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The association between early exposure to violence in emerging adulthood and substance use in early-adulthood among inner-city individuals

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Abstract

This study investigated whether being exposed to violence early in life is a risk factor for substance use later in life. Tenets of the stress-coping model and the self-medication hypothesis guided the analyses. Participants included 850 individuals from an economically challenged, urban community in Flint, MI (83% Black/African American; 50% male). Exposure to violence was measured four times in sequential years during emerging adulthood (ages 20–23), and substance use four times during early-adulthood (ages 29–32). Multilevel growth models investigated the relationship between early exposure to violence and later rates of substance use. Youth who had above average exposure to violence during emerging adulthood had increasing substance use during early-adulthood compared to those with a below average score, after controlling for prior use. These findings may inform practitioners to screen for substance use among individuals exposed to violence, and intervene earlier before substance use becomes problematic.

Keywords

Violence; substance use/abuse; alcohol use/abuse; health behavior; injury

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Author Contribution

D. Roehler contributed to conception and design, contributed to analysis and interpretation of data, drafted the manuscript, critically revised the manuscript, gave final approval, and agreed to be accountable for all aspects of work in ensuring that questions relating to the accuracy or integrity of any part of the work are appropriately investigated and resolved. J. Heinze, S. Stoddard, J. Bauermeister, and M. Zimmerman contributed to conception and design, contributed to analysis and interpretation of data, critically revised the manuscript, gave final approval, and agreed to be accountable for all aspects of work in ensuring that questions relating to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Introduction

During emerging adulthood, contextual changes, developmental changes, and changes in social roles are occurring, making this stage of development important for health and well-being (Arnett, 2007). In particular, researchers have found that this stage of development is critical for initiating substance use that may lead to substance use problems later in life (Johnston, 2010). Substance use, particularly polydrug use, has been linked to unemployment, sustained substance use and abuse later in life, health complications, and mental health disorders (Dermody et al., 2015; Moss, Chen, & Yi, 2014; Salom, Betts, Williams, Najman, & Alati, 2016). While not every user of alcohol, tobacco, and marijuana will develop a substance use disorder, several socioeconomic and racial/ethnic disparities have been documented in the literature. Researchers have noted that individuals living in the United States in disadvantaged neighborhoods, neighborhoods with high-income inequality, or below the poverty line are more likely to be current substance users, suffer from substance use disorders, and poly-substance use disorders (Diez Roux et al., 1997; Galea, Ahern, Tracy, & Vlahov, 2007; Goldmann & Galea, 2014). Individuals who classify themselves as living below the poverty line have higher rates of cigarette use up to nearly 30%, compared to just 16% for those living at or above the poverty line (Jamal et al., 2014). Researchers have also found an inverse relationship in the United States between income- and alcohol-related problems (e.g., dependence), with the effect being stronger among non-White populations (Brenner, Diez Roux, Barrientos-Gutierrez, & Borrell, 2015). Notably, others have found increases socioeconomic status (SES)- and alcohol-related problems in Latin American countries (Macinko, Mullachery, Silver, Jimenez, & Neto, 2015; Souza, Areco, & Filho, 2005). Research that explores why low-income individuals in the United States are more likely to have negative substance using consequences, relative to medium- and high-income individuals, is lacking. This study attempts to explore this association from a developmental perspective, by focusing on the critical developmental stage of emerging adulthood, guided by the stress-coping model and the self-medication hypothesis. Moreover, this study explores this relationship by focusing on one possible stressor in the lives of this population: exposure to violence.

Experiencing stressful events (either chronic or acute), and the psychological or emotional stress that follows, is strongly associated with substance use (Shiffman, 1993). Within the stress-coping framework of substance use, researchers have noted that individuals' motives for substance use are linked to desired psychoactive effects (e.g., heighten positive affect or lower negative affect) during stressful situations (Kassel et al., 2007; Shiffman, 1993; Wills & Shiffman, 1985). Indeed, when researchers conduct surveys of adults in the general population, they find that those under higher levels of stress have greater substance use initiation, higher rates of substance use, and greater frequency of use (Finkelstein, Kubzansky, & Goodman, 2006; Roberts, Fuemmeler, McClernon, & Beckham, 2008; Sullivan, Kung, & Farrell, 2004; Wills & Cleary, 1996). According to the self-medication hypothesis, for example, heavy substance users consume drugs as a defense mechanism to protect one's ego and to dull pain (Khantzian, 1997). At first, substance use is used not as a means for seeking pleasure from the substance but as an attempt to mitigate the negative repercussions of a negative experience. Such stressors could arise from inadequate resources

in their community and structural racism (Diez Roux et al., 1997). Over time, this adapts into a regular method for seeking refuge from previous harmful experiences and creates an illusion of relief (Khantzian, 2007). When individuals experience psychological pain, their use of substances could be considered a self-medicating coping mechanism. Emerging adulthood is a period marked by extensive change, and this transition may be particularly challenging for some, which could lead to maladaptive behaviors (Schulenberg, Sameroff, & Cicchetti, 2004). Importantly, not all individuals who experience stressful events succumb to problematic and harmful behaviors; some employ positive coping methods and are resilient (Fergus & Zimmerman, 2005).

