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Reciprocal Effects of Alcohol Use and Violence Perpetration among Early Adolescents in Mexico: A Gendered Analysis

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Abstract

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Authors' Contributions

SK conceived the study, developed the research questions, designed the analysis plan, performed statistical analyses, and drafted the manuscript; JJ and SA helped design the analysis plan, interpret results, and draft sections of the manuscript; FM developed the conceptual background and the prevention research implications of the study; BN, DC, and MM contributed to the literature review, the description of the Mexican social and cultural context, and the interpretation of results; EK performed statistical analyses, drafted sections of the manuscript, and helped interpret results; and SH drafted introductory sections of the manuscript. All authors read and approved the final draft.

Data Sharing Declaration

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Ethical Approval

The study adhered to data collection protocols to ensure human subjects' protections in accordance with the 1964 Helsinki declaration and its later amendments. Protocols were approved by the Arizona State University Institutional Review Board and by university or agency Institutional Review Boards in each study city.

Informed Consent

After receiving information sent home about the study, parents provided passive consent for their child's participation, and could opt the child out of completing the survey. Students assented to complete the surveys after they were informed of the purpose of the study, that participation was voluntary, and that their responses would remain confidential.

Although substance use and violent behaviors often emerge together in adolescence, and both have similar widely cited causes and negative consequences for development, it remains unclear whether and how they may be linked causally. This study of early adolescents in Mexico's three largest cities tested whether alcohol use and violence perpetration are temporally related, whether their relationship is unidirectional or reciprocal, and whether the relationship differs by gender and the type of violence. The study employed longitudinal data from seventh grade students (N=4,830; M age = 12.0, range 11–15; 49% female) in 18 public middle schools in Mexico City, Guadalajara and Monterrey. Students completed questionnaires at the beginning, middle, and end of the 2014–2015 academic year. Students' responses to a multi-dimensional violence assessment emerged in two distinct patterns: criminally violent acts, and bullying/aggression. Although males engaged in both types of violence more frequently than females at all three time points, they used alcohol more frequently than females only at the first survey, after which the gender gap disappeared. Cross-lagged multi-group path models showed that, for both males and females, more frequent alcohol use predicted subsequent increases in criminally violent behavior, and bullying/aggression predicted later increases in alcohol use. Reciprocal associations varied by gender and type of violence: Alcohol use was reciprocally linked to criminally violent behavior among males only, and reciprocally linked to bullying-aggression among females alone. The results are interpreted in the context of sharply increasing rates of violence in Mexico and changing gender norms, with implications for youth prevention programs.

Keywords

adolescents; Mexico; violence; alcohol; prevention; gender

Introduction

Substance use and violence are important public health concerns globally, particularly for young populations (Ellickson, Tucker, and Klein 2003; Massetti and Vivolo 2010). Use of alcohol and drugs in adolescence has negative effects on psychological wellbeing and physical development (Center for Disease Control 2016 2018). In addition to the risk of physical injury and death, youth violence is also related to mental health problems, poor performance in school, harmful use of alcohol and drugs, and later victimization or perpetration of violence as an adult (Kieselbach, and Butchart 2015), including in Mexico (Quiroz del Valle et al. 2007; Juárez, Villatoro, Gutiérrez, Fleiz, and Medina-Mora 2005).

Substance use and violence among youth are closely associated empirically, and their most commonly cited causes and consequences often overlap. However, whether a causal link exists between substance use and youth violence, its direction, and its underlying mechanisms, remain unclear. Because substance use and violence both have profound, lingering, and cumulative negative effects on the physical and mental health of adolescents, it is important to clarify the direction of the association, especially in settings where violence or substance use, or both, are pervasive. Better understanding of the nature of this association among younger adolescents can help inform early prevention efforts. The main purpose of this study is to examine the association among early adolescents in large urban areas of Mexico, where substance use and violence have recently emerged as critical social

problems. Mexico has experienced a notable narrowing in the gap between female and male adolescents in the prevalence of problem behaviors, including rates of substance use and violence. Accordingly, this study investigated whether violence and substance use were related in ways that were similar or different for male and female Mexican early adolescents. The study focused specifically on alcohol use because it is the substance that prior research has most often linked to violence as well as the substance most widely used by adolescents in Mexico and elsewhere.

Substance Use and Violence in Mexico

Mexico has witnessed sharp increases in recent years in the prevalence of substance use among its youth and a rapidly closing gender gap in use. In a 2016 national sample of Mexican adolescents, 5.3%, 6.2%, and 6.4% reported lifetime use of marijuana, other illegal drugs, and any drugs, respectively, representing substantial increases from 2008 and 2011 (Escobar et al. 2018). Adolescent gender gaps in substance use, especially use of alcohol, narrowed in 2016 compared to 2002 and 2008, mostly reflecting increasing rates of use among female adolescents. For example, among female adolescents between ages 12 and 17, 8.6% reported excessive alcohol use in 2011, but that number nearly doubled by 2016, to 14.9%. Meanwhile, the gender gap in excessive alcohol use narrowed significantly, with the percentage among males exceeding that of females by 6.9% in 2011 but only by 0.6% in 2016. Among middle school (*secundarias*) and high school (*bachilleratos)* students in Mexico, 19% of males and 16% of females reported using alcohol, tobacco or other drugs (Instituto Nacional de Psiquiatría Ramon de la Fuente Múñiz [INPRFM] 2015). An important emerging feature of the narrowing gender gap in alcohol use among Mexican youth is its developmental timing. In elementary schools (*primarias*) through 6th grade, boys in the national survey have reported twice the rate of lifetime alcohol use compared to girls (INPRFM 2015), which suggests that the shrinking of the gender gap occurs among early adolescents during or soon after the transition to middle school.

Mexico provides a unique and important context to examine substance use and violence due to the relatively high and increasing prevalence of community level violence in recent years. Triggered by the drug war between the government and multiple criminal organizations dedicated to drug trafficking, crime rates in Mexico have risen sharply since 2007, affecting widening sectors of the country (CNN 2018). Homicides among youth between age 10 and 29 rose from less than 10 to 25.5 per 100,000 persons from 2007 to 2010, and females are increasingly perpetrators, as well as victims, of violence (World Bank 2012). Data on school violence indicates that over two-fifths (44%) of middle school students in Mexico have been robbed in school, and 14% have been physically hurt by peers (Aguilera, Muñoz, and Orozco 2007). Mexico has a relatively high percentage of school bullying victims (20.2% in 2015), higher than the OECD average (18.7%) (Organization for Economic Co-operation and Development 2017). In some Mexican states, more than half of middle and high school students report involvement in bullying as a victim, aggressor or victim-aggressor (Joffre-Velázquez et al. 2011), with no significant differences by gender (Hernández, Huerta, Gordillo, Luna and Rodríguez 2016).

