



broken down by polydrug users (those who engaged in alcohol/marijuana and alcohol/NMUPD [nonmedical use of prescription drugs] stimulants), polydrug users reported higher levels of physical aggression compared to monodrug users. Similarly, monodrug users reported higher levels of physical aggression compared to nonusers. This research extends our understanding of aggression among users from two different subcategories: polydrug users in comparison to those who only engage in one form of substance use. Scholars and practitioners who work with violent offenders should consider patterns of drug use behavior when addressing substance use–related aggression.

polydrug use, aggression, violence, verbal aggression, nonmedical use of prescription stimulants, marijuana use

The co-occurrence of substance use and aggressive behavior is a pressing social problem given its delirious impact on the individual user and the general public. While the link between alcohol use and violence is well established in the literature (Shorey, Stuart, & Cornelius, 2011; Tomlinson, Brown, & Hoaken, 2016), less is known about subcategory forms of substance use, including polydrug use. Polydrug users, those who use multiple substances at the same time, have more negative and severe social and health consequences compared to monosubstance users (monodrug users; Egan, Reboussin, Blocker, Wolfson, & Sutfin, 2013; McCabe, Cranford, Morales, & Young, 2006). Whether polydrug use is defined as simultaneous (co-ingested at the same time in the same setting) or concurrent (taken within a set time frame but not co-ingested in the same setting), polydrug use leads to increased risk for alcohol- and drug-related problems including physical violence, blacking out, becoming physically ill, unplanned sex, sexual assault, depression, and suicidal thought (Earleywine & Newcomb, 1997; Egan et al., 2013; Hermos, Winter, & Heeren, 2009; McCabe et al., 2006; Midanik, Tam, & Weisner, 2007).

According to the Drug Abuse Warning Network, most drug-related emergency room visits include alcohol and the use of another drug (usually prescription stimulants) and is most common among those aged 18 to 25 (Substance Abuse and Mental Health Services Administration [SAMHSA], 2013). While college students have the highest rates of simultaneous use of alcohol and nonmedical use of prescription drugs (NMUPD) compared to young adults in the general population, research is lacking with only a few

A limited number of studies have examined the role of specific drugs and intimate partner violence (IPV): Results from these studies indicate that similar to alcohol use, the use of illicit drugs, including marijuana, is correlated with physical violence in dating (de Bruijn & de Graaf, 2016; Moore et al., 2008; Reingle, Staras, Jennings, Branchini, & Maldonado-Molina, 2012; Shorey et al., 2011; Tomlinson et al., 2016) and interpersonal violence (Moore & Stuart, 2005). However, while marijuana users are more likely to use physical aggression than nonusers, it is unclear whether the violence is due to withdrawal or an unknown confounding variable (Moore & Stuart, 2005; Moore et al., 2008; Nabors, 2010; Shorey et al., 2011; Tomlinson et al., 2016). A number of studies, including self-report and laboratory studies, have consistently demonstrated that marijuana withdrawal may lead to irritability and aggression (Budney, Moore, Vandrey, & Hughes, 2003; Chung, Martin, Cornelius, & Clark, 2008; Haney, Ward, Comer, Foltin, & Fischman, 1999; Lee et al., 2014; Moore & Stuart, 2005; Moore et al., 2008; N. T. Smith, 2002; Tomlinson et al., 2016). One of the most comprehensive early studies on marijuana withdrawal demonstrated that self-reported aggression increased significantly on Day 4 of marijuana abstinence and reached its highest point on Day 6 compared with aggression levels of regular marijuana users (Budney et al., 2003). Similar results were found in Lee et al. (2014) and P. H. Smith, Homish, Leonard, and Collins (2013).

Although less studied, verbal aggression has emerged as an area of violence research. A few studies have examined the relationship between substance use and verbal aggression. Recently, Farrell, Sullivan, Goncy, and Le (2015) using the Problem Behavior Frequency Scale (PBFS) demonstrated that physical and verbal aggression are two different constructs and that a combination of the two different measures lead to a decrease in model fit. Interestingly, an increase in verbal aggression, as a separate measure from physical aggression, has been associated with alcohol use (Shook et al., 2000; Wells et al., 2011) as well as the co-ingestion of alcohol and energy drinks (Miller, Quigley, Eliseo-Arras, & Ball, 2016). Research on verbal aggression and drug use is sparse; however, at least one study found that in a sample of high school students, marijuana and alcohol use (measured separately) were higher among those who engaged in verbal bullying (Radliff, Wheaton, Robinson, & Morris, 2012).