Exposure to violence can be a traumatic experience that results in increased stress (Berton & Stabb, 1996). Among inner-city youth in some American communities, rates of exposure to violence can be as high as 81% (Schubiner, Scott, & Tzelepis, 1993). In fact, violence is now the leading cause of death for young Black males (14–25 years) in the United States (here, Black refers to the several distinct cultures in the U.S. with people of African descent; Centers for Disease Control and Prevention, 2014). In addition to the fear of immediate physical trauma due to violence, the long-term effects of exposure to violence can be substantial. In one sample of youth living in a major metropolitan area in the Southern United States, 29% reported clinical levels of post-traumatic stress disorder (PTSD); further analyses revealed that minority youth who reported PTSD had the highest levels of exposure to violence (Berton & Stabb, 1996). PTSD is a major psychiatric disturbance following an ongoing or single-episode traumatic stress. Symptoms, which may be lifelong, include flashbacks, intrusive thoughts, negative affect, feeling isolated, difficulty sleeping, aggression, and hypervigilance (American Psychiatric Association, 2013). Consequently, exposure to violence may alter one's response to stress, contributing to an individual turning to alcohol, cigarettes, or other substances to cope.

Few researchers have studied the association between exposure to violence during emerging adulthood and substance use during early adulthood longitudinally, specifically for a predominately urban and African American population. Vermeiren, Schwab-Stone, Deboutte, Leckman, and Ruchkin (2003) conducted a three-country cross-sectional study of 15 year-olds and found that the association between witnessing violence and substance use (i.e., cigarette, alcohol, and marijuana use) varied by country. Witnessing violence was associated with substance use in Arkangelsk, Russia and Antwerp, Belgium, but not in New Haven, United States. A longitudinal study may be necessary to test the effects of violence exposure on substance use because substance use may serve as a delayed coping response (Mistry et al., 2015). Furthermore, Vermeiren and colleagues' measure of violence exposure emphasized lifetime exposure to six different forms of violence, irrespective of the frequency of exposure. This measurement approach may not reflect the effect of multiple exposures as someone exposed to one form of violence 10 times may receive a lower score than a peer exposed only once to two different forms of violence. We build on Vermeiren and colleagues' work by exploring the relationship between exposure to violence and substance use with a longitudinal design and with an exposure to violence measure that assesses frequency of several forms of exposure to violence. In another study, Menard, Covery, & Franzese (2015) uncovered an association between exposure to violence during adolescence and substance use in adulthood; however, this association becomes

nonsignificant when substance use during emerging adulthood and young adulthood are controlled for in their analysis. We build on their work by replicating their study using a different measure of exposure to violence, a different sample, and time-variant covariates for substance use during emerging adulthood. Moreover, given the potential salience of being exposure to violence, we believe that exposure to violence may be associated with not only varying levels of substance use but changes in rates of substance use later in life. Therefore, we will also build on these studies by including an interaction term for substance use and time in our models.

In this study, we focus on how rates of exposure to violence during emerging adulthood (ages 21–25) are associated with changes in substance use during early adulthood (ages 28–33). We used these two developmental periods because the former is associated with a time in one's life where their brain is still developing, they are easily influenced, and this stage of development is understudied in terms of long-term repercussions of trauma (Sabbagh, 2006). We will investigate the relationship between trajectories of exposure to violence and substance use over time and across stages of development. We examine these relationships using a stress-coping model and the self-medication hypothesis to guide the analysis. We hypothesize that increases in exposure to violence during emerging adulthood will be associated with increases in substance use later in life. We expect this relationship to persist after controlling for mental health, race, sex, SES, negative peer influence, and substance use early in life.

Methods

Participants

Data used for this study are from the Flint Adolescent Study (FAS; Zimmerman, Salem, & Notaro, 2000). This longitudinal study that began in 1994 consists of 850 ninth graders from the city of Flint, Michigan. FAS started as a study of youth at risk for school dropout, so only students with a grade point average of 3.0 or lower upon entering high school were eligible to participate. Students identified by the schools, as having emotional and/or development impairments were not included in the study. Data were collected over 12 nonconsecutive waves and included ages 31–33 in the 12th wave.