The closing gender gaps in youth substance use and violence in Mexico can be attributed to increasing gender equality and empowerment of women in Mexico, the eroding influence of traditional gender roles, and gendered ways of coping with stress. While the promotion of gender equality has led to advancements for Mexican women in educational and employment opportunities, it has also increased exposure to and involvement in risk behaviors (Sørensen 2018). Increasingly, female adolescents in Mexico are questioning or no longer adhering to traditional gender role norms, which in the past discouraged their involvement in substance use and other risk behaviors (Benjet, Borges, Méndez, Casanova and Medina-Mora 2014). The lessening of these cultural restraints results in less strict parental monitoring of adolescent women and their greater exposure to risky environments such as unsupervised parties or bars. Research also indicates that women use alcohol as a coping mechanism to manage the depression and anxiety resulting from violence, which exacerbates the likelihood of re- victimization and alcohol abuse over time (Fossos, Kaysen, Neighbors, Lindgren and Hove 2011.

Looking at the association between adolescent substance use and violence in different socioeconomic and political contexts is important in that previous studies have focused on a few highly developed countries, particularly the USA. It is possible that adolescent substance use and violence are related in distinctive ways in different social, cultural and political contexts. In fact, studies comparing contexts within societies have found that pervasive violence at the household level (Espelage, Low, Rao, Hong, and Little 2014), and high crime rates and low socioeconomic status at the neighborhood level (Fagan, Wright, and Pinchevsky 2015; White, Jackson, and Loeber 2009) are associated with more substance use, because they exacerbate perceived danger and the fear of violence (Egerter, Barlay, Grossman-Kahn, and Braveman 2011). Further, accumulated exposure to violence within different life domains, such as family, school and neighborhood, is likely to increase the chance of future substance use among adolescents (Wright, Fagan, and Pinchevsky 2013). These considerations suggest that it is important to investigate the relationship between substance use and violence among adolescents in diverse settings.

Theoretical Explanations Linking Substance Use and Violence

Competing theoretical models have attempted to disentangle the mechanism behind the association between substance use and violence (Wagner 1996). The first model advances a unidirectional causal hypothesis that substance use leads to violence. Illicit substance users might resort to violence to generate income to sustain a drug habit (Goldstein 1985), or experience a state of disinhibition from the psychopharmacological effects of substance misuse that promotes violent behavior (Mulvey et al. 2006). The second model reverses the causal direction, proposing that violence causes substance use (Agnew 2006; Moore and Stuart 2005). Possible mechanisms for this causal direction are that criminally violent subcultures promote substance use as part of an unconventional image, that those prone to violence self-select into social situations and social networks where substance use is prevalent and encouraged, and that youth perpetrating violence (and often victimized by it) use substances as a coping mechanism to deal with the stress caused by violence. A third, reciprocal model, proposes a bi-directional association where substance use and violence are linked in a mutually reinforcing cycle, due to the simultaneous operation of the dynamics

proposed in the first two models (Mrug and Windle 2009). The fourth model contends that substance use and violence are only indirectly related, that some common factor increases vulnerability to both of them (Logan-Greene et al. 2011; White et al. 2009). Their observed association in adolescence may be spurious and is sometimes attributed to weak bonding with parents, poor school integration and low academic performance, and associations with anti-social friends that encourage delinquent behaviors (Hirschi 2017).

Empirical Evidence Connecting Substance Use and Violence

The empirical record on the connection between youth substance use and violence remains uncertain for several reasons (see Scholes-Balog, Hemphill, Kremer and Toumbourou 2013). Many studies have been cross-sectional, obscuring directionality (Mulvey et al. 2006; Soyka 2000). Longitudinal studies supporting better causal inferences, however, have produced inconclusive results (Boden, Fergusson, and Horwood 2012; Green, Doherty, Zebrak, and Ensminger 2011; Lim and Liu 2016; Marcus and Jamison 2013; Swahn and Donovan 2004; Xue, Zimmerman and Cunningham 2009). Some reasons for the mixed findings of previous longitudinal studies are: 1) examining the association within or across different developmental stages (pre-, early-, middle-, late adolescence through young adulthood); 2) using restricted samples (e.g., African Americans only, adolescents in juvenile justice, and drinkers only); 3) differing measures of substance use (e.g., frequency, amount, dichotomous, and heavy episodic drinking) and violence (e.g., bullying, aggression, criminal behavior, and dating violence); 4) failure to include common risk factors influencing both substance use and violence; and 5) failure to use statistical methods that allow for reciprocal causation.

Some studies that focus on the developmental stage of adolescence have tried to overcome the drawbacks of previous research and added explorations of gender differences in the association between substance use and violence. The results, however, continue to be mixed. A study in Australia used a cross-lagged path model to test the association among adolescents and found that alcohol use in the 7th grade predicted a higher level of violence in the 8th grade, but not vice versa, with similar results for boys and girls (Scholes-Balog et al. 2013). Heavy episodic drinking also predicted a higher level of violence two years after the 7th grade, but only for female students. Another study examined cross-lagged associations among family violence, fighting perpetration, and substance use among adolescents from four US Midwestern middle schools (Espelage et al. 2014). The findings showed a uni - directional causal relationship from violence to substance use for both genders. Interestingly, change in marijuana use was weakly but inversely associated with change in aggressive behavior, suggesting potentially different effects for different substances. On the other hand, another study of US adolescents found evidence of bi-directional causation (White, Fite, Pardini, Mun and Leber 2013).

Current Study

This study tested for temporal links between alcohol use and violence perpetration among 7th grade students in large Mexican cities, and whether they vary by gender. The study estimates cross-lagged path models with three time points to test four research questions:

whether alcohol use predicts later violence perpetration; whether violence perpetration predicts later alcohol use; whether the relationship is bi-directional; and whether these relationships differ by gender. It extends prior research by investigating these links in a country with sharply increasing, relatively high, and intense levels of violence that expose large proportions of youth to violence in their communities. While most prior studies of this type have examined populations from the wealthiest industrialized societies, this study examines an emerging economy. The focus is on alcohol use because it is the most commonly used and easily accessible substance for adolescents, and because of the rapidly narrowing gender gap in alcohol use as rates of use and misuse for adolescent women approach those of adolescent men in Mexico. As this gender gap disappears among youth in Mexico, any gender differences in the relationship between alcohol use and violence cannot be attributed simply to gender differences in the prevalence of these behaviors.

Methods

Sample and Participants

Data for this study are from a multisite feasibility trial of a school-based substance use prevention curriculum in Mexico. The participants were 7th grade students (N=4,830) from 18 public middle schools (*secundarias*) in Mexico's three largest cities—Mexico City, Guadalajara, and Monterrey. Students completed self-administered questionnaires at the beginning (T1: Fall 2014), middle (T2: Winter 2015), and end (T3: Spring 2015) of the academic year, with 3–4 month lags between each of the three survey waves. Half of the schools, randomly selected, delivered the prevention curriculum between T1 and T2. Attrition rates were relatively low (18% from T1 to T2; 19% from T1 to T3).