Because previous work has established that interpersonal violence perpetration and substance use behavior are gendered behavior, we briefly highlight that literature here. The preponderance of evidence suggests that males tend to engage in interpersonal violence with more frequency and severity compared with women (Kimmel, 2002). The same is true for substance use behavior (Christie-Mizell & Peralta, 2009; Hingson & Rehm, 2014; White &

Hingson, 2014). National survey data suggest that when men drink, they are more likely to engage in heavy episodic drinking compared with women. Heavy episodic drinking, in turn, is a significant risk factor for aggression (Brewer & Swahn, 2005), and alcohol use in general appears to be more frequently associated with violence compared with other forms of drug use (Reiss & Roth, 1993). It is important to note that the association between aggression and forms of substance use other than alcohol appears to occur for both men and women (Bachman & Peralta, 2002; Shorey, Stuart, Moore, & McNulty, 2014). Some scholars argue that major differences in substance use (and especially for alcohol) are based on male–female sex differences (see Wilsnack et al., 2000, for an excellent review), while others argue that socio-structural or social-psychological explanations are better suited to explain gendered patterns in violence perpetration and substance use behavior (see Anderson & Umberson, 2001; Courtenay, 2000; Locke & Mahalik, 2005; Peralta & Tuttle, 2013).



Relatively few studies on polydrug use among college students and its explicit connection to aggression and violence exist. McCabe et al. (2006) and Egan et al. (2013) found that college students engaging in polydrug use that consisted of “stimulants combined with alcohol” and “alcohol combined with marijuana” (McCabe et al., 2006) were more likely to get into a verbal argument and report physical aggression (i.e., fighting) compared with individuals who only used alcohol. However, both studies measured aggression using a relatively wide spectrum of behaviors that included various activities and consequences such as damaging property, urinating in public, and poor academic performance, which confounds our understanding of whether violence as a single measure is associated with polydrug use. A similar limitation emerges when examining drug use and violence in the general population. One study examined the simultaneous use of marijuana and alcohol: this form of polydrug use was associated with negative consequences measured using a 15-item scale that included problems associated with legal concerns, health, fighting, accidents, and relationships in a single measurement (Midanik et al., 2007).

In addition, recent studies on substance abuse and treatment in clinical populations have moved toward a more nuanced examination of polydrug use. Researchers are now examining whether there are substantial demographic and behavioral differences between (a) nonusers (i.e., those who did not report any substance use), (b) monodrug users (i.e., those who reported

one type of substance use), and (c) polydrug users (i.e., those who reported two or more types of substance use) (Kedia, Sell, & Relyea, 2007; Martinotti et al., 2009). When examining the difference between mono- and polydrug users, Kedia et al. (2007) found that there were significant race and age differences between the two groups. Specifically, White respondents were more likely to be monodrug users compared with African Americans who reported an increased prevalence of polydrug use while Hispanics were equally likely to belong to either category (which is contrary to previous research on Hispanic ethnicity and polydrug use; Kedia et al., 2007). In addition, Kedia et al. found that polydrug use was most likely to be reported between ages 18 and 44, whereas respondents younger than age 18 or older than age 44 were more likely to engage in monodrug use. Similarly, Martinotti et al. (2009) found polysubstance users had significantly higher reports of aggression, impulsivity, and suicidal ideation compared to monodrug users. These findings demonstrate that there may be important differences between mono- versus polydrug users and highlight the need for research that examines polydrug and monodrug use differences in nontreatment populations.

The present research fills significant gaps in the literature by examining the relationship between polydrug use, physical aggression, and verbal aggression among college students using nonuser, monodrug, and polydrug user subcategory distinctions. Our research question is: Does physical and verbal aggression occur more often and at a higher frequency among polydrug users compared to monodrug users?

