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Longitudinal Associations Between Substance Use and Violence in Adolescence Through Adulthood

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Abstract

Substance use and violence are interrelated behaviors during adolescence and early adulthood. Using National Longitudinal Study of Adolescent to Adult Health data, this study examined the longitudinal relationships between (a) alcohol and violence perpetration, (b) marijuana and perpetration, (c) alcohol and victimization, and (d) marijuana and victimization. Cross-lagged structural equation models showed that longitudinal patterns of violence and substance use vary somewhat and that the ways preceding stages of violence and substance use are associated with subsequent violence, and substance use differ by violence, substance type, and transitional stage. Our findings call for primary and secondary prevention strategies targeting early adulthood.

Keywords

adolescents; alcohol; heavy drinking; life course; longitudinal; marijuana; victimization; violence

Substance use and violence are serious public health problems in the United States. Violence is one of the leading causes of death for people ages 1 to 44 (Centers for Disease Control, 2013) and exerts a detrimental toll on the physical and mental health of young people, families, and communities (Aisenberg & Herrenkohl, 2008). Marijuana and heavy alcohol use are also linked to significant impairments in health and well-being above and beyond the individual user. Marijuana is the most used illegal substance in the United States (Ostrowsky, 2011; Ragan & Beaver, 2010), and the past month prevalence in 2014 was 7.4% among 12- to 17-year-olds, 19.6% among 18- to 25-year-olds, and 6.6% among people 26 years old and older (Center for Behavioral Health Statistics and Quality [CBHSQ], 2015).

The overall prevalence rate of problematic alcohol use in people age 12 or older was 23.0% for binge use (five or more drinks on the same occasion at least one day in the past 30 days) and 6.2% for heavy use (binge use at least 5 days in the past 30 days) in 2014 (CBHSQ, 2015). In general, problematic alcohol trends increased during adolescence (13% among 16–

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17-year-olds, 29% among 18–20-year-olds), peaked in early adulthood (43% among 21–25-year-olds, 40% among 26–29-year-olds), and declined thereafter (Substance Abuse and Mental Health Services Administration, 2014). There is a high prevalence of violence and substance use in adolescence and early adulthood (Boles & Miotto, 2003), and these behaviors often do not occur in isolation. Thus, it is important to pay close attention to how they are interrelated to prevent long-term consequences that might endure across the life course. Using data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), the overall study goal is to ascertain how violence and substance use are associated with one another during the transition from adolescence into adulthood, and whether this relationship varies by type of violence (i.e., perpetration or victimization) or substance (i.e., alcohol or marijuana).

BACKGROUND

Research on violence and substance use generally uses five competing theories to explain the relationship: (a) substance use causes violence (i.e., pharmacological effects (Goldstein, 1985); (b) violence causes substance use (Goldstein, 1985; Moore & Stuart, 2005; Patrick, Schulenberg, O'Malley, Johnston, & Bachman, 2011); (c) the relationship is bidirectional (White, Loeber, Stouthamer-Loeber, & Farrington, 1999); (d) violence and substance use occur together as part of problem behaviors that share mutual causal factors (Logan-Greene et al., 2011; White, Jackson, & Loeber, 2009); and (e) they are not related, but rather occur independently with disparate causes (Wagner, 1996). Overall, the violence and substance use relationship is very complex and the extant research regarding the directionality of this relationship is inconclusive (Barrett, Mills, & Teesson, 2011; Boles & Miotto, 2003; Scholes-Balog, Hemphill, Kremer, & Toumbourou, 2013). The complexity of this relationship warrants further investigation to better understand the nuances of how substance use and violence influence one another.

The violence–alcohol relationship has been studied to a much greater extent than violence and other substances, and the existing literature on the violence–marijuana relationship is especially limited. Given the rising prevalence of marijuana use among adolescents and young adults, and the limited studies on marijuana and violence, it is essential to investigate how substance type (i.e., marijuana vs. alcohol) is similar or different in its relationship to violence.

A major limitation of prior studies on violence and substance use is the cross-sectional nature of the data where both behaviors were measured at a single time point (Ostrowsky, 2011; Wagner, 1996; Xue, Zimmerman, & Cunningham, 2009), thus presenting issues related to temporality and causal inference. Moreover, many studies are based on criminal justice populations, such as offenders, and asked retrospective questions related to drinking or being drunk at the time of their offense; or the reverse, studied a substance-using population with retrospective questions assessing their history of violence experiences (Boles & Miotto, 2003; Lennings, Copeland, & Howard, 2003; Ostrowsky, 2011; Wagner, 1996). Although the acute occurrences of these interrelated behaviors have received most of the attention (e.g., substance use at the time of violent event), the longitudinal associations on the cooccurrence of violence and substance use have received less scrutiny (White, Lee,

Mun, & Loeber, 2012). Longitudinal data can offer insights into how substance use and violence cooccur and change over different stages of the life course.