Measurements

At each of the three survey waves, students responded to identically phrased questions regarding alcohol use, violence perpetration and a selection of control variables and covariates.

Alcohol use.—Recent use of alcohol was assessed by a single question, "How many times in the last 30 days have you drunk any alcohol beverage?" Responses were recorded on a 7–point Likert scale ranging from "never" to "more than 30 times." This validated measure has been shown to be reliable and is widely used in surveys of adolescent substance use (Graham et al. 1984).

Violence perpetration.—The study utilized a validated multi–dimensional measure of violence that includes subscales for perpetration, victimization, and witnessing violence (Nadel, Spellmann, Alvarez–Canino, Lausell–Bryant, and Landsberg 1996). Respondents reported how often in the last 12 months they had engaged in, been victimized by, or witnessed different forms of violence, on 5 point Likert scales from "never" to "more than 10 times." Because this study focused specifically on violence perpetration in a unique study population and societal context, psychometric properties were explored through a factor analysis of all the items from the three violence subscales together. The items measuring victimization and witnessing factored as originally designed into two distinct factors. The

violence perpetration items loaded onto two additional separate factors. One set of five items (brandishing a weapon, using a weapon in a fight, using physical force to compel someone, robbery/theft, and intimate partner violence) loaded onto a criminally violent (or "delinquent") behavior factor (α = .83), while six items (making fun of someone, spreading false rumors, hitting, pushing, engaging in group fighting, and destroying property) loaded onto a bullying/aggression factor (α = .80). Because violence perpetration is correlated with witnessing violence and victimization (r = .46 to .52 in this sample), the current analysis used these criminal violence and aggression/bullying perpetration factor scores that were orthogonal to witnessing violence and violence victimization. This demonstrated the particular effects of engaging in criminal violence and aggression/bullying, net of concomitant victimization and witnessing of violence.

Controls and covariates.—All multi–variate analyses controlled for the effects of age, sampling site, type of school session, and intervention condition, all of which were measured at the pretest survey. Five additional potential covariates were employed in alternate models to ascertain whether these variables were responsible for producing spurious relationships between alcohol use and violence. These covariates were employed as time-varying measures using each of the three survey waves.

Age.—Age was self-reported by the student in whole years.

Study site/city.—The study locations (Mexico City, Guadalajara, or Monterrey) were treated as a set of dummy variables (0 or 1), with Mexico City as the reference.

School session.—The students attended schools that met only in the morning or in the afternoon. This was dummy coded, with morning sessions as the reference.

Intervention condition.—Students attending schools that had been randomized to implement the substance use prevention program (*keepin' it REAL*, or *Mantente REAL* in Spanish) were coded 1, and those in a non- implementing school serving as a comparison group were coded 0 (see Marsiglia et al. 2014 for a description of the intervention).

Academic performance.—The students self-reported their "usual school grades" on a zero-to-four scale that corresponds to an E–D–C–B–A grade point average.

Susceptibility to negative peer influence.—This scale, measuring the student's likelihood of succumbing to peer pressure to engage in anti- social behaviors, includes six yes/no items, such as "I would go along with my best friend if s/he wanted to skip class" and "If my friends challenged me to do it I'd rip a page out of a library book" (Luengo, Romero, Gómez-Fraguela, Guerra, and Lence 1999; Cronbach α = .76 in this sample at the pretest).

Associations with friends using substances.—This scale combines four items that ask students to estimate the proportion of their best friends (from "none"=0 to "all"=5) that use alcohol, cigarettes, marijuana, and other drugs (Hansen and Graham 1991; α = .90).

Parent-child conflict.—The pervasiveness and intensity of conflictual interactions between the student and his/her parents in the last month is measured by this scale, including eight items such as “Your parents get angry with you every day” and “Conversations with your parents are frustrating.” Responses range from “never” (0) to “always” (4) (Robin and Foster 1989; α = .93).

Depressive symptomology.—The final scale assessing potential covariates was the CES-D short self-report measure of the frequency of experiencing depressive symptoms during the past week (from “never or rarely”=0 to “most or all of the time”=3). Examples of the ten items include “I felt alone,” “I felt sad,” and “I couldn’t motivate myself” (Phillips et al., 2006; α = .90).

Plan of Analyses

Using t–tests and chi–square tests, preliminary analyses assessed whether there were gender differences in levels of alcohol use, violence perpetration, and in variables employed as controls. Then, cross–lagged multi-group path models in Mplus 7.0 were estimated to examine the reciprocal effects of alcohol use and violence perpetration and determine whether the paths differed by gender. The path models used alcohol and violence measures that adjusted through residualizing for the effects of potentially salient control variables, all measured at the T1 pretest: age, site/city, morning or afternoon school sessions, and intervention condition (experimental or comparison group). The residualization was performed by saving the residuals from regression models that entered all the control variables as predictors of alcohol use and of the two violence perpetration subscales, performed separately at each survey wave. This process removed any predictive effects of these controls on the alcohol and violence measures.

Two cross–lagged path models were estimated, one for criminal violence and another for bullying/aggression. Both models tested for the effects of T1 and T2 alcohol use on later T2 and T3 violence, as well as the effects of T1 and T2 violence on subsequent T2 and T3 alcohol use. The models permitted the alcohol and violence measures at the same time point to co-vary, utilized full information maximum likelihood (FIML) to adjust for any missing data and attrition, and included school-level random effects. Standardized coefficients are reported for model comparisons. These coefficients were produced using the MLR (maximum likelihood with robust standard errors) estimator. All models included auto-regressive paths for the influence of earlier alcohol use on later use, as well as earlier violence as a predictor of later reports of violence. Global model fit was assessed using the chi -square goodness of fit statistic, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR).

The final models included specific tests of gender differences for all four cross–lagged paths in each model. To test for significant gender differences in the cross-lagged paths, baseline comparison models were first established. To do so, statistically significant gender differences in auto-regressive paths were tested for through a series of nested models. Auto-regressive paths were individually constrained to be equal across gender; using the Satorra–Bentler chi-square difference test, each nested model was examined for a loss of model fit

relative to the full model in which all parameters were free to vary by gender. In the baseline model, auto-regressive paths were constrained to be gender invariant when doing so did not result in a significant loss of model fit. Next, gender differences in cross–lagged paths were tested using the same procedure used to establish the baseline model. Every path was tested separately for gender differences, comparing each nested model to the baseline model. Correlations were permitted to vary by gender. Only the final models are presented, indicating where auto-regressive and cross-lagged paths vary by gender, and where they were constrained to be equal, as indicated by the sequence of model fit tests.