For the current study, emerging adulthood included Waves 5–8 (2000–2005), and early adulthood included Waves 9–12 (2007–2012). The final analysis included 850 participants. The sample included 679 African American ninth graders (80%), 145 Whites (17%), and 26 mixed

African American and White (3%). For the purposes of this study, those who identified as African American or mixed were collapsed into one group. The sample contained an equal number of males and females. Both sexes were of similar age at the start of the study (Males: $M = 14.93$, $SD = .66$; Females: $M = 14.79$, $SD = .62$).

Procedures

Trained research assistants from a local research firm collected data through structured face-to-face interviews and a self-administered pencil-and-paper portion in a private setting.

When possible, participants and interviewers were matched based on sex and race. The face-to-face interview included information about education, support, psychosocial, and other nonsensitive variables. The self-administered portion collected data on more sensitive information such as substance use, sexual behavior, and violence. Each survey/interview took between 90 and 120 min to complete. Participants were remunerated for their participation. In Wave 4, FAS had a retention rate of 90.6% ($n = 770$), 68.1% ($n = 579$) in Wave 8, and 45.2% ($n = 384$) in Wave 12. Our institutional review board approved this study, as well as the Flint School Board.

Measures

Means and standard deviations from all study variables of interest are presented in Table 1.

Demographics.—Individuals self-identified their sex and race. Family SES at Wave 4 was assessed using a parental occupational prestige rating (Nakao & Treas, 1992). Research assistants asked participants to report the occupations of their mother and father (or guardian), and that occupation was then assigned a prestige score. The highest occupational group is equivalent to professional/specialty and the lowest group is equivalent to private household work; and the higher the prestige score, the higher the level of SES. If youth reported occupations for both parents, we included only the highest score for analysis purposes. If both parents were unemployed, they received a zero for SES. This covariate was included because researchers have found a relationship between poverty and substance use (Vermeiren et al., 2003).

Substance use.—Cigarette, alcohol, and marijuana use in the past 30 days were assessed using three separate questions. Each item asked how often they had used that specific substance in the past 30 days. Response options range from “not at all” to “two packs or more per day” for the cigarette question and to “40+ times” for alcohol and marijuana use. Scores for each item range from 1 to 7. The higher the score, the more often they used that specific substance. These questions are the same used in the Monitoring the Future Study (Johnston, 2010). Time-varying covariates of cigarette, alcohol, and marijuana use during four waves of emerging adulthood were included separately as covariates (Waves 5–8). The dependent variable is an index of the sum of all three of these variables at each wave from 9 to 12. This item has a range of 0–21, with the higher score pertaining to more substance use. The outcome of this study is the substance use as a slope from Waves 9 to 12 when the sample was 26–33 years old.

Exposure to violence.—The exposure to violence scale is the average of 5 items that measured if the participant had observed or experienced violence over the last 12 months (Stoddard, Heinze, Choe, & Zimmerman, 2015). Items include “had someone physically assaulted or hurt you,” “had someone threatened to hurt you,” “had someone taken something from you using physical force,” “had you seen someone commit a violence crime where someone was hurt,” and “had you seen someone get shot, stabbed, or beaten up?” Items included five response options ranging from 0 times to 4+ times. Cronbach’s alphas for the four waves included in this analysis (Waves 5–8) ranged from .71 to .75.

Negative peer influence.—The negative influence by peers on the respondent was captured by 13 items that asked how many friends partake in a host of high-risk behaviors (Stoddard, Zimmerman, & Bauermeister, 2012). For example, “drink beer or wine at least once a week,” “have used cocaine,” “have a drug or alcohol problem,” “get into fights,” and “have carried a gun.” Negative peer influence between Waves 5 and 8 was included as a covariate because peers can have either a positive or negative influence during this stage of development, and associations have been found related to peer influence and substance use (Huang et al., 2014; Leung, Toumbourou, & Hemphill, 2014). Response items range from 1 (*none*) to 5 (*all*). Cronbach’s alphas for the included waves range from .91 to .92.

Depressive symptoms.—Depressive symptoms were measured using the Brief Symptom Index (Derogatis & Spencer, 1993). This measure is the average of 6 items that assessed symptoms during the past week including thoughts of ending your life, feeling lonely, and feeling blue. Items were recoded so that a score of 5 reflected greater depressive symptoms, and a score closer to 1 reflected little to no depressive symptoms. Depressive symptoms between Waves 5 and 8 were included as a covariate because researchers have reported a strong relationship between depression during any stage of life and subsequent smoking behaviors (Anda et al., 1999). The Cronbach’s alpha for the depressive symptoms measure from Waves 5 to 8 ranged from .83 to .87.

