Published in final edited form as:

J Soc Work Pract Addict. 2016 ; 16(1-2): 132–159. doi:10.1080/1533256X.2016.1146612.

The Relationship between Interpersonal Violence Victimization and Smoking Behavior across Time and by Gender

ALLISON N. KRISTMAN-VALENTE, MSW, PH.D. [Research Scientist],

Social Development Research Group, School of Social Work, University of Washington, Seattle, WA, USA

SABRINA OESTERLE, PH.D. [Research Associate Professor],

Social Development Research Group, School of Social Work, University of Washington, Seattle, WA, USA

KARL G. HILL, PH.D. [Principal Investigator and Associate Professor],

Social Development Research Group, School of Social Work, University of Washington, Seattle, WA, USA

ELIZABETH A. WELLS, PH.D. [Research Professor],

Social Development Research Group, School of Social Work, University of Washington, Seattle, WA, USA

MARINA EPSTEIN, PH.D. [Research Scientist],

Social Development Research Group, School of Social Work, University of Washington, Seattle, WA, USA

TIFFANY M. JONES, M.A. [Research Assistant], and

Social Development Research Group, School of Social Work, University of Washington, Seattle, WA, USA

J. DAVID HAWKINS, PH.D. [Principal Investigator and Founding Director]

Social Development Research Group, School of Social Work, University of Washington, Seattle, WA, USA

Abstract

The current study examined relationships between interpersonal violence victimization and smoking from childhood to adulthood. Data were from a community-based longitudinal study ($N = 808$) spanning ages 10 - 33. Cross-lag path analysis was used to model concurrent, directional, and reciprocal effects. Results indicate that childhood physical abuse predicted smoking and partner violence in young adulthood; partner violence and smoking were reciprocally related in the transition from young-adulthood to adulthood. Gender differences in this relationship were not detected. Social work prevention efforts focused on interpersonal violence and interventions targeting smoking cessation may be critical factors for reducing both issues.

Keywords

interpersonal violence; partner violence; child abuse; substance use; smoking; gender; longitudinal

In the United States the monetary cost of tobacco use is estimated at \$300 billion and the impact of interpersonal violence is estimated around \$4 billion every year (Plichta, 2004; Thun et al., 2013; U.S. Department of Health and Human Services, 2014). A strong connection between experiencing interpersonal violence, including childhood abuse and partner violence victimization, and the use of alcohol and illicit drugs has been well established in the literature (Fals-Stewart & Kennedy, 2005; Kristman-Valente & Wells, 2013; Simpson & Miller, 2002). However, information on the connection between interpersonal violence victimization and other licit drugs such as nicotine has received less attention. Studies investigating the linkage between interpersonal violence victimization and substance use rarely focus on tobacco which is often excluded, rolled into generalized measures of substance use, or ignored entirely, leaving uncertainty regarding the unique relationship between nicotine and experiences of interpersonal violence across time.

Though understudied in relation to interpersonal violence, tobacco use, in particular cigarette smoking, which is the most prevalent behavioral method of nicotine delivery (Center for Disease Control, 2014), kills more people than the use of any other drug, and is the leading cause of morbidity and mortality among adults in the United States (Campaign for Tobacco-Free Kids, 2012; Chassin, Presson, Rose, Sherman, & Prost, 2002; Mokdad, Marks, Stroup, & Gerberding, 2004). Cigarette smoking remains one of the most available and widely used substances in the United States (U.S. Department of Health and Human Services, 2014) and is highly comorbid with the use of other substances, including alcohol, that have been strongly linked to interpersonal violence victimization (Falk, Yi, & Hiller-Sturmhofel, 2006).

A better understanding of the unique relationship of nicotine, particularly via cigarette smoking, with interpersonal violence victimization has the potential to reduce the large public health burden these two issues have placed on society by informing the development of novel integrated interventions for social work practice. While the past decade has provided social work practitioners with several promising integrated treatments for individuals who have co-occurring interpersonal violence victimization experience and addiction (Covington, 2008; Frisman, Ford, Lin, Mallon, & Chang, 2008; Hien, Cohen, Miele, Litt, & Capstick, 2004), these interventions have rarely been used for smoking cessation or nicotine dependence (Moses, Reed, Mazelis, & D'Ambrosio, 2003; Torchalla, Nosen, Rostam, & Allen, 2012). To date only one treatment has been developed and tested specifically focused on the link between smoking and trauma (McFall et al., 2010; McFall et al., 2005).