Based on our review of the literature, we present four specific hypotheses:

Hypothesis 1 (H1): Polydrug users will be more likely to report physical aggression than their monodrug using counterparts.

Hypothesis 2 (H2): Polydrug users will be more likely to report verbal aggression compared to their monodrug using counterparts.

Hypothesis 3 (H3): Physical aggression will occur more frequently among polydrug users compared to monodrug users.

Hypothesis 4 (H4): Verbal aggression will occur at a higher incidence among polydrug users compared to monodrug users.

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The data were collected from undergraduates attending a medium-sized Midwestern university using a 50-min online survey (SurveyGizmo). After Institutional Review Board approval was granted, the survey was advertised to Introduction to Sociology courses during the semesters of fall 2013 and spring 2014. Students were offered extra-credit for taking part in the survey.

The survey was anonymous and no personal identifying information were collected except for standard demographic information. Only the primary investigator and members of the research team had access to the study data. Students were provided with counseling and health behavior referral information at the conclusion of the study. Participants were also provided with contact information of the principal investigator so that participants could obtain aggregated results of the study should individual participants be interested in receiving such information. Data collection concluded with an initial sample size of 1,026 participants, yielding an approximate response rate of 44%.¹ Adjusting for missing data yielded a final study sample size of 793. Data were analyzed using SPSS.

Potential confounding covariates of physical and verbal aggression were age, sex, race, on- or off-campus residence, and parent's highest level of education (see Table 1 for descriptive statistics). Race, sex, and living arrangement were coded as dichotomous variables. Similar to the overall demographics of the university, the majority of respondents were White (75%; "White" coded "1" and non-White coded "0"). Sex was coded male "1" and female "0." Living on-campus was coded "1"; living off-campus coded "0." As a proxy for socioeconomic status, we included both Father's Education and Mother's Education coded 0 = some high school, 1 = high school, 2 = some college, 3 = bachelor's degree, 4 = master's degree or higher, and then combined (range = 0-8). The Center for Epidemiological Studies–Depression Scale (CES-D) was included to account for possible depressive symptoms confounds (see Radloff, 1977). The CES-D was used to measure the presence of depression: It had satisfactory levels of internal consistency ($\alpha = .73$).

Physical and verbal aggression in the last month were derived from the Centers for Disease Control Youth Risk Behavior Survey (Aggression–PBFS) to allow for comparisons with national data (see Brener, Kann, McManus Kinchen, Sundberg, & Ross, 2002; Brener et

I. Descriptive Statistics (N = 793).

| | N | M/% | SD | Range | α |
|---------------------------------------|-----|-------|------|-------|----------|
| Outcome variables | | | | | |
| Verbal aggression | 750 | 15.85 | 5.11 | 11-33 | .89 |
| Physical aggression | 716 | 4.00 | 3.60 | 0-11 | .89 |
| Predictor variables: Last year | | | | | |
| Nonuser (yes = 1) | 180 | 23 | 0.25 | 0-1 | |
| Monodrug user | 93 | 12 | 0.13 | 0-1 | |
| Polydrug user | 454 | 57 | 0.62 | 0-1 | |
| Marijuana + alcohol nonuser | 201 | 26 | 0.44 | 0-1 | |
| Marijuana + alcohol monodrug user | 283 | 37 | 0.48 | 0-1 | |
| Marijuana + alcohol polydrug | 288 | 37 | 0.48 | 0-1 | |
| Stimulants + alcohol nonuser | 213 | 28 | 0.45 | 0-1 | |
| Stimulants + alcohol monodrug user | 444 | 58 | 0.49 | 0-1 | |
| Stimulants + alcohol polydrug | 103 | 14 | 0.34 | 0-1 | |
| Control variables | | | | | |
| Age (18 = 0, 25 = 7) | 796 | 1.65 | 1.71 | 0-7 | |
| Sex | | | 0.49 | 0-1 | |
| Male (1) | 314 | 0.40 | | | |
| Female (0) | 476 | 0.60 | | | |
| Race (White = 1, Other = 0) | | | 0.76 | 0-1 | |
| White (1) | 603 | 0.76 | | | |
| Non-White (0) | 188 | 0.24 | | | |
| Parent's education | 768 | 4.43 | 4.43 | 0-8 | |
| Living on-campus | | 0.62 | 0.47 | 0-1 | |
| Yes (1) | 300 | 0.38 | | | |
| No (0) | 490 | 0.62 | | | |
| CES-D | 769 | 8.71 | 4.45 | 0-21 | .74 |

† CES-D = Center for Epidemiological Studies–Depression Scale. Variables that are dichotomous (0-1) are percents in decimal form in column three (M/%).