LONGITUDINAL ASSOCIATIONS

Among studies that have looked at the longitudinal course of alcohol use or violence, there is a general consensus regarding the consistency of behaviors across time—initial substance use is related to later substance use, and initial violence is related to later violence (Wagner, 1996; White et al., 2009). The specific longitudinal linkages between substance use and violence (e.g., substance use to later violence perpetration) have not been researched as extensively. Among the studies that have looked at the cross-lagged associations between substance use and violence involvement, the results have been mixed. For instance, some studies have shown that violence in one developmental stage (e.g., early adulthood) is related to substance use during the same developmental stage (e.g., also early adulthood), but that substance use at a previous developmental stage (e.g., adolescence) does not predict later violence (e.g., early adulthood; Marcus & Jamison, 2013; Wanner, Vitaro, Carbonneau, & Tremblay, 2009; White et al., 2009). On the other hand, other studies indicate that earlier substance use is indeed associated with later violence (Wanner et al., 2009; Wei, Loeber, & White, 2004; White & Hansell, 1998), but that earlier violence is not related to later substance use. Several studies report support for the counter direction: Violence involvement predicts later substance use (Fagan, Wright, & Pinchevsky, 2015; Wright, Fagan, & Pinchevsky, 2013). Furthermore, two studies using longitudinal data found that effects of violence on substance use are influential in the short term (i.e., within the same period), but not in the long term (i.e., 5 years later; Miller, Fagan, & Wright, 2014; Thompson, Sims, Kingree, & Windle, 2008). Finally, other studies have shown a bidirectional relationship over time (White et al., 1999; Xue et al., 2009).

Longitudinal studies on substance use and violence are often limited to early adolescence through early adulthood (about 24–25 years old) rather than through adulthood (the latter half of the 20s and into the 30s; Marcus & Jamison, 2013; Xue et al., 2009). Prior studies have not looked beyond early adulthood because the relationship between violence and substance use is strongest in adolescence and the strength of the association decreases or is not significant by early adulthood (White et al., 2009). These studies might assume that the relationship will continue to attenuate because of the normative patterns of these behaviors (White et al., 2009, 2012): violence peaks in adolescence (Dahlberg & Potter, 2001; Elliott, Huizinga, & Morse, 1986; Loeber & Hay, 1997; Marcus, 2009; Petts, 2009) and substance use peaks in early adulthood (White et al., 2009; White et al., 2012; Xue et al., 2009). Given the demographic trends of a delayed transition into adulthood (Arnett, 2000; Shanahan, 2000), and the continued, albeit decreased, involvement in these behaviors, it is critical to examine how the associations between substance use and violence change beyond early adulthood. Based on the life course perspective that earlier behaviors influence later behaviors and outcomes (Elder, Johnson, & Crosnoe, 2004), this study examines these behaviors using an age range (11–32 years) that extends beyond the typical peak stages of these behaviors and age ranges of prior studies. We also investigate whether people mature out of the cooccurrence of substance use and violence in adulthood.

A LIFE COURSE FRAMEWORK FOR SUBSTANCE USE AND VIOLENCE

Examination of the substance use–violence relationship across the life course is imperative because adolescent problem behaviors are often related to future behaviors that lead to long-term health consequences and compromise a young person’s successful transition to adulthood (Elder et al., 2004; Wanner et al., 2005). Using a life course framework, this study examines how early adolescent substance use and violence experiences longitudinally affect these behaviors in subsequent life stages (i.e., late adolescence, early adulthood, and adulthood). Specifically, we investigate how substance use and violence involvement in early adolescence affects late adolescence; how that, in turn, affects substance use and violence in early adulthood; and then consequently in adulthood. We also consider the direct relationships of substance-to-substance and violence-to-violence across the developmental stages. The following combinations are investigated: (a) heavy drinking and perpetration, (b) heavy drinking and victimization, (c) marijuana use and perpetration, and (d) marijuana use and victimization. By exploring how these behaviors are generally associated from adolescence into early adulthood through adulthood, we demonstrate the extent to which the strength of their connection waxes or wanes across these key developmental stages. This allows for the identification of critical stages to target primary and secondary prevention efforts that address the cooccurrence of these behaviors. The inclusion of the relationship between marijuana use and violence victimization, which has been examined to a lesser extent than the cooccurrence of alcohol and violence perpetration, provides an opportunity to uncover whether and how the longitudinal linkages of violence and substance use vary according to the type of violence involvement and the type of substance.