Further, there are significant gender differences in the prevalence of smoking and interpersonal violence suggesting that the association between the two could be gender-dependent. A clearer understanding of the role that gender plays in the relationship between interpersonal violence and smoking across the life course may aid in the development of targeted interventions that are gender responsive and developmentally attuned.

Interpersonal Violence and Substance Use

Experiencing interpersonal violence has been linked with alcohol and illicit substance use outcomes at every developmental stage. Experiencing childhood interpersonal violence (i.e., experiencing child physical abuse) has been found to increase the risk of alcohol use (Jones et al., 2010), alcohol dependence (Widom, Ireland, & Glynn, 1995; Widom & White, 1997; Widom, White, Czaja, & Marmorstein, 2007), binge drinking (Widom et al., 2007), problem substance use (Lansford, Dodge, Pettit, & Bates, 2010; Widom, Marmorstein, & White, 2006), and illicit substance use (Lansford et al., 2010; Widom et al., 2006) in young adulthood and adulthood. Childhood interpersonal violence is also associated with increasing a person's risk of future interpersonal violence (e.g., partner violence) at later developmental periods including adolescence, young adulthood, and adulthood (Coid et al., 2001; Desai, Arias, Thompson, & Basile, 2002; Fang & Corso, 2007; Smith, White, & Holland, 2003; Sunday et al., 2011).

Partner violence is one of the most common types of interpersonal violence experienced in young adulthood and adulthood, defined as being the victim of sexual, physical, or emotional violence or threats of violence at the hands of an intimate partner (Black & Breiding, 2008). In cross-sectional and longitudinal studies partner violence victimization has consistently been found to be associated with an increased risk for alcohol use (for a review, please see Devries et al., 2014) and use of illicit substances such as marijuana (for a review, please see Moore et al., 2008). Reciprocally, alcohol and illicit drug use, by one or both partners, has been linked to increased risk for reported partner violence (Foshee, Benefield, Ennett, Bauman, & Suchindran, 2004; Huizinga, Weiher, Espiritu, & Esbensen, 2003). However, very few longitudinal studies specifically focus on the unique relationship between childhood interpersonal violence and later smoking (Kristman-Valente & Wells, 2013) or the partner violence-smoking link at any developmental period (Crane, Hawes, & Weinberger, 2013).

Interpersonal Violence and Smoking

When the interpersonal violence-smoking connection has been investigated, independent associations between experiences of interpersonal violence and smoking behavior have been identified across developmental periods, suggesting that this is a potentially robust relationship. Several cross-sectional studies have found significant within-time associations between childhood abuse and reports of ever smoking (Lau, Chan, Lam, Choi, & Lai, 2003; Roberts, Fuemmeler, McClernon, & Beckham, 2008; Vander Weg, 2011) and current smoking (Draper et al., 2008; Ramiro, Madrid, & Brown, 2010; Vander Weg, 2011). A small subset of longitudinal work on the child abuse-smoking link has found significant links between early childhood abuse and increased smoking frequency in adolescence (Kristman-Valente, Brown, & Herrenkohl, 2013), as well as ever using tobacco and daily cigarette smoking in young-adulthood and adulthood (Mersky & Topitzes, 2010; Topitzes, Mersky, & Reynolds, 2010).