Results

Table 1 presents descriptive statistics for the sample, separated by gender, along with tests for gender differences in these characteristics. The mean age of students overall was 12.4 years, and 49% were female. There were no significant differences between males and females in distributions across sites/cities (X^2=0.17, d.f.=2, p=.916) or in their assignment to an intervention condition (X^2=0.04, d.f.=1, p=.849). However, males were slightly older than females (t=4.12, d.f.=4,721, p=.001), on average by .06 years, and somewhat less likely to attend a school having sessions in the morning versus the afternoon (X^2=6.67, d.f.=1, p=.010), by 3%. Although these small gender differences may not be substantively meaningful to an examination of gender differences in the association between alcohol use and violence, the analytic models that were employed included controls (through residualization) for any influence of age and of school session, as well as any effects of participation in the intervention.

Table 1 also addresses overall gender differences in alcohol use and violence perpetration. Compared to females, males reported significantly more frequent alcohol use at T1 (t=7.25, d.f.=4,821, p=.001), but females increased their alcohol use at T2 and T3 by enough to narrow the gender gap to non-significance. However, males consistently reported significantly more violence perpetration than females at all survey waves, both for criminally violent behavior (t=37.96 at T1, t=37.62 at T2, t=51.32 at T3; p<.001) and bullying/aggression (t=29.85 at T1, p<.001; t=4.40 at T2, p<.001; t=8.83 at T3, p<.001). Measures of the prevalence of alcohol use and violence in the sample (not reported in tables) provide more substantive context than can be gleaned from the means and standard deviations. The proportion of students reporting any past 30 day use of alcohol rose from 20% to 24% from T1 to T3, and in that interval the gender gap in any alcohol use narrowed from 20 to 4 percentage points. Reports of any criminally violent perpetration rose from 18% to 22% overall from T1 to T3, and the gender gap grew from 4 to 7 percentage points. Reports of any bullying/aggressive behavior rose from 55% to 60% in the same interval, with a slightly shrinking gender gap, from 6 to 5 percentage points.

Figure 1 reports the final multi-group auto-regressive path model testing the relationships between alcohol use and criminal violence. This model had acceptable fit to the data (χ^2[12 d.f.] = 7.52, p=.820; RMSEA = 0.001; CFI = 1.00; SRMR = 0.021). There were sizeable auto-regressive relationships for alcohol use and for criminal violence. More frequent earlier alcohol use was a significant predictor of greater subsequent alcohol use, and was invariant across gender from T1 to T2 (β =.412, p = <.001) and T1 to T3 (β =.211, p<.001). However,

earlier alcohol use at T2 predicted T3 alcohol use somewhat more strongly for females (β =.429, p<.001) than for males (β=.323, p<.001). Earlier involvement in criminally violent behavior was also a significant predictor of more criminal violence at all subsequent waves, and these relationships that were gender invariant (T1 ➔ T2: β =.422, p<.001; T1 ➔ T3: β =.229, p<.001; T2 ➔ T3: β =.458, p<.001). The cross-lagged paths from alcohol use to criminal violence were also statistically significant. More frequent earlier alcohol use predicted higher levels of criminal violence at all subsequent waves, and these relationships did not vary significantly by gender (T1 ➔ T2: β =.058, p<.001; T2 ➔ T3: β =.074, p<.05). However, in the cross-lagged paths running in the opposite direction, higher levels of criminal violence predicted greater subsequent use of alcohol use only from T1 to T2 and only for males (β =.121, p<.01). The level of criminal violence at T2 was not a significant predictor of T3 alcohol use for either gender.

Figure 2 presents the path model testing the bi-directional effects of alcohol use and bullying/aggression across the three time points. This model also had acceptable fit to the data (χ^2 [13 d.f.] = 14.02, p =.37; RMSEA = .006; CFI = .999; SRMR = .021). All the auto-regressive relationships were again statistically significant. More frequent prior use of alcohol predicted greater subsequent use of alcohol, and these relationships were gender invariant (T1 ➔ T2: β =.418, p<.001; T1 ➔ T3: β =.212, p<.001; T2 ➔ T3: β =.379, p<.001). The level of earlier bullying/aggression was also a gender invariant predictor of more subsequent bullying/aggression across all waves (T1 ➔ T2: β =.518, p<.001; T1 ➔ T3: β =.249, p<.001; T2 ➔ T3: β =.442, p<.001). The cross-lagged paths from earlier alcohol use to later bullying/aggression were statistically significant only from T1 to T2 and only for females (β =.085, p<.01). Greater alcohol use at T2 was not a significant predictor of T3 bullying/aggression for either gender. Finally, earlier bullying/aggression predicted later use of alcohol at all waves and did not vary by gender (T1 ➔ T2: β =.068, p<.001; T2 ➔ T3: β =.063, p<.001).

Sensitivity Analyses and Alternate Models

Before proceeding to the final models, alternate approaches to measurement were explored. For example, a measure of alcohol use combined the Likert–type scale for alcohol use frequency with another for alcohol amounts consumed in the last 30–days, by standardizing both of them and calculating their mean. Different measures of violence included the use of constructed scales for the frequency of engaging in criminal violence and in bullying/aggression, rather than the factor scores used in the final models. Models using these alternate measures produced results mirroring those in Figures 1 and 2. The final models used only the alcohol frequency measure because it more clearly charted changes in the degree of use, and employed the orthogonal factor scores for violence because they separated perpetration of violence from simultaneous victimization and witnessing of violence.

In addition to the final path models that tested for unidirectional and reciprocal relationships between alcohol use and violence, alternate models explored whether these might be spurious relationships that are attributable to other influences. These tests for spurious relationships considered a range of commonly cited influences, spanning factors in the

school, peer and family domain as well as an individual level measure of internalizing symptomology (White, Loeber, Stouthamer-Loeber, and Farrington 2009). These alternate models added, one at a time, five variables to the cross-lagged models as predictors of subsequent alcohol use and violence: school grades as a measure of academic performance; a scale measuring susceptibility to negative peer influence; the proportion of the student's friends that used various substances; a parent-child conflict scale; and the CES–D short self-report measure of depressive symptoms. After introducing each of these into the models as time- varying direct predictors of subsequent alcohol use and violence, the relationships between alcohol and violence were unchanged in direction, statistical significance, and general magnitude. These models demonstrated that the relationships between alcohol use and violence were not spuriously attributable to the effects of poor performance in school, negative peer influence, associating with substance -using friends, conflictual relationships with parents, or depressive symptoms.