METHOD

Data

The study sample was derived from Add Health, an ongoing, nationally representative, school-based study of U.S. adolescents followed into adulthood (Harris et al., 2009). Add Health used a multistage stratified cluster design (using region, school characteristics, and racial and ethnic composition) to first select a sample of 80 high schools and feeder schools that was representative of U.S. schools (Harris et al., 2009). Following an in-school survey, an in-home sample was interviewed in 1994 and 1995 when respondents were 12 to 18 years old (Wave 1; 76% response rate [RR], $n = 20,745$). The in-home sample was followed up in 1995 and 1996 at ages 13 to 18 years (Wave 2; 88% RR), 2000 and 2001 at ages 18 to 26 years (Wave 3; 77% RR), and 2007 and 2008 at ages 24 to 32 years (Wave 4; 80% RR). Parents of the Wave 1 (hereafter, wave is shortened to W) in-home sample participated in an interview in 1994 or 1995 (85% RR).

This study was approved by the University of California, Los Angeles, Human Subjects Protection Committee.

Measures

Violence—The violence perpetration measure was based on questions that were asked at all four waves. Violence perpetration at each wave was coded 1 if respondents reported they

participated in any of the following acts in the past 12 months: serious physical fight, group fight, used or threatened use of a weapon, pulled a knife or gun on someone, or shot or stabbed someone. Violence victimization at W1 and W2 was coded 1 if respondents indicated experiencing any of the following incidents in the previous 12 months: someone pulled a knife or gun on you, someone shot you, someone stabbed you, you saw someone shoot or stab another person, or you were jumped. The five W3 and W4 victimization questions differed somewhat: someone pulled a knife or gun on you; someone shot or stabbed you; you saw someone shoot or stab another person; you were beat up; or someone slapped, hit, choked, or kicked you. To ensure comparability across waves and time points and to address the varying degrees of skewness, violence perpetration and victimization at each wave were dichotomized to 1 = *yes/at least once* and 0 = *no/never*.

Substance use—At each wave, respondents were asked, “During the past 12 months, on how many days did you drink [for males] 5 or more or [for females] 4 or more drinks in a row?” Responses included *none, 1 or 2 days, once a month or less, 2 or 3 days per month, 1 or 2 days a week, and almost every day or daily*. Past-year heavy drinking was dichotomized into none and heavy drinking on a monthly basis (from 2–3 days per month to daily). Respondents were asked at each wave: “During the past 30 days, how many times did you use marijuana?” Past-month marijuana use was coded as none or used in past 30 days.

Covariates—Demographic variables included gender and race or ethnicity (i.e., non-Hispanic white, non-Hispanic black, Hispanic, Asian or Pacific Islander, and other). We accounted for family structure in adolescence (i.e., two-parent household, single-parent household, or other), household income, and parental education (i.e., less than high school, high school or general education diploma, some college, college, and graduate school). Due to the large number of missing data, we included a category of missing for household income and parent education (Kim, Egerter, Cubbin, Takahashi, & Braveman, 2007).

Statistical Analysis

First, we conducted descriptive statistics of each of the outcome variables and covariates. Second, we use a structural equation modeling (SEM) framework with cross-lagged paths to test for longitudinal associations between the substance use and violence variables, controlling for all covariates. In this analysis, synchronous relations captured associations between violence and substance use within each wave (e.g., W1 violence–W1 alcohol). Autoregressive effects accounted for the influence of violence at one time point on a subsequent time point (e.g., W1 violence–W2 violence), and similarly for substance use (e.g., W1 alcohol–W2 alcohol). These effects indicated the temporal stability of the constructs from wave to wave. Most important, cross-lagged effects represented the reciprocal effects between violence and substance use throughout the time points, while controlling for the autoregressive effects. We ran four separate cross-lagged SEM models: violence perpetration and heavy drinking (Model 1), violence victimization and heavy drinking (Model 2), violence perpetration and marijuana (Model 3), and violence victimization and marijuana (Model 4). We compared log likelihoods from nested models (with and without covariates) to determine model fit. Descriptive and multivariate statistics were obtained using Stata Version 13.0 (StataCorp LP, 2013). The Stata—`gsem`- command is

not compatible with features to account for complex survey design, and thus, we were not able to incorporate sampling weights and survey design.

RESULTS

The analytic sample was restricted to individuals who participated in all waves of data collection and had no missing data on substance use and violence variables ($N = 9,551$). Overall, female respondents made up a slightly higher proportion of the sample (see Table 1). The average ages across the four time points were 15.3 (W1), 16.2 (W2), 21.6 (W3), and 28.1 (W4). Non-Hispanic Whites were the majority of the sample at 55%. Blacks and African Americans composed one fifth of the sample, followed by Hispanics or Latinos (14%), Asian Americans (7%), and Native Americans (2%). A majority of respondents lived with both biological parents (56%), 17% lived in a reconstituted two-parent home, 23% in a single-parent household, and 5% in another type of household. Family income had a fair distribution across brackets, and more than half of adolescents had parents with some college exposure.

