	-.086	.017	.380***					
<i>Traumatic stressors</i>									
5. Direct physical violence	.261***	.215*	-.020	.444***	.682***				
6. Direct sexual violence	.092 [†]	-.398***	-.000	.431***	.543***	.493***			
7. Indirect exposure	.052	-.219*	.013	.255**	.631***	.484***	.331**		
8. Witnessing in person	.205***	.054	-.006	.573***	.819***	.769***	.406***	.627***	
9. Stressful life events	.215***	.046	.073	.306***	.308***	.209***	.096 [†]	.178***	.268***
10. Monosubstance use ^b	.132*	.119	.075	.080	.108*	.226*	-.026	.100	.149
11. Polysubstance use ^c	.182***	.213+	-.024	.275*	-.018	.137	.028	-.170	.111

Note. DV, dependent variable. All correlations generated using pairwise deletion. Pearson's correlations were generated for ratio-scaled variables; Spearman's correlation, interval-scaled variables; tetrachoric correlations, nominal-scaled variables.

[†] $p < .01$.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

^a Count of number of traumatic stressors associated with street life.

^b Use of one substance during previous 30 days; no substance use was reference group.

^c Use of two or more substances during previous days; no substance use was reference group.

Table 3

Multivariable Ordinary Least Squares Regression of Severity of Depression by Demographic Characteristics, Environmental Risks, and Substance Use

	Model 1			Model 2			Model 3			Model 4		
	<i>b</i>	<i>SE</i>	<i>b</i> *	<i>b</i>	<i>SE</i>	<i>b</i> *	<i>b</i>	<i>SE</i>	<i>b</i> *	<i>b</i>	<i>SE</i>	<i>b</i> *
Male	0.109	0.098	0.055	0.002	0.109	0.001	0.119	0.098	0.06	0.117	0.099	0.059
Age	0.055*	0.023	0.129	0.064**	0.024	0.149	0.057*	0.023	0.132	0.054*	0.023	0.126
Family maltreatment	0.260*	0.108	0.145	0.250*	0.112	0.14	0.304**	0.108	0.169	0.253*	0.109	0.141
Count of traumatic stressors	0.075*	0.029	0.148				-0.036 ^a	0.057	-0.071	0.076**	0.029	0.149
Categories of trauma												
Direct physical violence				0.408**	0.129	0.198						
Direct sexual violence				-0.058	0.12	-0.026						
Indirect exposure				-0.145	0.1	-0.075						
Witnessing in person				0.072	0.116	0.04						
Stressful life events	0.028	0.028	0.06	0.040	0.03	0.086	0.034	0.028	0.074	0.006	0.038	0.013
Substance use												
Monosubstance use	0.320*	0.126	0.143	0.271*	0.127	0.121	0.361**	0.123	0.161	0.316*	0.126	0.141
Polysubstance use	0.438**	0.146	0.174	0.379**	0.145	0.149	0.425**	0.146	0.169	0.444**	0.146	0.176
Interaction term ^b							0.151*	0.065	0.24			
Interaction term ^c										0.048	0.055	0.069
<i>R</i> ²		0.154			0.177			0.168			0.157	
<i>df</i>		307			289			306			306	
<i>F</i>		9.464			7.056			10.17			8.759	

Note. *b*, unstandardized regression coefficient; *b**, standardized regression coefficient; SE, standard error, calculated using robust estimator; *df*, degrees of freedom. Analyses were conducted using data from participants who had completed information for all variables included in the analytic model (*n* = 315); accordingly, the *df* reflects number of cases with complete data used in the analyses, less number of parameters estimated. The majority of missingness (80%) were due to missing data on traumatic stressors, family maltreatment, or a combination. Participants with missingness on these variables did not differ in age, gender, or severity of depression compared to participants with no missingness.

* $p < .05$.

** $p < .01$.

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 $p < .001$.

^aThe interaction term between family maltreatment and traumatic stressor was highly correlated with the main effect of traumatic stressor, $r(328) = .84, p < .001$, resulting in a change of direction in the latter. According to Allison (2012), multicollinearity caused by the inclusion of an interaction term can be safely ignored.

^bInteraction term between family maltreatment and traumatic stressors associated with street life.

^cInteraction term between family maltreatment and stressful life events.