In the complementary body of literature investigating the partner violence victimization – smoking link, a recent meta-analysis concluded that the strength of the association between

smoking and partner violence victimization had a moderate effect size ($d = .41$) (Crane et al., 2013). Experiencing partner violence increases an individual's likelihood of initiating smoking at an earlier age (Yoshihama, Horrocks, & Bybee, 2010) and being a current smoker (Ackerson, Kawachi, Barbeau, & Subramanian, 2007; Black & Breiding, 2008; Jun, Rich-Edwards, Boynton-Jarrett, & Wright, 2008; Scott-Storey, Wuest, & Ford-Gilboe, 2009; Stene, Jacobsen, Dyb, Tverdal, & Schei, 2013; Vest, Catlin, Chen, & Brownson, 2002). One longitudinal study of inner city women found that even after controlling for adolescent smoking behavior there remained a significant association between smoking and partner violence victimization in young adulthood (Stueve & O'Donnell, 2007). Investigations of the smoking-partner violence victimization link have been primarily cross-sectional with all-female samples, limiting our understanding of the generalizability of the relationship between partner violence victimization and smoking. This raises questions about the temporal ordering between smoking and partner violence victimization, and whether this relationship extends over different developmental periods.

Theoretical Frameworks for Interpersonal Violence and Smoking

In addition to the empirical evidence linking interpersonal violence victimization with cigarette smoking, there are three theoretical frameworks that support this relationship, as presented in Figure 1. The within-time correlation found in the existing cross-sectional literature may be explained by a Common-cause model (Hirschi & Gottfredson, 1994) where engagement in the parallel processes of smoking and partner violence victimization across time are compelled by similar early risk factors such as experiencing childhood interpersonal violence such as physical abuse. It could be that smoking and partner violence victimization are correlated but not causally associated and that the within-time relationship seen in extant literature reflects a common cause risk profile. Figure 1, Panel A, depicts the conceptual common cause model of smoking and interpersonal violence.

A second theoretical explanation for the link between interpersonal violence victimization and smoking is grounded in a stress and coping framework, where interpersonal violence victimization constitutes the stressor, and smoking the coping mechanism. Self-medication theory, a subset of stress-coping, posits that experiences of trauma can lead to higher levels of substance use in an attempt to cope or self-medicate (Khantzian, 1985, 1997). Smoking has been suggested as a self-medication behavior, where the act of smoking becomes a maladaptive coping mechanism for the individual exposed to stressors such as partner conflict and relationship violence (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Khantzian, 1985; Scott-Storey et al., 2009). Nicotine, the licit substance found in tobacco and cigarettes, has been found to reduce stress by impacting the stress response systems of the brain, further supporting the self-medication hypothesis (Baker et al., 2004; Khantzian, 1985; Scott-Storey et al., 2009). Figure 1, Panel B, depicts the self-medication pathways where partner violence victimization predicts future smoking.

An alternative directional pathway between smoking and interpersonal violence victimization is the Lifestyle theory (Hindelang, Gottfredson, & Garofaio, 1978; Riley, 1987), which hypothesizes that engagement in risky social behaviors, such as substance use, increases the risk for future victimization because of heightened exposure to delinquent

others, impaired judgment, and lowered inhibitions (Brooks-Russell, Foshee, & Ennett, 2013). It is plausible that smoking uniquely increases an individual's risk for victimization as well but through the mechanism of associating with delinquent peers who are more likely to use other substances like alcohol. However, to date this model has not been tested with smoking specifically. Figure 1, Panel C, depicts the conceptual pathways of lifestyle theory for smoking and partner violence victimization.

Lastly, it may be that these processes – the common-cause model, self-medication model, and lifestyle theory – work in tandem, contributing to a reciprocal process where interpersonal violence victimization and substance use mutually inform each other. There is evidence in the general substance use literature that a reciprocal process does indeed occur. For example, Begle (2011) found that delinquent behavior, including substance use, increased the risk for victimization and victimization increased the risk of delinquent behavior and substance use creating a continuous cycle between the two phenomena. However, this model has not been tested specifically looking at the interpersonal violence victimization - smoking link. In the present study reciprocal influences will be assessed across four time periods; this is depicted in Figure 1, Panel D.