The overall trends from adolescence through adulthood for past-year violence perpetration were highest in early adolescence at 41% in W1, and gradually declined to 28% in W2, 13% in W3, and increased slightly to 16% in W4. Experiences of victimization in the past year were also highest in early adolescence (23%), declined during the transition from adolescence to early adulthood (18% in W2 and 11% in W3), and increased to a similar proportion as W1 in adulthood (23%). Monthly heavy drinking was lowest in adolescence (9% in W1 and 12% in W2), highest in early adulthood (22%), and remained at a similarly high level in adulthood (20%). Past-month marijuana use was lowest in adolescence (14% in W1 and 15% in W2), highest in early adulthood (22% in W3), and declined to similar rates to adolescence in adulthood (16% in W4).

Violence and Heavy Drinking

Figures 1 and 2 illustrate the cross-lagged logistic regression models of violence and monthly heavy drinking (Models 1 and 2, respectively). The results of the cross-lagged regression models are also presented in Table 2. These models controlled for baseline demographic characteristics.

Autoregressive effects—For violence perpetration (Figure 1) and victimization (Figure 2), the autoregressive effects showed that W1 violence predicted W2 violence, W2 violence predicted W3 violence, and W3 violence predicted W4 violence. Effects were strongest in adolescence (W1–W2), then declined but remained significant in early adulthood (W2–W3) and adulthood (W3–W4). Alcohol use had a similar pattern where monthly heavy drinking was significantly associated with monthly heavy drinking at subsequent time points. However, although there was a decline in effects from adolescence to early adulthood (W1–W2 to W2–W3), the effects of heavy drinking increased during the transition to adulthood (W3–W4).

Direct effects (within wave)—The direct effects of violence perpetration to heavy drinking (e.g., W1 violence to W1 drinking), as well as victimization to heavy drinking,

were also significant at each time point, suggesting strong associations within waves. For perpetration and heavy drinking, the within-wave odds ratio was 2.89 in W1 and slightly decreased in W2. The magnitude of the relationship increased and was the strongest in W3 (3.18), and then steeply declined in W4. The link between heavy drinking and victimization was strongest in W1, declined in W2, increased slightly in W3, and decreased again and had the weakest association in W4.

Cross-lagged effects—Controlling for prior heavy drinking and covariates, the cross-lagged effects showed that perpetration was significantly associated with heavy drinking at subsequent time points (Table 2). Having engaged in perpetration, the odds of engaging in heavy drinking at the following time points were 1.74, 1.65, and 1.42 for W2, W3, and W4, respectively. The cross-lagged effects for victimization and heavy drinking were similar with odds ratios that also declined over time (1.74, 1.33, and 1.19). Reversing the relationship, heavy drinking significantly predicted violence in adolescence (W1–W2), early adulthood (W2–W3), and adulthood (W3–W4). An exception was the association between W3 heavy drinking and W4 victimization, which was not significant. Additionally, the magnitudes of the odds ratios for heavy drinking to next wave violence increased from adolescence to early adulthood (W1–W2, W2–W3), but decreased from early adulthood to adulthood (W3–W4).

Violence and Marijuana Use

The cross-lagged logistic regression models of violence and past-month marijuana use are shown in Figures 3 (Model 3) and 4 (Model 4), and adjusted for gender, race and ethnicity, adolescent family structure, and family socioeconomic status.

Autoregressive effects—For violence perpetration (Figure 3) and victimization (Figure 4), the autoregressive effects showed that violence predicted subsequent wave violence. The strongest effects of violence victimization and perpetration were in adolescence (W1–W2), and then declined during the transition to adulthood (W2–W3, W3–W4). In contrast, effects of marijuana use on subsequent use was highest in adolescence (W1–W2), then declined during the transition to early adulthood (W2–W3), and then increased to similar levels as in adolescence during adulthood (W3–W4).

Direct effects (within wave)—The direct effects of violence perpetration to marijuana use, as well as victimization to marijuana use, were significant at all waves. For violence perpetration, the strength of the association was strongest in W1 (2.59), decreased somewhat in W2 (2.30), was similar in W3 (2.38), and declined to 1.31 in W4. The magnitude of the relationships between violence victimization and marijuana use was strongest in W1 and declined at each wave thereafter.