Analysis

We used multilevel growth models to estimate substance use trajectories in our sample. First, we fitted a model with time as a predictor of substance use with an associated random effect (Model 1). Subsequently, we fit a model with time as a linear variable (see Table 2), and time as a quadratic variable to examine nonlinear change in substance use. Next, fixed effects were added to the model (i.e., substance use in emerging adulthood: alcohol, cigarettes, marijuana, depression, income, race, and sex; Model 2). The third model includes exposure to violence as a time-varying variable during emerging adulthood as a predictor of individuals’ substance use during early adulthood above and beyond the covariates. Lastly, the interaction of exposure to violence in early adulthood and time was added to the model as a predictor of the trajectory of later substance use (Model 4). This analysis allowed us to examine whether rates of exposure to violence during one stage of life can be associated with the trend of substance use in a later stage of life, above and beyond several covariates. These analyses were conducted using STATA (Version 13.1). Missing values were imputed with expectation-maximization imputation techniques using Equations Program Manual (EQS) (Version 6.3) and 17.8% of the cases were imputed.

Results

Growth model estimates of all fixed effects, estimated variances of the random effects, and fit indices are reported in Table 2. Over time, mean exposure to violence scores decreased from 1.47 ($SD = .58$) in Wave 5 to 1.43 ($SD = .52$) in Wave 8, while the mean substance use scores rose over time from 2.64 ($SD = 3.9$) in Wave 9 to 2.75 ($SD = 3.9$) in Wave 12. In the first regression model we performed, time (linear) was not associated with substance use, $b = .04$, $t(848) = .75$, $p = .46$, nor was time (quadratic), $b = -.01$, $t(848) = -.55$, $p = .58$. When

the covariates were included in the model (Model 2), alcohol ($b = .14$, $t(841) = 2.82$, $p = .005$) and marijuana ($b = .24$, $t(841) = 5.43$, $p = .001$) use during emerging adulthood were each predictive of substance use in early adulthood. Additionally, those who identified as Black ($b = -.91$, $t(841) = -3.41$, $p = .001$), and male ($b = -.55$, $t(841) = -2.78$, $p = .005$) were more likely to have a lower substance use in early adulthood. In the next model (Model 3), we added exposure to violence during emerging adulthood, and this was not a significant predictor of later substance use. Table 2 includes the random effects findings.

Given our hypothesis that exposure to violence during emerging adulthood is associated with different rates in substance use in early adulthood, we decided to run a final model that included the interaction term of exposure to violence during emerging adulthood and time (Model 4). The interaction term predicted the slope of substance use during early adulthood, accounting for the covariates included in the model, $b = .32$, $t(839) = 3.38$, $p = .001$ (Table 2). When looking at different levels of exposure to violence, one's risk of substance use during emerging adulthood changes (Table 3). In decomposing the interaction term, exposure to high levels of violence (those above the mean exposure to violence) during emerging adulthood is associated with increasing rates of substance use during early adulthood, while those below the mean exposure to violence during emerging adulthood is associated with a decreasing trend in substance use during early adulthood, although this group only approaches significance (Figure 1).

Discussion

The goal of this study was to explore the relationship between exposure to violence during emerging adulthood and substance use in early adulthood. While we did not find an association between difference levels of substance use (i.e., high vs. low levels of substance use) and exposure to violence, which is inconsistent with prior research (Menard et al., 2016), we did find differences in the rates of substance use (i.e., increasing vs. decreasing rates of substance use). Although we did not design this study to explicitly test the stress-coping model and the self-medication hypothesis, one possible explanation for these findings is consistent with these guiding frameworks. We found that the traumatic experience of exposure to violence is related to increasing rates of substance use—a known coping mechanism—later in life. As previously discussed, emerging adulthood is a vulnerable time for a young person, given the many transitions they are experiencing. When one factors in the traumatic experience of being exposed to violence, it can be a particularly salient developmental period.

The relationship between exposure to violence during emerging adulthood and substance use during early adulthood is not congruent with what Vermeiren and colleagues (2003) found in their American sample, but is consistent with what they found for their Russian and Belgium samples. One possible reason for the divergent findings is that our study was longitudinal in nature and it may have taken U.S. respondents longer to initiate substance use as a coping response. Another difference between these two previously mentioned studies and ours is that we measured violence exposure in a somewhat more detailed fashion requiring a shorter time frame for recall (1 vs. 2 years). More proximal experiences may be more stressful than exposures further back in time, which may result in greater likelihood to use substances to

cope with the trauma. Our longitudinal analysis also examined slopes of substance use over time which may have been more sensitive to individual variation in substance use tied to coping with violence exposure.