Discussion

Although substance use and violent behaviors often emerge together in adolescence, and both have similar widely cited causes and negative consequences for development, the evidence on whether and how they may be linked has remained somewhat unclear. A patchwork of inconsistent results from prior studies suggest that it may be important to consider developmental timing, gender differences, the type of violence, and social, cultural and economic contexts as factors in how substance use and violence are interrelated in adolescence. The main aims of this study were to test for interrelationships between alcohol use and two forms of violence perpetration—criminally violent behavior and bullying/aggression—and whether the relationships differed by gender in a multi-site urban sample of Mexican middle school students. Results from multi-group cross-lagged path models produced two major findings. First, the direction of the relationship between alcohol use and violence was dependent on the type of violence being perpetrated. Regardless of gender, more frequent alcohol use predicted increases in later criminally violent behavior, but not necessarily later bullying-aggression. Looking at the reverse causal direction, bullying/aggression predicted later increases in alcohol use at all intervals, but criminally violent behaviors did not predict more alcohol use at the final survey wave. Two additional findings pointed to gender differences in reciprocal relationships. For male adolescents, prior criminally violent behavior predicted increased alcohol use, and vice versa, from the start to the middle of 7th grade (T1 to T2), but not later in the academic year (from T2 to T3). For female adolescents, more frequent alcohol use predicted later bullying-aggression, and vice-versa, but again only from T1 to T2.

The results supply at least partial support for several of the models that have been advanced to explain the association between adolescent substance use and violence. The one-directional model proposing that substance use leads to violence is consistent with the finding that alcohol use predicted later criminally violent behavior, both for females and males, and durably, at multiple time intervals. Evidence also emerged for the second model that reverses the one-way causal direction—that violence leads to substance use. Results showed that bullying/aggression predicted later alcohol use, for females and males, and across all time intervals. The evidence for the third, reciprocal model, was limited and

contingent: it varied by type of violence, gender, and developmental stage. Alcohol use and criminally violent behavior were reciprocally predictive of each other only for males and only from the start to the middle of 7th grade. Similarly, alcohol use and bullying/aggression were reciprocally related only for females and only from the start to the middle of 7th grade. But many of the statistically significant cross-lagged paths between alcohol use and both types of violent behaviors were indistinguishable by gender, male and female early adolescents in urban Mexico. The reasons for this convergence may relate to the changes in gender role socialization in Mexico, discussed more fully below. Finally, it should be noted that alternate models to those presented had ruled out prime candidates for causing spurious relationships between substance use and violence, as proposed by the fourth conceptual model of the nature of the substance use and violence connection. The cross-lagged paths of alcohol use and both types of violence were essentially undisturbed after also entering alternate explanatory variables into the models, including poor academic performance, negative peer influence, associations with substance-using friends, parent-child conflict, and depressive symptomology.

The nature and magnitude of overall gender differences in the frequency of alcohol use and perpetration of violence provide some perspective for interpreting how alcohol and violence were related to each other in this sample, sometimes in the same way for males and females, and at times in different ways. Males reported significantly more alcohol use at the beginning of 7th grade, with 20% more males than females reporting some recent use. But increasing use by females narrowed the gender gap in alcohol use to non-significance by the middle and end of 7th grade. This is consistent with national surveys in Mexico showing that a large gender gap in elementary school, with males outpacing females in alcohol use, closes during middle school (INPRFM 2015). In this sample the gender gap narrowed dramatically and very rapidly during the first semester of the first year of middle school. For criminally violent behavior and bullying/aggression, males reported that they perpetrated violence more frequently than females at all study time points. However, the proportion engaging in these forms of violence remained within narrow bands across all time points, for both males and females: 15% to 21% for criminally violent behavior, and 52% to 62% for bullying/aggression. That suggests that the gender differences in relationships between alcohol use and violence were not due to rarely occurring violent behaviors.

One explanation for the findings is their possible connection to gender role socialization and how that is changing for youth in Mexico, especially for women (Benjet et al. 2011; Medina–Mora 2001). The clearer evidence of reciprocal relationships between alcohol and criminally violent behavior for males alone may reflect gender norms in Mexico that continue to encourage males to display traditional masculine identities through excessive substance use, particularly heavy alcohol use, risk-taking, and dangerous behaviors (Chávez–Ayala, Rivera–Rivera, Leyva–López, Sánchez–Estrada, and Lazcano–Ponce 2013). The reciprocal relationships between alcohol and bullying/aggression that emerged for females alone may reflect gender norms that enable girls to engage in verbal aggression and intimidation more readily than in serious physical violence. As Mexico undergoes cultural change towards less traditional patterns in the reproduction of gender roles, females may connect alcohol use and certain forms of violence as part of the achievement of pseudo–gender equality with males (Velasquéz–Pulido and Nuño- Gutiérrez 2009).

The findings can also be viewed against the backdrop of dramatic and widely reported increases in violence in Mexico. As a result violence can become normalized and be internalized by adolescents as an acceptable behavior in daily interactions with peers. A qualitative study conducted with adolescents in Guadalajara reported that adolescents responded to violence with violence, which created a vicious cycle (Velasquéz–Pulido and Nuño–Gutiérrez 2009). The adolescents had a high tolerance for violence and were unable to easily identify what was and what was not violence. Even sexual violence was mistaken as a romantic courtship behavior. Findings from the current study are consistent with these interpretations because of the strong correlations between violence perpetration, victimization and witnessing of violence. For both genders, the bidirectional link between alcohol consumption and violence suggests a pattern of connected risk behaviors among early adolescents that quickly begins to reproduce itself. The strongest bidirectional relationships between violence and alcohol use occurred at the start of the first year of middle school. While navigating the disruptive transition from primary school early adolescents are also building the set of social skills that will define their relationships with peers through early adulthood. The context of pervasive violence that many students perpetrate, experience, and/or witness, may make it even more challenging to acquire the interpersonal and decision-making skills necessary for healthy behavioral choices at this stage of life.

There are several implications of the study findings for prevention programs in general. It is notable that the changes in alcohol use and violence predicted one another over the course of a single academic year, 7th grade, which is a pivotal developmental stage for identity formation, transitions from childhood to adolescence, and the declining influence of parents and increasing influence of peers. Because large pluralities of the students were not current users of alcohol at the three time points, prevention interventions at this stage may be ideally timed to delay initiation of harmful substance use and other risk behaviors. The findings suggest that targeted substance use prevention efforts in middle schools may be enhanced by addressing its connection to violence. For both females and males, it is important to use valuable resources to prevent alcohol use, which could also result in a lower likelihood of criminal violence in the near future. This approach is particularly important for female adolescents, especially in the early school years, in that it would reduce the likelihood of problems related to bullying-aggression among peers, which in turn would lead to less alcohol use in the future. Another implication is that prevention resources that are used to reduce bullying-aggression among female and male peers would also prevent more adolescents from increasing their alcohol use in the future. For male adolescents, efforts to prevent criminally violent behaviors would significantly lower the likelihood of increasing alcohol use, which in turn would lead to less criminally violent behavior in the future. The results imply that early intervention—at the start of middle school—is important to interrupt the self- perpetuating cycle of substance use and violence. Interventions might develop skills training to help students navigate both substance use and violent risk situations, possibly in gendered ways. Particular attention to the etiology of adolescent violent behavior may be needed, which is complicated by the high and rising level of violence in Mexico. As youth are increasingly exposed to violent environments in their homes, schools, neighborhoods,

and through media, they encounter more role models of violent behavior, as witnesses and victims, which elevates their risk of perpetrating violence as well.