(b) Been in a fight in which someone was hit? (c) Threatened to hurt a teacher? (d) Shoved or pushed another person? (e) Threatened someone with a weapon (gun, knife, club, etc.)? (f) Hit or slapped another person? (g) Threatened to hit or physically harm another person? All of the items had response options: 1 (0 times), 2 (1-2 times), 3 (3-5 times), 4 (6-9 times), 5 (10-19 times), and 6 (20 or more). Combined items had a range of 0 to 11, a mean of 4.0, and a Cronbach's alpha of .89.

Verbal aggression in the last month was measured using the following questions: (a) Insulted someone's family? (b) Teased someone to make them

angry? (c) Put someone down to their face? (d) Gave mean looks to another student? (e) Picked on someone? (f) Didn't let another student be in your group anymore because you were mad at them? (g) Told another person you wouldn't like them unless they did what you wanted them to do? (h) Tried to keep other from liking another person by saying mean things about him or her? (i) Spread a false rumor about someone? (j) Left another person out on purpose when it was time to do an activity? (k) Said things about another student to make other students laugh? All of the items had response options: 1 (0 times), 2 (1-2 times), 3 (3-5 times), 4 (6-9 times), 5 (10-19 times), and 6 (20 or more). Combined items had a range of 11 to 33, a mean of 15.9, and a Cronbach's alpha of .89.

them . . . (c) Tranquilizers are sometimes prescribed by doctors to calm people down, quiet their nerves, or relax their muscles. Librium, Valium, and Xanax are all tranquilizers. On how many occasions (if any) have you taken tranquilizers on your own—that is, without a doctor telling you to take them.” (Monitoring the Future, 2010).

All the substance use variables were combined together and recoded into three categories: (a) nonusers (i.e., those who did not report any substance use in the last 12 months), (b) monodrug users (i.e.,

2. OLS Regression: Physical Aggression in the Last Month ($N = 793$).

| | Model 1 | | Model 2 | |
|-------------------------------------|---------|-------------|---------|---------|
| Male (= 1) | 1.91 | 0.27*** | 1.58 | 0.26*** |
| White (= 1) | -1.33 | 0.32*** | -1.39 | 0.30*** |
| On-campus (= 1) | -0.07 | 0.30 | 0.17 | 0.29 |
| Age | 0.30 | 0.08*** | 0.21 | 0.08** |
| Highest level of parent's education | -0.1 | 1.58, 1.3). | | |

of the following drugs: LSD, powder cocaine, crack cocaine, MDMA, steroids, inhalants, meth, and heroin and combined accounted for only 11% of the sample ($N = 84$).

When examining drug use and physical aggression, there was a statistically significant difference between groups as determined by one-way ANOVA ($F = 49.81, p = .001$). A Scheffé post hoc test for significance indicated that the physical aggression was significantly higher among polydrug users compared with monodrug users ($M = 2.87, SD = .385, p = .001$) and compared with nonusers ($M = 2.44, SD = .301, p = .001$). Analysis for verbal aggression indicated there was a statistically significant difference between groups as determined by one-way ANOVA ($F = 6.16, p = .01$). A Scheffé post hoc test for significance indicated that the verbal aggression was significantly higher among polydrug users compared with monodrug users ($M = 1.69, SD = .591, p = .05$) and compared with nonusers ($M = 1.21, SD = .460, p = .05$).