Cross-lagged effects—As shown in Table 2 (Model 3) and Figure 3, perpetration was significantly associated with marijuana use at the following wave, after controlling for prior marijuana use and covariates. Having engaged in violence perpetration, the odds were 1.69, 1.45, and 1.42 for using marijuana at the subsequent time point. Figure 3 illustrates that the cross-lagged effect for victimization and marijuana was 1.88 in adolescence (W1–W2). The association between victimization and subsequent stage marijuana use decreased in the

transition to early adulthood (W2–W3, 1.31), but increased again in the transition to adulthood (W3–W4, 1.48). Examining the relationship of marijuana use to later stage violence perpetration and victimization, marijuana use was significantly related to perpetration and victimization in adolescence (W1–W2) and early adulthood (W2–W3) with the magnitudes of the odds ratios increasing during these transitions. The odds ratios for marijuana use to violence perpetration were 1.34 in W1 to W2 and 1.37 in W2 to W3. W3 marijuana use did not significantly predict violence perpetration at W4, but was significantly associated with violence victimization.

DISCUSSION

This study applied a life course perspective to examine the longitudinal associations between substance use and violence, specifically considering the relationships of violence perpetration and victimization with the substances of marijuana and alcohol. Findings support the complicated and interrelated nature of violence involvement and substance use as indicated in existing literature (Boles & Miotto, 2003; Wagner, 1996; White et al., 2009). Our results illustrate that the longitudinal patterns of violence and substance use vary, and that the ways in which preceding stages of violence involvement and substance use are associated with subsequent violence and substance use differ by violence type, substance type, and transitional life stage.

Longitudinal Patterns Within Behavior Type

Over the life course, the general longitudinal patterns of violence and substance use are strongest in adolescence and decrease into early adulthood (from age 18 to mid-20s). However, the magnitudes of the associations of violence-to-violence and substance-use-to-substance-use differ during the transition from early adulthood to adulthood (from the mid-20s to early 30s). Violence continued to decrease in the transition from early adulthood into adulthood, regardless of type of violence (i.e., perpetration or victimization). In contrast, substance use in early adulthood increased again during the transition from early adulthood to adulthood. In fact, the link between marijuana use in early adulthood and adulthood reached a magnitude similar to that within adolescence. This finding was unique to marijuana. Although the finding regarding high substance use prevalence during early adulthood and adulthood is not new, our study results reemphasize that young people who use substances in adolescence and continue to use into adulthood potentially represent more chronic, persistent users than those who only use at one life stage, with particular attention focused on persistent marijuana users.

Within Life-Stage Association Between Violence and Substance Use

Our findings on the substance use–violence relationship within developmental stages (e.g., adolescent violence–adolescent substance use) support existing literature indicating that these behaviors are linked to one another (e.g., White et al., 2009). The significant direct effects of substance use and violence within life stages, regardless of violence and substance type, provide further evidence for the bidirectional or mutual cause theories of how substance use and violence are connected. Previous research has stated that the “contemporaneous” association, that is within developmental stage, between alcohol and

violence is strongest during adolescence because these behaviors are considered unconventional problem behaviors during this developmental stage (White et al., 2009; White et al., 2012; Xue et al., 2009). Our results showed that this is the case for heavy drinking and victimization, but not perpetration, for which the highest association was in early adulthood. For marijuana, the finding that adolescence is a high-risk period for problem behaviors applies to its relationship with both types of violence.

The contemporaneous associations between violence and substance use in early adulthood should not be overlooked. The magnitudes of the relationships between substance use and violence in early adulthood were similar to their associations during adolescence. Plausible explanations are that heavy drinking and marijuana use are most prevalent in early adulthood (White et al., 2009) or because young adults are now outside of the purview of their parents (Arnett, 2000) and might have more opportunities to engage in these behaviors. Moreover, the development of the cognitive control mechanisms that inhibit impulsive behaviors and coordinate decision-making skills are continuing to develop in early adulthood (Steinberg, 2008).

The results of this study both concur and contrast with existing research regarding the longitudinal cooccurrence of substance use and violence. For example, some studies indicate that it is the contemporaneous association, rather than the “historical” (i.e., cross-lagged) connection that matters (Marcus & Jamison, 2013). As described earlier, this study indeed supports the literature regarding the contemporaneous association, as the magnitudes of the relationships between substance use and violence are significant and strongest within developmental stages. However, after accounting for these contemporaneous associations, the cross-lagged relationships in which previous developmental stages of violence involvement or substance use predict later violence and substance use remain significant, emphasizing the importance of historical behaviors on later behaviors.

Cross-Lagged Associations Between Violence and Substance Use

The significant cross-lagged effects of violence and substance use operated in both directions from adolescence through early adulthood, making it difficult to disentangle whether one causes the other, and provide support for the theory of a bidirectional (White et al., 1999) or common cause (White et al., 2009) relationship. However, the cross-lagged associations during the transition from early adulthood through adulthood were not significant in both directions. Specifically, violence in early adulthood significantly increased marijuana use and heavy drinking in adulthood, but the ways in which early adulthood substance use predicted violence in adulthood varied. Heavy drinking in early adulthood predicted perpetration, but not victimization in adulthood. In contrast, marijuana in early adulthood predicted victimization, but not perpetration in adulthood. The reasons for these differences are not evident in our data. The results suggest that perhaps the particular effects of these specific substances on people’s experiences with violence affect their risk of later violence involvement.