Proper interpretation of the study results requires a consideration of certain sampling, measurement and modeling limitations. Although the sample included five or more middle schools in each of the three city sites, it was not a probability sample of all schools. Results are limited to 7th grade students in urban, public middle schools in the largest Mexican cities, located in the central and northern region. The sample does not represent those from smaller cities and rural areas, or other regions with different levels of drug trafficking and violence, such as borderlands areas near the USA and the southern Mexican states. Because this is a school-based sample, findings do not represent the small but appreciable minority of Mexican students who do not continue their studies beyond primary school.

The developmental period encompassed by the surveys, and available measures in this secondary data analysis study also limit interpretations. The study modeled changes in alcohol use and violence perpetration that occurred over a period of less than one year, while the students were in the seventh grade. Relationships between alcohol use and violence could be different at earlier or later developmental stages. While the three survey observations were spaced at three- or four-month intervals, the alcohol measures were restricted to the last thirty days of use, and the violence measures covered experiences over the last 12 months. The narrower timeframe for alcohol use and overlapping timeframes for reports of violence are likely to affect the precision of the estimates of their interrelationships, although not necessarily whether significant relationships exist. Another limitation is possible conceptual overlap in the factor score measures of criminal violence and bullying/aggression. The orthogonal factor for bullying/aggression included two items that involved physical violence (hitting, pushing), which are similar in the mode—but not the degree—of violence to the items on the criminal violence factor. Although the student surveys included a number of measures that were useful in ruling out spurious relationships between alcohol use and violence, encompassing influences in the school, peer and family domain, only one individual level measure, depression symptomology, was available. Other individual level factors such as impulsivity or emotional self-regulation might be salient. Finally, the cross-lagged path models employed longitudinal, correlational approaches that can only infer causality because they rely on a time lag between behavioral measures.

Conclusion

Several aspects of this study add to the abundant research on the connection between substance use and violent behaviors. It focused on the developmental period of early adolescence, when many youth who use substances initiate use, providing a window onto the early stages when substance use and violent behaviors first begin to intertwine. It examined a social and cultural context in an emerging economy, one where rates of violence and of youth substance use have risen sharply in the last decade. In addition, by examining urban adolescents in Mexico, the study delves into gender differences and similarities among youth who have grown up in a society with rapidly narrowing gender differences in the prevalence of substance use and anti-social behaviors. The study provides selective support for a bi-directional relationship between alcohol use and violence, with stronger evidence of a

reciprocal link to criminally violent behavior in males and to bullying/aggression in females. For both male and female adolescents, increased alcohol use predicted later criminally violent behavior, and more bullying-aggression predicted increased later alcohol use. The findings suggest that life skills prevention approaches for Mexican youth need to consider ways to address substance use in combination with violence, and how these risk behaviors are intertwined in somewhat different ways for males and females. Early adolescence is a critical point when substance problems and anti-social behaviors begin to emerge and can persist throughout later points of the life course. Implementing prevention approaches during this developmental period to address the interconnection between substance use and violence may have lasting effects into adulthood.

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References

Agnew R (2006). General strain theory: Current status and directions for further research. Taking stock:The Status of Criminological Theory, 15, 101–123.

Aguilera MA, Muñoz G, & Orozco A (2007). Disciplina, violencia y consumo desustancias nocivas a la salud en escuelas primarias y secundarias de México. Instituto Nacional para la Evaluación de la Educación (INEE) Retrieved from http://www.inee.edu.mx/images/stories/documentos_pdf/Publicaciones/Libros_Informes/Violencia/disciplina_violencia_y_consumo6.

Benjet C, Borges G, Méndez E, Casanova L, & Medina-Mora ME (2014). Adolescent alcohol use and alcohol use disorders in Mexico City. Drug and Alcohol Dependence, 136, 43–50. [PubMed: 24438842]

Boden JM, Fergusson DM, & Horwood LJ (2012). Alcohol misuse and violent behavior: findings from a 30-year longitudinal study. Drug & Alcohol Dependence, 122(1), 135–141. [PubMed: 22015176]

Center for Disease Control & Prevention. (2016, 10 20). Underage drinking. Retrieved from https://www.cdc.gov/alcohol/fact-sheets/underage-drinking.htm

Center for Disease Control & Prevention. (2018, 3 15). Alcohol and public health. Retrieved from https://www.cdc.gov/alcohol/fact-sheets/alcohol-use.htm

Chávez–Ayala R, Rivera–Rivera L, Leyva–López A, Sánchez–Estrada M, & Lazcano–Ponce E (2013). Orientación al rol de género y uso de tabaco y alcohol en jóvenes de Morelos, México. Salud Pública de México, 55(1),43–56. [PubMed: 23370258]

CNN. (2018). Mexico Drug War Fast Facts. CNN News. Retrieved from https://www.cnn.com/2013/09/02/world/americas/mexico-drug-war-fast-facts/index.html

Egerter S, Barclay C, Grossman-Kahn R, & Braveman P (2011). Violence, social disadvantage and health. Robert Wood Johnson Foundation, Issue Brief, 10.

Ellickson PL, Tucker JS, & Klein DJ (2003). Ten–year prospective study of public health problems associated with early drinking. Pediatrics, 111(5), 949–955. [PubMed: 12728070]

Escobar ER, Gamino MNB, Salazar RM, Hernández ISS, Martínez VC, Bautista CF, …Velázquez JAV (2018). National trends in alcohol consumption in Mexico: results of the National Survey on Drug, Alcohol and Tobacco Consumption 2016–2017. Salud Mental, 41, 7–16.

Espelage DL, Low S, Rao MA, Hong JS, & Little TD (2014). Family violence, bullying, fighting, and substance use among adolescents: A longitudinal mediational model. Journal of Research on Adolescence, 24(2), 337–349.

Fagan AA, Wright EM, & Pinchevsky GM (2015). Exposure to violence, substance use, and neighborhood context. Social Science Research, 49, 314–326. [PubMed: 25432621]

Fossos N, Kaysen D, Neighbors C, Lindgren KP, & Hove MC (2011). Coping motives as a mediator of the relationship between sexual coercion and problem drinking in college students. Addictive Behaviors, 36, 1001–1007. [PubMed: 21719202]

Goldstein PJ (1985). The drugs/violence nexus: A tripartite conceptual framework. Journal of Drug Issues, 15(4), 493–506.