Similar to the control model (Model 1), in Model 2 those who engaged in physical aggression in the last month were more likely to be male ($\beta = 1.58, p < .001$), non-White ($\beta = -1.39, p < .001$), and older in age ($\beta = 0.21, p < .01$), and to report higher levels of depression ($\beta = 0.03, p < .05$) (see Table 2). Those respondents who engaged in any form of polydrug use reported higher levels of physical aggression compared with monodrug users ($\beta = 2.64, p < .001$), after

polydrug use reported higher levels of verbal aggression compared with monodrug users ($\beta = 1.19, p < .05$), after controlling for confounding vari-

($\beta = -0.93, p < .05$). In Model 3, those respondents who reported, $\beta = 1.26, p < .001$, polydrug use reported higher levels of physical aggression compared with monodrug users ($\beta = 1.26, p < .001$). Nonusers reported lower levels of physical aggression compared with monodrug users of stimulants or alcohol ($\beta = -1.08, p < .001$). Analysis for marijuana + alcohol use and NMPD stimulants + alcohol and the association with verbal aggression was conducted but neither combination were predictive.

This study makes a unique contribution to the interpersonal violence and substance abuse literatures by examining unambiguous forms of aggression (i.e., verbal aggression and physical aggression) and specific forms of substance use (mono- vs. polydrug use) in an undergraduate population. Although previous research has found associations between polydrug use and aggression, much of the literature has not distinguished between nonusers, monodrug users, and polydrug users and their respective utilization—if any—of aggression. One study has found that college students are less likely to engage in violence compared with noncollege peers (21% college, 23% noncollege; Schwartz, Beaver, & Barnes, 2015). However, Schwartz et al. (2015) also found that college populations were more likely to report that violent behavior and bullying acts were associated with alcohol use compared with nonstudent populations.

Results from the current study indicate that polydrug users reported more physical and verbal aggression compared to their monodrug using counterparts, as determined by one-way ANOVA. Physical aggression occurred more frequently among polydrug users compared to monodrug users in both the 30-day and 1-year substance use models. Multivariate analyses demonstrated that “polydrug user” status was predictive of higher levels of verbal and physical aggression compared to monodrug users: There were no significant differences between those who abstained from substance use or only used a single drug (i.e., monodrug users). We attribute the lack of significant difference due to the 1-year measurement of substance use because nonusers were significantly less likely to engage in physical aggression compared to monodrug users using a 1-month time frame. When polydrug use was analyzed according to the most commonly used drug combinations, (a) alcohol and marijuana and (b) alcohol and stimulants, there were no significant differences between these two drug combinations for verbal aggression. However, both categories of polydrug use were predictive of a more frequent use of physical aggression compared with monodrug use. Furthermore, there were differences in physical aggression scores between monodrug use and

abstention, where monodrug users reporting more frequent use of physical aggression compared to nonusers. Consistent with previous studies on polydrug use in college populations, the combination of stimulant and alcohol use is predictive of physical aggression (Egan et al., 2013; McCabe et al., 2006), although this previous research measured aggression on a scale with other health-risk behaviors and consequences such as declining academic performance.

The use of alcohol and stimulants was predictive of physical aggression among mono- and polydrug users compared with nonusers. This is consistent with previous research, which has found that the use of stimulant drugs used in high doses or chronic use, including prescription stimulants, can induce delusions, paranoia, and irritability (Boles & Miotto, 2003). In addition, alcohol is a well-established predictor of aggression and violence (Hines & Straus, 2007; Riggs et al., 2000; Shorey et al., 2011). Although, the timing and dosage of the drugs used in this study were not measured, if these drugs were taken simultaneously the effects of stimulant medication may conceal the effects of alcohol intoxication longer, thus leading to a greater amount of alcoholic beverages consumed and an increase in the likelihood of aggression (Egan et al., 2013). It is also possible that higher levels of aggression could be attributed to other factors not measured in this research such as childhood neglect and abuse. At least one study in a clinical treatment sample found that polydrug users had significantly higher levels of aggression and emotional/physical neglect in childhood compared to monodrug users (Martinotti et al., 2009).