The Potential Role of Gender in the Interpersonal Violence-Smoking Link

One factor that may play an important role in the connection between interpersonal violence (childhood abuse and partner violence) and smoking over time is gender. Evidence suggests that men and women differentially respond to stress. For instance, following a stressful situation women are more likely than men to choose internalizing behaviors including smoking to cope (Byrne & Mazanov, 2003; Diehl, Coyle, & Labouvie-Vief, 1996). Unfortunately, within the limited literature investigating the relationship between interpersonal violence and smoking, gender differences in the two processes have rarely been examined and findings have been mixed (Crane et al., 2013; Kristman-Valente & Wells, 2013).

One study investigating the impact of early childhood physical and sexual abuse on whether or not adolescents ever smoked and smoking frequency found that for men both childhood physical abuse and sexual abuse predicted increased smoking frequency in adolescence (Kristman-Valente et al., 2013). For women, only sexual abuse experienced in childhood increased adolescent smoking frequency. In contrast, a study by Tipton et al. (2010) found that child maltreatment (sexual abuse, physical abuse and neglect) before the age of 18 predicted increased smoking frequency in young adulthood for both men and women. The association between partner violence victimization and smoking has been found for women (Ackerson et al., 2007; Black & Breiding, 2008; Jun et al., 2008; Stene et al., 2013; Yoshihama et al., 2010) and men (Black & Breiding, 2008) separately, but differences in this relationship have not yet been tested formally due to the literature's focus on the substance use-victimization link among women, the substance use-perpetration link among men (for example, Easton, Weinberger, & George, 2007), and the preponderance of all-female samples when the partner violence-smoking link is investigated (Crane et al., 2013).

Aims of the Current Study

The present study draws on the Common-cause model, Self-medication theory, and Lifestyle theory to examine concurrent, directional and reciprocal relationships between interpersonal violence and cigarette smoking. Contributing to the growing literature in this field, the current work (a) examines the association between interpersonal violence and smoking for concurrent, directional, and reciprocal effects, (b) analyzes how this relationship might be differentially related for men and women, and (c) explores if this relationship extends across multiple developmental periods. This investigation uses data from the Seattle Social Development Project (SSDP), a theory-driven study of childhood and adolescent risk and protective factors for the development of prosocial behavior, as well as substance use and related health and behavior problems.

First, we examine a common-cause model (Hirschi & Gottfredson, 1994) where early childhood interpersonal violence, captured by reports of child physical abuse, compels engagement in future partner violence victimization and smoking behavior, and if this common factor explains the within-time relationship between future partner violence experience and smoking (Panel A, Figure 1). Second, we explore whether experiencing partner violence victimization predicts later smoking using the self-medication hypothesis where smoking is used as a way of coping with the stress of partner violence victimization in young adulthood and adulthood (Baker et al., 2004; Khantzian, 1985; 1997, Panel B, Figure 1; Scott-Storey et al., 2009). Third, we consider if smoking behavior increases the risk of future partner violence victimization based on the lifestyle theory (Hindelang et al., 1978; Riley, 1987) which hypothesizes that engagement in risky behaviors, such as smoking, increases the risk for victimization at future time points (Brooks-Russell et al., 2013, Panel C, Figure 1). Fourth, we test if the relationship between childhood physical abuse, partner violence victimization and smoking work in tandem across time (Panel D, Figure 1). Lastly, we formally test the pathways between smoking and interpersonal violence in the final model to determine if the relationships between these two phenomena are similar or different for men and women.

Method

Participants

The Seattle Social Development Project (SSDP) sample was recruited in 1985, when students were in the fifth grade (mean age = 10.7 years, SD = 0.5 years). Participants were recruited from elementary schools serving high-crime neighborhoods in Seattle, to participate in a multicomponent intervention study focused on protective and risk factors. Due to mandatory bussing at that time, students from other parts of the city were also enrolled. From a population of 1,053 fifth graders in 18 schools, 808 students (76.7% of the population) consented to participate in the study, and they constitute the ongoing SSDP sample. Participants were interviewed annually until age 16, again at age 18, and then every 3 years until age 33. The current study uses data from ages 10-33. The study is gender balanced: 49% (396) are females and 51% (412) are males; economically variable: 52% were eligible for free and reduced-price lunch in elementary school; and ethnically diverse: 47% Caucasian, 26% African American, 22% Asian American and 5% Native American.