Altogether these cross-lagged findings could suggest that given that these behaviors are common in adolescence and early adulthood, and less common in adulthood, the direction or “causes” become more transparent among those who continue to be involved in substance

use or violence. These findings further indicate that there is likely a potentially high-risk subgroup of individuals who continue to be involved in violence and substance use into adulthood. To better document the directionality of substance use and violence as people progress through the life course, future studies are needed to examine the cross-lagged nature of these behaviors in adulthood beyond the age of 32, the upper age limit of our sample.

In general, the cross-lagged associations of violence on subsequent substance use were highest within adolescence, but generally decreased thereafter into adulthood. The longitudinal cross-lagged associations of victimization and marijuana use, however, did not follow this overall trend. The magnitude of the relationship from early adulthood victimization to adulthood marijuana use was higher than that during the transition from adolescence to early adulthood. This finding might suggest that there are additional risks to being a victim of violence and using marijuana specifically during the transition from early adulthood to adulthood, an area that needs to be examined in future studies.

In contrast to the effect of violence on subsequent substance use, the cross-lagged associations from substance use to subsequent violence were generally strongest during the transition from adolescence into early adulthood, and declined entering adulthood. Additionally, the links are weakest, and in two instances not significant, during the transition from early adulthood into adulthood. The weakened effect during the transition to adulthood might be because heavy substance use is normative and on average peaks in early adulthood (White et al., 2009) whereas violence perpetration typically peaks in adolescence (Dahlberg & Potter, 2001; Elliott et al., 1986; Loeber & Hay, 1997; Marcus, 2009; Petts, 2009). The contrasting effects of type of substance on type of violence from the early 20s through early 30s warrant further investigation. Specifically, research is needed to identify the explanatory factors (including impact on the brain) as to why heavy alcohol use is related to later perpetration whereas marijuana use is not. Similarly, future studies are necessary to examine whether the relationship between marijuana use in early adulthood and victimization in adulthood continues to be a risk factor whereas heavy alcohol use does not.

LIMITATIONS

There are several limitations of this study. First, substance use and violence measures were all self-reported, which could lead to underreporting of behaviors considered to be illegal or stigmatizing. Alcohol was captured by frequency in the past year, whereas marijuana was captured by frequency in the past month. Additionally, although the violence measures included five different acts of violence perpetration or victimization, for ease of interpretation and to account for degree of skewness, the violence measures were dichotomized and only captured whether the respondents participated in any of the violent acts or experienced any of the types of victimization. Moreover, although we controlled for sociodemographic characteristics, we do not include other risk factor covariates that are related to violence and substance use, such as individual personality and temperament measures or social relationships (Boles & Miotto, 2003; Marcus & Jamison, 2013; Xue et al., 2009). Finally, although we draw from a nationally represented data set, we do not include population survey weights into the model, and thus our findings are not

generalizable to the adolescent population from which this school-based sample was drawn from in 1994.

Policy and Practice Implications

Our study has several notable strengths. The longitudinal design of the study with the utilization of four waves of data covering the developmental stages of adolescence through adulthood addresses the limitations of prior longitudinal studies that end in early adulthood (early 20s; Marcus & Jamison, 2013; White et al., 2012). By covering a longer period of development, this study revealed the need to further investigate the violence–substance use relationship during the transition from early adulthood to adulthood to uncover how the processes between these experiences and behaviors differ at this juncture and perhaps at later stages of the life course. Furthermore, this study examined alcohol and marijuana—the two most widely used substances in adolescence—and both violence perpetration and victimization, to further elucidate the ways in which these behaviors are connected to one another over the life course.

Our study findings point to several policy and practice implications. First, the results illustrate that there are opportunities for primary and secondary prevention efforts for heavy drinking, marijuana use, violence perpetration, and violence victimization in adolescence, early adulthood, and adulthood. It is important to prevent violence and substance use before they occur given that involvement in these behaviors and experiences has detrimental effects across the life span. Among people who are violent or use substances, interventions can be designed to decrease, discontinue, or prevent these behaviors or experiences from continuing.