The findings regarding marijuana and alcohol polydrug use association with a higher level of physical aggression were unexpected and perhaps signify a complex association. Previous studies show that marijuana tends to decrease violence or has no effect on violent behavior (Boles & Miotto, 2003; Denson & Earleywine, 2006; Moore et al., 2008; Wei, Loeber, & White, 2004). However, early studies did not examine the effects of marijuana withdrawal on violence perpetration. More recent studies have consistently demonstrated that marijuana withdrawal may lead to irritability and aggression (Budney et al., 2003; Chung et al., 2008; Haney et al., 1999; Lee et al., 2014; Moore & Stuart, 2005; Moore et al., 2008; N. T. Smith, 2002; Tomlinson et al., 2016). Theoretically, individuals could be using alcohol to self-medicate the withdrawal symptoms of marijuana, which could increase the likelihood of aggression and violence even further. Additional evidence in support of this association was found by Mercado-Crespo and Mbah (2013): They examined marijuana and alcohol polydrug use among high school students and reported that polydrug users were more likely to be physically aggressive compared to those who used only one substance—either alcohol or marijuana. There is also the possibility that the association between the poly-use



of marijuana and alcohol and aggression is spurious. It is possible that heavy drinkers who are more prone to violence compared to moderate drinkers are more likely to suffer from an alcohol-induced hangover the next day and may use marijuana to alleviate hangover symptoms such as nausea. The association between aggression and polydrug use (marijuana and alcohol) could be due to the effects of heavy episodic drinking, not the combination of the two drugs. Although there is no research addressing this possible phenomenon,

incidence of aggression and the time of substance use. It is also important to note that the number of times substances are used is not the same as dosage per use: Future surveys on aggression and substance use should ask questions differentiating between frequency and quantity of use per sitting.

Third, due to data limitations, we cannot distinguish between simultaneous and concurrent polydrug use. Recent research has demonstrated that simultaneous polydrug use is thought to be of greater mental, social, and health consequence compared with concurrent polydrug use (Baggio et al., 2014). Future research should examine possible differences in aggression between concurrent and simultaneous polydrug users versus monodrug users.

In addition, our inclusion of race/ethnicity as a binary variable is a limitation because the non-White category included a diverse number of ethnora-
cial subgroups (i.e., African American composed 14% of the sample; Hispanics, Asians, Native Americans, and self-identified “biracial” groups accounted for only 9% of our sample). We dichotomized “race” due to too few responses from each of the aforementioned minority groups. In a recent study, Mercado-Crespo and Mbah (2013) found that physical aggression varied not only due to the extent of alcohol and/or marijuana use but also by race/ethnicity with the highest reports of physical aggression for Black and Hispanic adolescents. Therefore, future research should take into account sociological theories that prioritize positionality in social structures and hier-

with mono- and nonusers. We note that polydrug use may be particularly dangerous given that most drug-related emergency room visits are the result of the co-ingestion of alcohol and another drug (SAMHSA, 2013). We also note that our results are congruent with findings from other studies that highlight the need for prevention efforts to focus on polydrug use at the collegiate level.

Current prevention efforts at the college level primarily focus on alcohol use and decreasing binge drinking (Quintero, 2009). Prevention efforts should perhaps respond to specific patterns of drug use—especially polydrug use. Sex differences should also be taken into account in prevention and intervention strategies. College officials responsible for college health and violence prevention/intervention should be aware of the important distinction potentially associated with mono- versus polydrug use. Finally, our work informs policy by providing a framework to help inform academic administrators and support staff, researchers, and public health practitioners in their understanding about potential underlying sources of violence and aggression among college students. Prevention, intervention, and treatment approaches to aggression should include an assessment of subcategories of drug use, which include the mixing of alcohol, stimulants, and other forms of drug use to determine risk for future aggression and interpersonal violence perpetration. We caution that more research needs to be conducted before formal protocols should be put into place—Yet, polydrug use appears to be a risk factor for violence perpetration and should thus be in consideration as more research sheds much-needed light on the nexus between the criminal justice and public health aspects of interpersonal violence.

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1. A precise response rate cannot be calculated due to the anonymous nature of the study and the convenience sampling frame. Those over age 25 and those under age 18 were dropped from the analysis to focus on a traditionally aged college population.

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