For more information on the original study see Hawkins, Catalano, Morrison, O'Donnell, Abbott, and Day (1992). All data collection procedures have been approved by the University of Washington Institutional Review Board.

Retention of participants has been high—92% at age 33. Nonparticipation at each assessment wave was not related to gender; lifetime use of tobacco, alcohol, or participation in delinquency by age 10; nor consistently related to ethnicity. These retention rates exceed Hansen, Tobler, and Graham's (1990) estimated target retention rate of 87% for studies of 3 or more years' duration required to minimize threats to internal and external validity. As detailed below, the sample size for the present analyses (taking into account retention and data availability for the primary dependent variables) was $n = 699$.

Measures

Child Physical Abuse—*Childhood Physical Abuse* (CPA) (before age of 10) was measured by five items from the Childhood Trauma Questionnaire short form (CTQ-SF; Bernstein et al., 2003), which was administered in the SSDP study at age 24 to retrospectively assess experiences of child maltreatment. For the present study, five items from the CTQ were used to create a physical abuse variable including: “Being hit so hard by someone in my family that I had to see a doctor or go to the hospital,” “People in my family hit me so hard that it left me with bruises or marks,” “I was punished with a belt, a board, a cord, or some other hard object,” “I got hit or beaten so badly that it was noticed by someone like a teacher or doctor,” and “I believe I was physically abused.” Each item was a frequency recall of the experience before the age of 18: Never True (0), Rarely True (1), Sometimes True (1), Often True (2), Always True (3). If a participant answered that they had experienced the item, a follow-up question asking if this experience occurred before the age of 10 was administered. If a participant endorsed any physical abuse item with a value greater than 0, and reported that this occurred prior to age 10, the participant was assigned a “1” indicating the experience of CPA, or a “0” indicating no CPA experience prior to age 10. While the CTQ also assesses other forms of childhood abuse, including sexual and emotional abuse, physical abuse was selected as the focus of the current study to maximize construct consistency with the later physical partner violence examined in adulthood.

Partner Violence—As suggested by Cho (2012), latent variable modeling was utilized to develop a comprehensive model of partner violence victimization using quantitative data. Questions from the Revised Conflict Tactic Scale (CTS2) were used to assess *partner violence victimization* in the SSDP sample at ages 24 - 33. Four indicators were used to create a latent construct of physical partner violence victimization at each age (24, 27, 30, 33). These four indicators include reports that in the prior year the participant had experienced: (a) verbal abuse (i.e., being sworn at, insulted, or yelled at); (b) threat of violence (physical or by weapon); (c) physical violence (slapped, pushed, shoved, kicked or hit); and (e) injury (breaks, sprains, or having to see a doctor due to violence) at the hands of their partner. Latent constructs were tested for measurement invariance across gender and time. In general, the latent variable was invariant at each time point (results not shown). To reduce model complexity, factor scores, or an individual's computed value generated by the

latent variable, were saved and used in the current analysis as suggested by DiStefano, Zhu, & Mindrila (2009).

Smoking Behavior—The SSDP study included measures of multiple forms of tobacco use including cigarettes, cigars, pipes and chew. The current study chose to focus on cigarette smoking only due to the fact that cigarette use is the most prevalent form of tobacco use, has the largest public health impact and is the source of the greatest tobacco related health consequences (Center for Disease Control, 2014). At each interview from ages 24 to 33, participants reported having ever smoked, frequency of use in the past month, and nicotine dependence to cigarettes in the past year based on the Diagnostic Interview Schedule (DIS; Robins, Cottler, Bucholz, & Compton, 1995). These indicators of cigarette smoking behavior were combined and coded along a risk continuum where: 0 = never-smokers, 1 = past user but not current, 2 = current intermittent smoker, 3 = current daily smoker, and 4 = current smoker who met diagnostic criteria for nicotine dependence. Missingness in response to cigarette smoking items was low (< 7%) across time.