Given the magnitude of the link between substance use and violence, substance use prevention and treatment providers who address heavy drinking and marijuana use would benefit from understanding the connectedness of these behaviors. Specifically, they can assess program participants' history of violence perpetration and victimization, and inform participants of the risk for violence involvement as related to their substance use. Providers whose target populations are victims or perpetrators of violence could also gather information about their participants' history of and current substance use, specifically marijuana and heavy drinking. Having knowledge about the cooccurrence of substance use and violence and the risks they pose at the present moment, as well as later life stages, will allow for practitioners and people involved in these behaviors to be cognizant of and prioritize addressing these behaviors to lower the likelihood of further harm to their health and safety. Furthermore, the cooccurrence of these behaviors should be evaluated in adolescence through adulthood because they are combined risks at all of these life stages.

CONCLUSION

Violence and substance use are serious public health issues that affect individuals in adolescence and early adulthood with consequences that continue into adulthood. Using a life course framework, this study highlights the linkages between violence and substance use at specific life stages from adolescence through adulthood, how each affects the other within life stages, and how each affects the other at subsequent life stages. This study enhances

findings from prior research by extending the analyses beyond early adulthood into the late 20s and early 30s. It also examines experiences of violence perpetration versus violence victimization, and compares how violence is associated with alcohol in contrast to marijuana. Although the results support existing research that these behaviors mostly cooccur in adolescence and early adulthood, our study additionally illustrates that prior experiences of violence and substance use are strongly related to later experiences in adulthood. Prevention and intervention efforts targeting substance use and violence should continue their focus on adolescence and early adulthood; however, prevention efforts in adulthood should not be overlooked. More specifically, intervention efforts should be tailored to individuals with a history of violence and substance misuse in adulthood.

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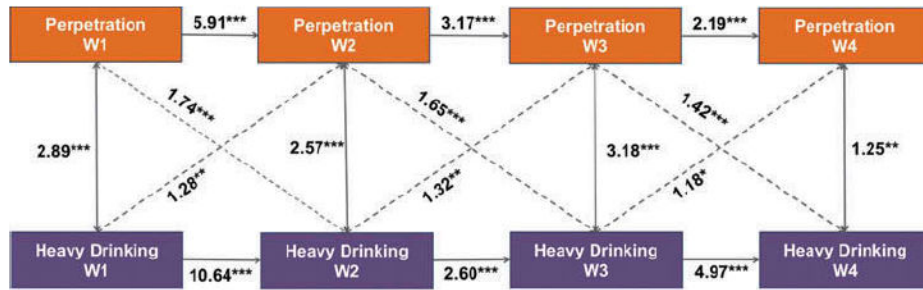


FIGURE 1.

Odds ratios for violence perpetration and monthly heavy drinking, cross-lagged logistic regression models.

Note: Logistic regression model controls for gender, race or ethnicity, adolescent family structure, household income, and parent education. * $p < .05$. ** $p < .01$. *** $p < .001$.

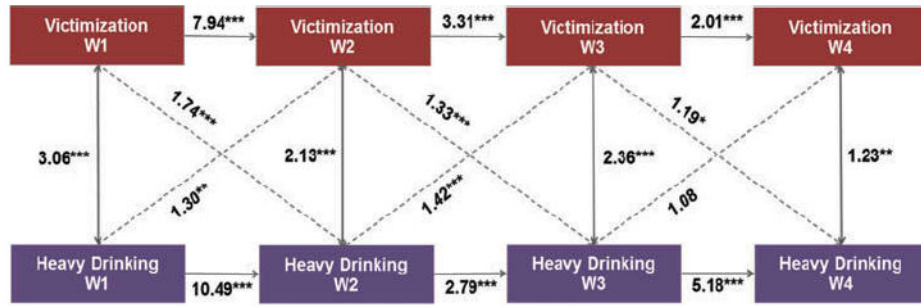


FIGURE 2. Odds ratios for violence victimization and monthly heavy drinking, cross-lagged logistic regression models.

Note: Logistic regression model controls for gender, race or ethnicity, adolescent family structure, household income, and parent education. * $p < .05$. ** $p < .01$. *** $p < .001$.

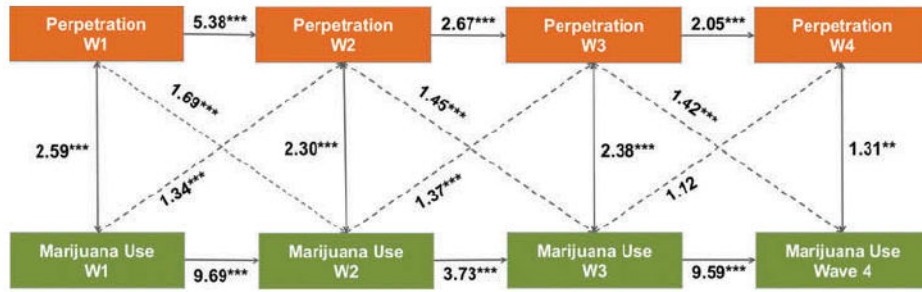


FIGURE 3. Odds ratios for violence perpetration and marijuana use, cross-lagged logistic regression models.