While participants who were exposed to violence more frequently than the sample's average amount of exposure were more likely to have increasing substance use in early adulthood, the remarkable aspect of this finding is that it took only two episodes of exposure to violence during emerging adulthood to increase substance use in early adulthood. This finding supports the notion that exposure to even low levels of violence can have lasting and detrimental effects (Berton & Stabb, 1996; Nemeroff, 2004). Our findings also support the results of Menard et. al. (2015) regarding the association between exposure to violence at one stage of life and substance use at a later stage of life. In contrast to Menard's study, however, our findings remained after we accounted for substance use as a time-varying covariate. An important difference between our study and Menard et al.'s study is they measured exposure to violence during adolescence, whereas we measured exposure to violence during emerging adulthood. Nevertheless, our study builds on the growing research indicating that violence exposure has significant and lasting effects on healthy development.

Limitations of the current study should be noted. First, the sample only included youth from an economically challenged community who entered ninth grade with low academic achievement. Poor academic achievement is a risk factor for substance use (Bryant, Schulenberg, Bachman, O'Malley, & Johnston, 2000). Yet, by the time students in the sample were in their senior year of high school, academic performance was more normally distributed (Zimmerman, Caldwell, & Bernat, 2002). Second, respondents self-reported their exposures to violence and substance use behaviors throughout all waves of data collection. These responses may have been influenced by social desirability bias or response recall. We attempted to maintain complete privacy and ensured the participants that their responses would be kept confidential, as almost all researchers measuring behaviors in a general population study have done. Additionally, substance use and violence questions were captured through the self-administered portion of the interview, not through the face-to-face portion, further protecting against social desirability bias. Third, our exposure to violence measure only included 5 items assessing if the participant had either witnessed or been a victim to different forms of violence. To capture exposures to chronic and acute forms of violence, a more robust measure is needed that may also include exposure to media violence, specific assessment of intimate partner violence, and gang-related violence. Nevertheless, the 5 items used to measure exposure to violence in the past 12 months captured many serious and salient events. Future research that includes other forms of exposure to violence may help inform whether different types of violence exposure have differing effects. Relatedly, our measure of substance use only included three types of substances. A more robust measure of substance use that includes both legal and illegal substances could yield a more complete understanding of the relationship between exposure to violence and substance use. Nevertheless, we did include the three substance uses most frequently reported in the sample and the frequency of use of all other substances was quite low. Furthermore, different exposure to trauma may have varying effects on coping responses. Future research that weighs different forms of exposure to violence uniquely may aid in the development of more effective and efficient interventions.

Despite these limitations, this study adds to our understanding of the effects of violence exposure in a number of ways. First, our sample is mostly low-income, Black individuals. Due to the lack of resources in their community, the high rates of violence in their city, and a high poverty rate, this sample is at a particularly high risk for violence. This is a unique sample that is historically understudied. Despite these intersectional challenges and risk factors, our findings suggest that many of the participants were resilient, especially given the overall low rates of substance use and harmful behaviors in early adulthood. With more studies in similar diverse samples, we can begin to start applying lessons learned to other populations. Second, the longitudinal nature of this study helps examine short- and long-term effects, and to determine whether substance use is a more ephemeral response to violence exposure or a more enduring response. As we found, exposure to violence during one developmental stage had lasting effects on substance use in a later developmental stage.

Implications for Practice

The findings of this study suggest that practitioners may consider tailoring existing adult substance use interventions for those exposed to violence when they were younger. Furthermore, to protect the health and well-being of those exposed to violence from subsequent substance use, prevention programs that focus on those exposed to violence may also help address cigarette, tobacco, and marijuana use. The findings from our study also suggest that community-based efforts to reduce violence may have a salutary effect on substance use.