Covariates

Smoking and interpersonal violence victimization share several common influences that may account for their comorbidity. For instance, lower socio-economic status has been associated with higher risks of reporting partner violence victimization (Campbell, 2002) and is a significant risk factor for smoking behavior (Gilman, Abrams, & Buka, 2003). Depression is also a common risk factor for both partner violence victimization (Howard & Wang, 2003; Lehrer, Buka, Gortmaker, & Shrier, 2006) and daily smoking and nicotine dependence (Breslau, Peterson, Schultz, Chilcoat, & Andreski, 1998; Fergusson, Goodwin, & Horwood, 2003). Additional confounders suggested by Crane et al. (2013) and Fletcher (2010) were used as covariates in the model, including race/ethnicity and alcohol abuse/dependence, and were included in the final analyses to best determine the unique and developmental relationship between interpersonal violence and smoking. A description of how included covariates are measured is provided below.

Ethnicity—Ethnicity was dummy coded into three variables: African American (1), Native American (1), and Asian American (1), with White as the referent category (0) in all three cases.

Socio-economic Status—Socio-economic status was a dichotomous variable based on school record of the children's eligibility for free and reduced-price school lunch when they were enrolled in Grades 5, 6, or 7. Children meeting eligibility for receipt of free and reduced-price lunch were coded as (1), while children not meeting criteria were coded as (0).

Alcohol Abuse or Dependence Diagnosis at Age 21—In the SSDP study, DSM-IV diagnosis and criterion counts of alcohol abuse and dependence were assessed at age 21 using the Diagnostic Interview Schedule (DIS; Robins et al., 1995). A dichotomous item was created indicating whether the participant met diagnostic criteria for alcohol abuse (exhibiting one or more diagnostic criteria) or dependence (exhibiting three or more criteria)

in the past year. Individuals who had met criteria for alcohol abuse or dependence were coded as (1) and those who did not meet criteria were coded as (0).

Major Depression Diagnosis at Age 21—The DIS was also used to create past-year diagnostic measures for major depression disorder based on the American Psychiatric Association's DSM-IV diagnostic criteria (Robins et al., 1995). A dichotomous item was created at age 21 where (0) indicated not meeting criteria for major depression in the past year and (1) indicated meeting criteria for major depression (exhibiting five or more diagnostic criteria).

Time-varying Covariate—Prior year smoking behavior and partner violence victimization were also treated as time-varying covariates in the model to account for within-construct continuity. For example, a person's partner violence victimization score at age 24 was modeled to predict their partner violence victimization at age 27.

Consideration of Intervention

During the elementary grades, a portion of the sample participated in a multicomponent social development intervention promoting positive youth development. To address possible threats to validity and confounding effects of the intervention within etiological studies, the current study examined multiple-group analysis based on intervention assignment to determine if the etiological pathways between smoking and partner violence victimization differed between those participants who received the intervention and those that did not. A multiple-group model analysis (results not shown) revealed that the strengths of association between smoking behavior, interpersonal violence, and other study variables were not significantly different based on receipt of the intervention. As a result of these findings, all further analyses were conducted using the full sample undifferentiated by intervention.

Analysis

All analyses were conducted using Mplus version 6.1. A cross-lag path analysis was used to investigate the directionality, strength, continuity, and discontinuity of the relationship between interpersonal violence and smoking from childhood to adulthood. Covariates (e.g., poverty, socio-economic status, ethnicity, major depression diagnosis, and alcohol abuse/dependence diagnosis) were added to the model to determine if the pathways linking interpersonal violence and smoking behavior had a unique relationship after accounting for other confounds. Finally, to determine gender differences, multiple-group analyses (MGA) were conducted. Model fit was assessed using the following criteria: the Comparative Fit Index (CFI) (Bentler, 1990; McDonald & Marsh, 1990), Tucker Lewis Index (TLI) (Tucker & Lewis, 1973), and the Root Mean Square Error of Approximation (RMSEA) (Browne & Cudeck, 1993; Steiger, 1990).

Although there was very little missingness in the data, Full Information Maximum Likelihood (FIML) estimation was used to obtain optimally unbiased estimates of model parameters and their standard errors as suggested by Schafer & Graham (2002). In the full model the number of cases with no information on the dependent variables ($n = 109$, 14%) was less than 20% of the total sample, which indicates a low threat of substantial bias in

estimates, as described in Arbuckle (1996). These cases were not included in the present analysis resulting in a final sample size of $n = 699$.