Note: Logistic regression model controls for gender, race or ethnicity, adolescent family structure, household income, and parent education. * $p < .05$. ** $p < .01$. *** $p < .001$.

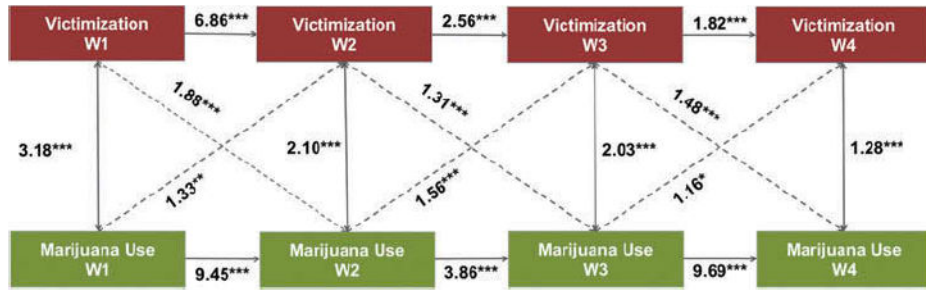


FIGURE 4. Odds ratios for violence victimization and marijuana use, cross-lagged logistic regression models.

Note: Logistic regression model controls for gender, race or ethnicity, adolescent family structure, household income, and parent education. * $p < .05$. ** $p < .01$. *** $p < .001$.

TABLE 1

Sample Descriptives, Waves 1 through 4 Add Health

	Wave 1	Wave 2	Wave 3	Wave 4
	%/M	%/M	%/M	%/M
Mean age	15.25	16.16	21.60	28.10
Gender				
Male	44.8			
Female	55.2			
Race/ethnicity				
White	54.8			
Black	21.3			
Hispanic	14.3			
Asian American	6.9			
Native American	1.9			
Other	0.8			
Family structure				
Two biological parents	55.5			
Two-parent reconstituted	17.1			
Single parent	22.6			
Other	4.8			
Household income				
< \$25,000	24.3			
\$25,000–49,999	28.6			
\$50,000	25.8			
Missing	21.3			
Parent education				
Less than high school	10.8			
High school degree/general education diploma	28.3			
Some college/tech	20.3			
College	23.5			
Graduate school	12.6			
Missing	4.5			
Outcome variables				
Monthly heavy drinking	9.3	12.2	21.9	19.8
Marijuana use in past month	13.6	15.2	22.5	16.3
Violence perpetration	41.4	27.6	13.2	16.1
Violence victimization	23.4	17.7	10.5	22.9

Note: N = 9,551.

TABLE 2

Cross-Lagged Effects from Structural Equation Models of Violence and Substance Use, Add Health

Model No.	Early adolescence → Adolescence (W1–W2)			Adolescence → Early adulthood (W2–W3)			Early adulthood → Adulthood (W3–W4)		
	OR	p	[95% CI]	OR	p	[95% CI]	OR	p	[95% CI]
Violence–Heavy drinking									
1 Perpetration → Heavy drinking	1.74	***	[1.52, 2.00]	1.65	***	[1.48, 1.85]	1.42	***	[1.23, 1.64]
2 Victimization → Heavy drinking	1.74	***	[1.50, 2.03]	1.33	***	[1.16, 1.52]	1.19	*	[1.01, 1.40]
1 Heavy drinking → Perpetration	1.28	**	[1.08, 1.51]	1.32	**	[1.11, 1.56]	1.18	*	[1.03, 1.37]
2 Heavy drinking → Victimization	1.30	**	[1.08, 1.57]	1.42	***	[1.18, 1.71]	1.08	ns	[0.95, 1.23]
Violence–Marijuana									
3 Perpetration → Marijuana	1.69	***	[1.48, 1.92]	1.45	***	[1.30, 1.63]	1.42	***	[1.21, 1.67]
4 Victimization → Marijuana	1.88	***	[1.64, 2.17]	1.31	***	[1.15, 1.49]	1.48	***	[1.24, 1.77]
3 Marijuana → Perpetration	1.34	***	[1.16, 1.56]	1.37	***	[1.17, 1.61]	1.12	ns	[0.97, 1.29]
4 Marijuana → Victimization	1.33	**	[1.13, 1.57]	1.56	***	[1.32, 1.85]	1.16	*	[1.02, 1.32]

Note: N = 9,551. Four separate models controlling for baseline gender, race or ethnicity, family structure, household income, and parent education. Bold values indicate differences in type of substance use from type of violence relationship.

* p < .05.

** p < .01.

*** p < .001.