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Biography

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References

- American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Anda RF, Croft JB, Felitti VJ, Nordenberg D, Giles WH, Williamson DF, & Giovino GA (1999). Adverse childhood experiences and smoking during adolescence and adulthood. *Jama*, 282(17), 1652–1658. [PubMed: 10553792]
- Arnett JJ (2007). Emerging adulthood: What is it, and what is it good for? *Child development perspectives*, 1(2), 68–73.
- Baker TB, Piper ME, McCarthy DE, Majeskie MR, & Fiore MC (2004). Addiction motivation reformulated: an affective processing model of negative reinforcement. *Psychological Review*, 111(1), 33. [PubMed: 14756584]
- Berton MW, & Stabb SD (1996). Exposure to violence and post-traumatic stress disorder in urban adolescents. *Adolescence*, 31(122), 489. [PubMed: 8726906]
- Brenner AB, Diez Roux A. V., Barrientos-Gutierrez T, & Borrell LN (2015). Associations of alcohol availability and neighborhood socioeconomic characteristics with drinking: cross-sectional results from the Multi-Ethnic Study of Atherosclerosis (MESA). *Substance Use & Misuse*, 50(12), 1606–1617. [PubMed: 26579610]
- Bryant AL, Schulenberg J, Bachman JG, O'Malley PM, & Johnston LD (2000). Understanding the links among school misbehavior, academic achievement, and cigarette use: A national panel study of adolescents. *Prevention Science*, 1(2), 71–87. [PubMed: 11521961]
- Centers for Disease Control and Prevention [CDC]. (2014). Web-based Injury Statistics Query and Reporting System (WISQARS). National Center for Injury Prevention and Control, Centers for Disease Control and Prevention Retrieved from <http://www.cdc.gov/injury/wisqars/index.html>
- Cohen JA, Mannarino AP, Berliner L, & Deblinger E (2000). Trauma-focused cognitive behavioral therapy for children and adolescents an empirical update. *Journal of Interpersonal Violence*, 15(11), 1202–1223.
- Dermody SS, Marshal MP, Cheong J, Chung T, Stepp S, & Hipwell A (2015). Risk of polysubstance use and co-occurring internalizing and externalizing symptoms among adolescent sexual minority girls. *Drug and Alcohol Dependence*, 146, e263.
- Derogatis LR, & Spencer PM (1993). Brief symptom inventory: BSI.
- Diez Roux A. V., Nieto FJ, Muntaner C, Tyroler HA, Comstock GW, Shahar E, et al. (1997). Neighborhood environments and coronary heart disease: a multilevel analysis. *American Journal of Epidemiology*, 146(1), 48–63. [PubMed: 9215223]
- Fergus S, & Zimmerman MA (2005). Adolescent resilience: A framework for understanding healthy development in the face of risk. *Annu. Rev. Public Health*, 26, 399–419. [PubMed: 15760295]
- Finkelstein DM, Kubzansky LD, & Goodman E (2006). Social status, stress, and adolescent smoking. *Journal of Adolescent Health*, 39(5), 678–685. [PubMed: 17046504]
- Galea S, Ahern J, Tracy M, & Vlahov D (2007). Neighborhood income and income distribution and the use of cigarettes, alcohol, and marijuana. *American Journal of Preventive Medicine*, 32(6), S195–S202. [PubMed: 17543711]

- Gallup (2015). More than four in 10 Americans say they have tried marijuana Gallup Poll, October 2015. Retrieved from: <http://www.gallup.com/poll/184298/four-americans-say-tried-marijuana.aspx>.
- Goldmann E, & Galea S (2014). Mental Health Consequences of Disasters. *Annual Review of Public Health*, 35(1), 169–183. 10.1146/annurev-publhealth-032013-182435
- Huang GC, Unger JB, Soto D, Fujimoto K, Pentz MA, Jordan-Marsh M, & Valente TW (2014). Peer influences: the impact of online and offline friendship networks on adolescent smoking and alcohol use. *Journal of Adolescent Health*, 54(5), 508–514. [PubMed: 24012065]
- Jamal A, Agaku IT, O'Connor E, King BA, Kenemer JB, & Neff L (2014). Current cigarette smoking among adults—United States, 2005–2013. *MMWR Morb Mortal Wkly Rep*, 63(47), 1108–1112. [PubMed: 25426653]
- Johnston LD (2010). *Monitoring the Future: National Survey Results on Drug Use, 1975–2008: Volume II: College Students and Adults Ages 19–50*. DIANE Publishing.
- Kassel JD, Evatt DP, Greenstein JE, Wardle MC, Yates MC, & Veilleux JC (2007). The acute effects of nicotine on positive and negative affect in adolescent smokers. *Journal of Abnormal Psychology*, 116(3), 543. [PubMed: 17696710]
- Kassel JD, Stroud LR, & Paronis CA (2003). Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. *Psychological Bulletin*, 129(2), 270. [PubMed: 12696841]
- Khantzian EJ (1997). The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. *Harvard Review of Psychiatry*, 4(5), 231–244. [PubMed: 9385000]
- Khantzian EJ (2007). Treating addiction as a human process.
- Leung RK, Toumbourou JW, & Hemphill SA (2014). The effect of peer influence and selection processes on adolescent alcohol use: a systematic review of longitudinal studies. *Health psychology review*, 8(4), 426–457. [PubMed: 25211209]
- Macinko J, Mullachery P, Silver D, Jimenez G, & Neto OLM (2015). Patterns of alcohol consumption and related behaviors in Brazil: Evidence from the 2013 National Health Survey (PNS 2013). *PLoS one*, 10(7), e0134153. [PubMed: 26230389]
- Menard S, Covey HC, & Franzese RJ (2015). Adolescent exposure to violence and adult illicit drug use. *Child abuse & neglect*, 42, 30–39. [PubMed: 25626337]
- Miech RA, Johnston LD, O'Malley PM, Bachman JG, & Schulenberg JE (2015). *Monitoring the Future national survey results on drug use, 1975–2014: Volume I, Secondary school students*. Ann Arbor, MI: Institute for Social Research, the University of Michigan.
- Mistry R, Heinze JE, Cordova D, Heish H-F, Goldstick JE, Ayer SM, & Zimmerman MA (2015). Transitions in Current Substance Use from Adolescence to Early-Adulthood. *Journal of Youth and Adolescence*, 1–13. [PubMed: 24682958]
- Moss HB, Chen CM, & Yi H-Y (2014). Early adolescent patterns of alcohol, cigarettes, and marijuana polysubstance use and young adult substance use outcomes in a nationally representative sample. *Drug and Alcohol Dependence*, 136, 51–62. [PubMed: 24434016]
- Nakao K, & Treas J (1992). The 1989 socioeconomic index of occupations: Construction from the 1989 occupational prestige scores.
- Nemeroff CB (2004). Neurobiological consequences of childhood trauma. *Journal of Clinical Psychiatry*, 65(Suppl. 1), 18–28.
- Roberts ME, Fuemmeler BF, McClernon FJ, & Beckham JC (2008). Association between trauma exposure and smoking in a population-based sample of young adults. *Journal of Adolescent Health*, 42(3), 266–274. [PubMed: 18295135]
- Sabbagh L (2006). The teen brain, hard at work. *Scientific American Mind*, 17(4), 20–25.
- Salom CL, Betts KS, Williams GM, Najman JM, & Alati R (2016). Predictors of comorbid polysubstance use and mental health disorders in young adults—a latent profile analysis. *Addiction*, 111(1), 156–164. [PubMed: 26190689]
- Schubiner H, Scott R, & Tzelepis A (1993). Exposure to violence among inner-city youth. *Journal of Adolescent Health*, 14(3), 214–219. [PubMed: 8323933]