Graham JW, Flay BR, Johnson CA, Hansen WB, Grossman LM, & Sobel JL (1984). Reliability of self–report measures of drug use in prevention research: Evaluation of the Project SMART questionnaire via the test-retest reliability matrix. Journal of Drug Education, 14, 175–193. [PubMed: 6536737]

Green KM, Doherty EE, Zebrak KA, & Ensminger ME (2011). Association between adolescent drinking and adult violence: Evidence from a longitudinal study of urban African Americans. Journal of Studies on Alcohol & Drugs, 72(5), 701–710. [PubMed: 21906497]

Hansen WB, & Graham JW (1991). Preventing alcohol, marijuana, and cigarette use among adolescents: Peer pressure resistance training versus establishing conservative norms. Preventive Medicine, 20, 414–430. [PubMed: 1862062]

Hernández A, Huerta M, Gordillo H, Luna M, & Rodríguez J (2016). Bullying among middle school students. Educación y Ciencia, 5(45), 6–18. Retrieved from http://dspace.rowan.edu/handle/10927/896

Hirschi T (2017). Causes of delinquency. Routledge.

Instituto Nacional de psiquiatria Ramon de la Fuente Muniz (INPRFM).(2015).Encuesta Nacional de Consumo de Drogas en Estudiantes 2014: Reporte de Alcohol. Mexico City, Mexico: INPRFM.

Joffre–Velázquez VM, García-Maldonado G, Saldívar-González AH, Martínez-Perales G, Lin-Ochoa D, Quintanar-Martínez S, & Villasana-Guerra A (2011). Bullying in junior high school students: General characteristics and associated risk factors. Boletin Medico Del Hospital Infantil de Mexico, 68, 177–185.

Juárez F, Villatoro JA, Gutiérrez ML, Fleiz C, Medina-Mora ME (2005). Tendencias de la conducta antisocial en estudiantes del Distrito Federal: Mediciones 1997–2003. Salud Mental, 28(3), 60–68.

Kieselbach B, & Butchart A (2015). Preventing youth violence: An overview of the evidence. World Health Organization.

Lim JY, & Lui CK (2016). Longitudinal associations between substance use and violence in adolescence through adulthood. Journal of Social Work Practice in the Addictions, 16, 72–92. [PubMed: 27366116]

Logan–Greene P, Nurius PS, Herting JR, Hooven CL, Walsh E, & Thompson EA (2011). Multi-domain risk and protective factor predictors of violent behavior among at-risk youth. Journal of Youth Studies, 14(4), 413–429. [PubMed: 21769283]

Luengo MA, Romero E, Gómez-Fraguela JA, Guerra Lopez A & Lence M (1999). La prevención del consumo de drogas y la conducta antisocial en la escuela: Analisis y evaluación de un programa. Madrid: Plan Nacional sobre Drogas.

Marcus RF, & Jamison EG II (2013). Substance use in adolescence and early adulthood: which best predicts violence in early adulthood? Journal of Child & Adolescent Substance Abuse, 22(1), 38–57.

Marsiglia FF, Booth JM, Ayers SL, Nuño-Gutiérrez BL, Kulis SS, & Hoffman S (2014). Short- term effects on substance use of the keepin' it REAL pilot prevention program: Linguistically adapted for youth in Jalisco, Mexico. Prevention Science, 15(5), 694–704. [PubMed: 23877541]

Massetti GM, & Vivolo AM (2010). Achieving public health impact in youth violence prevention through community–research partnerships. Progress in Community Health Partnerships: Research, Education, & Action, 4(3), 243–251.

Medina–Mora ME (2001). Women and alcohol in developing countries. Salud Mental, 24, 3–10.

Moore TM, & Stuart GL (2005). A review of the literature on marijuana and interpersonal violence. Aggression & Violent Behavior, 10(2), 171–192.

Mrug S, & Windle M (2009). Bidirectional influences of violence exposure and adjustment in early adolescence: Externalizing behaviors and school connectedness. Journal of Abnormal Child Psychology, 37(5), 611–623 [PubMed: 19199024]

Mulvey EP, Odgers C, Skeem J, Gardner W, Schubert C, & Lidz C (2006). Substance use and community violence: A test of the relation at the daily level. Journal of Consulting & Clinical Psychology, 74(4), 743–754. doi:10.1037/0022-006X.74.4.743

Nadel H, Spellmann M, Alvarez-Canino T, Lausell-Bryant L, & Landsberg G (1996). The cycle of violence and victimization: A study of the school-based intervention of a multidisciplinary youth violence-prevention program. American Journal of Preventive Medicine, 12(5), 109–119. [PubMed: 8909631]

Organization for Economic Co-operation and Development [OECD]. (2017), PISA 2015 Results (Volume III): Students' well-being, PISA, OECD Publishing, Paris 10.1787/9789264273856-en

Phillips GA, Shadish WR, Murray DM, Kubik M, Lytle LA, & Birnbaum AS (2006). The Center for Epidemiologic Studies depression scale with a young adolescent population: A confirmatory factor analysis. Multivariate Behavioral Research, 41(2), 147–163. [PubMed: 26782908]

Quiroz del Valle N, Villatoro JA, Juárez F, Gutiérrez ML, Amador NG, Medina-Mora ME, (2007). La familia y el maltrato como factores de riesgo de conducta antisocial. Salud Mental, 30(4), 47–54.

Robin AL, & Foster SL (1989). Negotiating parent-adolescent conflict: A behavioral-family systems approach. New York City: Guilford Press.

Scholes–Balog KE, Hemphill SA, Kremer P, & Toumbourou JW (2013). A longitudinal study of the reciprocal effects of alcohol use and interpersonal violence among Australian young people. Journal of Youth & Adolescence, 42(12), 1811–1823. [PubMed: 23354419]

Sørensen NN (2018). Diffusing gender equality norms in the midst of a feminicide pandemic: The case of AMEXCID and decentralized Mexican South-South cooperation. Progress in Development Studies, 18(2), 95–109.

Soyka M (2000). Substance misuse, psychiatric disorder and violent and disturbed behaviour. TheBritish Journal of Psychiatry, 176(4), 345–350.

Swahn MH, & Donovan JE (2004). Correlates and predictors of violent behavior among adolescent drinkers. Journal of Adolescent Health, 34(6), 480–492. [PubMed: 15145405]

Velásquez-Pulido JM, & Nuño-Gutiérrez BL (2009). Percepción de la violencia emocional en adolescentes escolares: Diferencias en la narrativa por género. Revista Médica del Instituto Mexicano del Seguro Social, 47, S67–S74.

Wagner EF (1996). Substance use and violent behavior in adolescence. Aggression & Violent Behavior, 1(4), 375–387.

White HR, Fite P, Pardini D, Mun EY, & Loeber R (2013). Moderators of the dynamic link between alcohol use and aggressive behavior among adolescent males. Journal of Abnormal Child Psychology, 41(2), 211–222. [PubMed: 22911129]

White HR, Jackson KM, & Loeber R (2009). Developmental sequences and comorbidity of substance use and violence In Krohn MD, Lizotte AJ, & Hall GP (Eds.), Handbook on Crime & Deviance (pp. 433–468). New York, NY: Springer.