- Schulenberg JE, Sameroff AJ, & Cicchetti D (2004). The transition to adulthood as a critical juncture in the course of psychopathology and mental health. *Development and psychopathology*, 16(04), 799–806. [PubMed: 15704815]
- Shiffman S (1993). Assessing smoking patterns and motives. *Journal of Consulting and Clinical Psychology*, 61(5), 732. [PubMed: 8245271]
- Souza DPO, Areco KN, & Filho DXS (2005). Álcool e alcoolismo entre adolescentes da rede estadual de ensino de Cuiabá, Mato Grosso. *Revista de Saúde Pública*, 39, 585–92.
- Stoddard SA, Heinze JE, Choe DE, & Zimmerman MA (2015). Predicting violent behavior: the role of violence exposure and future educational aspirations during adolescence. *Journal of Adolescence*, 44, 191–203. [PubMed: 26282242]
- Stoddard SA, Zimmerman MA, & Bauermeister JA (2012). A longitudinal analysis of cumulative risks, cumulative promotive factors, and adolescent violent behavior. *Journal of Research on Adolescence*, 22(3), 54–555.
- Substance Abuse and Mental Health Services Administration [SAMHSA]. (2014). *Mental Health Services Administration. (2013) Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings (No. NSDUH Series H-46, HHS Publication No.(SMA) 13–4795)*. Rockville, MD: Substance Abuse and Mental Health Services Administration.
- Sullivan TN, Kung EM, & Farrell AD (2004). Relation between witnessing violence and drug use initiation among rural adolescents: Parental monitoring and family support as protective factors. *Journal of Clinical Child & Adolescent Psychology*, 33(3), 488–498. [PubMed: 15271606]
- Triffleman E, Carroll K, & Kellogg S (1999). Substance dependence posttraumatic stress disorder therapy: An integrated cognitive-behavioral approach. *Journal of Substance Abuse Treatment*, 17(1), 3–14. [PubMed: 10435248]
- Vermeiren R, Schwab-Stone M, Deboutte D, Leckman PE, & Ruchkin V (2003). Violence exposure and substance use in adolescents: findings from three countries. *Pediatrics*, 111(3), 535–540. [PubMed: 12612233]
- Wills TA, & Cleary SD (1996). How are social support effects mediated? A test with parental support and adolescent substance use. *Journal of Personality and Social Psychology*, 71(5), 937. [PubMed: 8939042]
- Wills TA, & Filer M (1996). Stress-coping model of adolescent substance use, 91–132.
- Wills TA, & Shiffman S (1985). Coping and substance use: A conceptual framework. *Coping and Substance Use*, 3–24.
- Zimmerman MA, Caldwell CH, & Bernat DH (2002). Discrepancy Between Self-Report and School-Record Grade Point Average: Correlates With Psychosocial Outcomes Among African American Adolescents1. *Journal of Applied Social Psychology*, 32(1), 86–109.
- Zimmerman MA, Salem DA, & Notaro PC (2000). Make room for daddy II: The positive effects of fathers' role in adolescent development In Taylor RD & Wang MC(Eds.), *Resilience across contexts: Family, work, culture, and community*, Chapter 9 (pp. 233–253). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers

Figure 1.
Relationship between exposure to violence during emerging-adulthood and substance use during early-adulthood, as conditioned by level of exposure to violence

Table 1.Descriptive statistics for imputed study variables ($N = 850$)

	Wave 5	Wave 6	Wave 7	Wave 8	Wave 9	Wave 10	Wave 11	Wave 12
Age (years)	20.1	21	22.1	23.1	29.3	30.3	31	32
Time-varying covariates								
Cigarette use (5 = 40+ instances)	.8 (2.0)	1.7(7.7)	1.4(7.0)	1.0(2.2)				
Alcohol use (5 = 40+ instances)	1.4(1.3)	1.6(1.6)	1.7(1.6)	1.7(1.6)				
Marijuana use (5 = 40+ instances)	1.6(1.3)	1.7(1.8)	1.7(1.8)	1.7(1.9)				
Negative peer influence (5 = all friends)	1.9 (.7)	1.9 (.7)	1.9 (.6)	1.9 (.6)				
Depressive symptoms (5 = many depressive symptoms)	1.7 (.6)	1.7 (.6)	1.7 (.6)	1.7 (.6)				
Exposure to violence (5 = 4+ exposures)	1.5 (.6)	1.4 (.5)	1.4 (.5)	1.4 (.5)				
Time-varying outcome variable								
Substance use (index of substance use variables)					2.6 (3.9)	3.1 (4.2)	3.2 (4.2)	2.7 (3.9)

Table 2.

Summary of multilevel mixed-effects linear regression analysis for covariates predicting substance use in early-adulthood ($N = 850$)

Parameter	Model 1	Model 2	Model 3	Model 4
Intercept predictors				
Intercept (τ_{00})	2.88 (.12)	2.91 (.57)	2.90 (.58)	3.47 (.61)
Cigarette use in early-adolescence (τ_{01})		-.01 (.01)	-.01 (.01)	-.01 (.10)
Marijuana use in early-adolescence (τ_{02})		20 *** (.05)	20 *** (.05)	20 *** (.05)
Alcohol use in early-adolescence (τ_{03})		.11 * (.05)	.11 * (.05)	.10 * (.05)
Depression in early-adolescence (τ_{04})		.14 (.12)	.14 (.12)	.14 (.12)
Negative peer influence (τ_{05})		45 *** (.14)	44 ** (.14)	45 ** (.14)
Black (τ_{06})		-.98 *** (.27)	-.98 *** (.27)	-.98 *** (.27)
Male (τ_{07})		-.56 ** (.21)	-.56 ** (.21)	-.57 ** (.21)
Poverty in early-adolescence (τ_{08})		-.01 (.01)	-.01 (.01)	-.01 (.01)
Exposure to Violence during emerging adulthood (τ_{09})			.02 (.14)	-.40 (.19)
Slope predictors				
Time (τ_{10})	.04 (.05)	.02 (.05)	.02 (.05)	-.44 ** (.15)
Exposure to Violence during emerging adulthood * time (τ_{11})				32 *** (.10)
Random effects				
Intercept (τ_{00})	6.50 ***	5.46 ***	5.47 ***	5.50 ***
Time (τ_{10})	23 ***	20 ***	20 ***	19 ***
Residual (σ^2)	8.93 ***	9.44 ***	9.44 ***	9.40 ***
Fit index				
Log likelihood	-9210.3	-9172.8	-9172.4	-9166.7

*
 $p < .05$

**
 $p < .01$

 $p < .001$

Table 3.

Summary of multilevel mixed-effects linear regression analysis for covariates predicting substance use in early-adulthood interaction effects

Parameter	Model 1: Low Exposure to Violence (N = 511)	Model 1: High Exposure to Violence (N = 339)
Intercept	3.09 (.15)	2.57 (.20)
Level 1		
Time	-.09 (.06)	0.22 (.09) **

Note: Low and high exposure to violence membership was determined by individual average exposure to violence scores during emerging adulthood falling below and above the sample mean score (1.43), respectively.

*
p .05

**
p .01

p .001