White HR, Loeber R, Stouthamer-Loeber M, & Farrington DP (1999). Developmental associations between substance use and violence. Development & Psychopathology, 11(4), 785–803. [PubMed: 10624726]

World Bank. (2012). La violencia juvenil en México: Reporte de la situación, el marco Legal y los programas gubernamentales. Washington DC: World Bank Retrieved from http://documents.worldbank.org/curated/en/277681468155375869/La-violencia-juvenil-en-Mexico-reporte-de-la-situacion-el-marco-legal-y-los-programas-gubernamentales

Wright EM, Fagan AA, & Pinchevsky GM (2013). The effects of exposure to violence and victimization across life domains on adolescent substance use. Child Abuse & Neglect, 37(11), 899–909. [PubMed: 23743232]

Xue Y, Zimmerman MA, & Cunningham R (2009). Relationship between alcohol use and violent Behavior among urban African American youths from adolescence to emerging adulthood: A longitudinal study. American Journal of Public Health, 99(11), 2041–2048. [PubMed: 19762672]

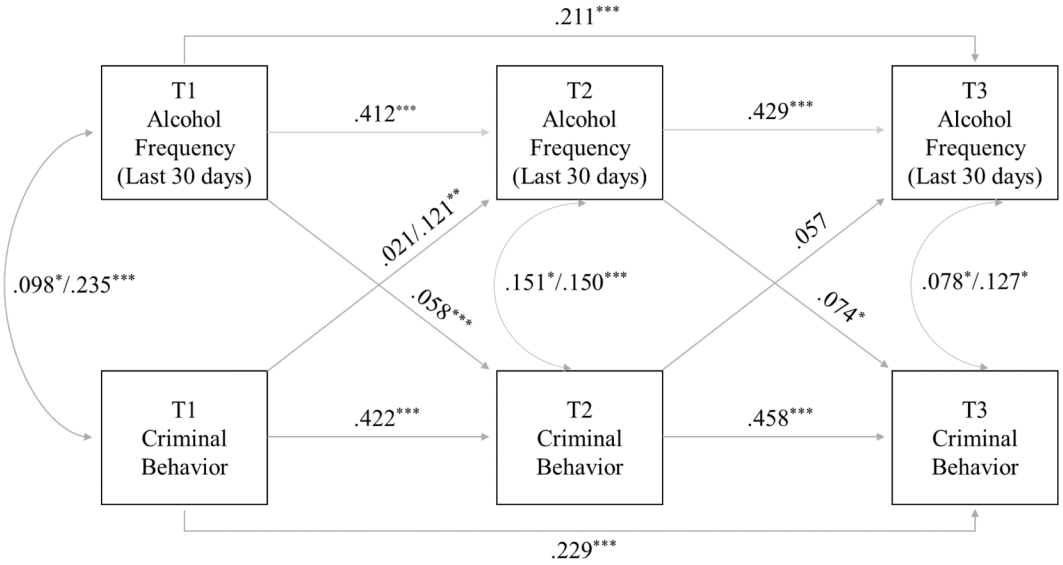

Figure 1.

Multi–group path model testing the cross-lagged effects of alcohol use and criminal violence factor scores, by gender

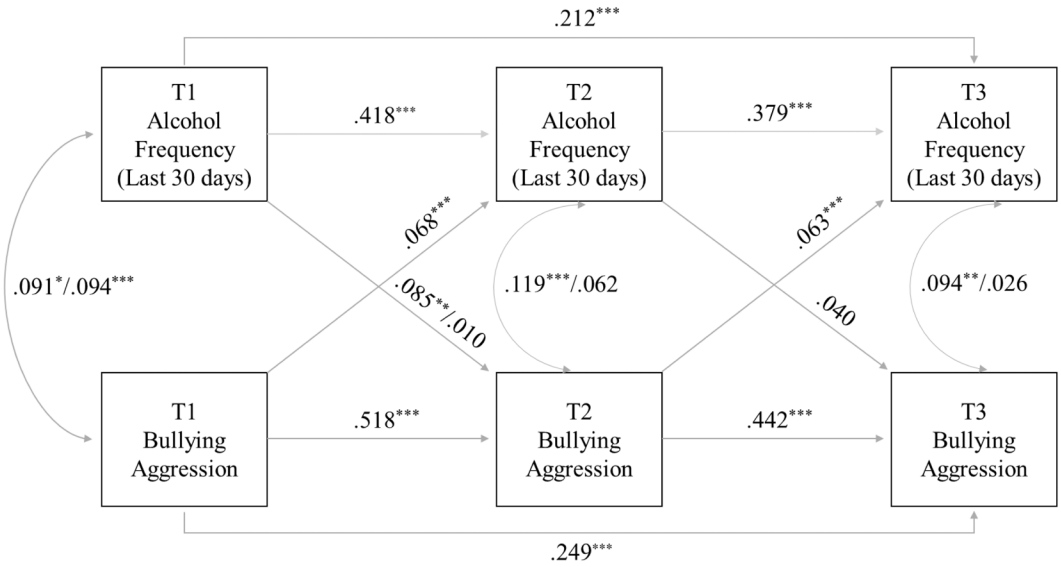

Figure 2.

Multi–group path model testing the cross-lagged effects of alcohol use and bullying/aggression factor scores, by gender

Table 1.

Gender Differences in Alcohol Use and Violence Perpetration

	Female (N=2,367)	Male (N=2,463)	Gender Difference
	Mean (SD)	**Mean (SD)**	**Test statistic**[a]
Controls			
Age	12.01 (0.51)	12.07 (0.59)	−4.12 ***
Site/City			0.17
Mexico City	43.9%	43.5%	
Guadalajara	40.2%	40.2%	
Monterrey	15.9%	16.3%	
			6.67 **
Session			
Morning (*Matutino*)	69.4%	66.0%	
Afternoon (*Vespertino*)	30.6%	34.0%	
			0.04
Intervention Condition			
Experimental	55.1%	54.9%	
Control	44.9%	45.1%	
Substance use			
Alcohol use at T1	0.27 (0.66)	0.33 (0.77)	7.25 *
Alcohol use at T2	0.37 (0.81)	0.35 (0.82)	0.51
Alcohol use at T3	0.35 (0.83)	0.39 (0.85)	2.90
Violence			
Criminal violence at T1	−0.08 (0.70)	0.08 (1.23)	37.96 ***
Criminal violence at T2	−0.08 (0.73)	0.08 (1.17)	37.62 ***
Criminal violence at T3	−0.09 (0.74)	0.10 (1.18)	51.32 ***
Bullying/aggression at T1	−0.08 (0.84)	0.08 (1.13)	29.85 ***
Bullying/aggression at T2	−0.03 (0.91)	0.03 (1.03)	4.40 *
Bullying/aggression at T3	−0.04 (0.93)	0.05 (1.09)	8.83 **

* $p<.05$.

** $p<.01$.

*** p<001

[a] t–tests were conducted for age, alcohol use, and violence, and Chi–square tests for site/city (d.f.=2), session (d.f.=1), and intervention condition (d.f.=1).