Results

Descriptive Statistics

Demographic information on study variables for the full sample and by gender is provided in Table 1. Childhood physical abuse was reported by 17% of the sample and this did not differ by gender. Partner violence victimization was reported by 21% to 36% of the sample between the ages of 24 and 33. Saved factor score values of partner violence victimization did not significantly differ for men and women at any age in the current analysis. In the present study, 77% of participants had reported smoking at least once in their lifetime by age 33. Overall, men and women reported similar levels of smoking behavior, with a few exceptions. Men were more likely to report daily smoking at age 27 ($\chi^2(4) = 12.558, p = .014$) and at age 30 ($\chi^2(4) = 13.062, p = .01$). At age 21, men were more likely than women to have met criteria for an alcohol abuse or dependence diagnosis ($\chi^2(1) = 31.450, p < .001$).

Contextual Cross-lag Analysis

To determine if interpersonal violence was uniquely related to smoking behavior across developmental periods, a bi-directional cross-lag model was tested including risk factors and covariates (as shown in Figure 2). The final model, using the full sample with both men and women together, including all covariates listed above, fit the data well ($\chi^2 220.62 (60), p < .001$, CFI = .99, TLI: .98 RMSEA = .062). Childhood physical abuse before the age of 10 predicted both partner violence victimization ($\beta = .22, p < .001$) and smoking behavior ($\beta = .11, p < .01$) at age 24. There was strong continuity for both smoking behavior and partner violence victimization throughout young adulthood and adulthood (β range: .64 to .98, partner violence victimization; .89 to .95, smoking behavior). Partner violence victimization and smoking behavior were associated within time at age 24 ($\beta = .10, p < .05$). A reciprocal bidirectional relationship between partner violence victimization and smoking behavior from age 24 to age 27 was found, suggesting that experiencing partner violence victimization at age 24 uniquely predicted increased smoking behavior at age 27, and that smoking behavior at age 24 uniquely predicted heightened exposure to partner violence victimization at age 27. These results were found even after controlling for covariates and accounting for the high within-construct continuity.

Gender Differences

To assess whether the model differed for men and women, multiple-group analysis was conducted on the final model depicted above (Figure 2). A freely estimated model where pathways were allowed to differ for men and women fit the data well ($\chi^2 245.33 (108) p < .001$, RMSEA: .06; CFI: .992, TLI: .987) (Figure 3). This model was tested against a fully constrained model where pathways were forced to be equal for men and women ($\chi^2 220.56 (137) p < .001$, RMSEA: .04; CFI: .995; TLI: .994). A chi-square test of difference indicated that the constrained model fit the data significantly less well ($\chi^2(29) = 46.79, p = .02$) and that further investigation was needed into which pathways differed for men and women.

Pathways were systematically constrained one at a time and tested against a fully free model to determine which pathways significantly differed for men and women.

No pathways between childhood physical abuse, partner violence victimization, and smoking behavior were found to differ significantly for men and women. Gender differences were detected in the pathways between risk factors and later smoking behavior, including: Asian women compared to Asian men were significantly less likely to smoke ($\chi^2(1) = 5.495, p=.02$); a diagnosis of alcohol abuse or dependence at age 21 was a stronger predictor of smoking behavior at age 24 for women than for men ($\chi^2(1) = 5.614, p = .02$); and smoking behavior at age 24 was a stronger predictor of smoking behavior at age 27 for women than for men ($\chi^2(1) = 6.672, p = .01$).

Discussion

The current study examined concurrent, directional, and reciprocal relationships between interpersonal violence victimization and smoking behavior from childhood to adulthood. While the current study identified that the continuity of partner violence victimization and smoking behavior was the strongest predictor of each behavior in the future, the addition of childhood physical abuse as a common cause and bidirectional-reciprocal pathways to the model helped to explain the relationship between interpersonal violence and smoking across multiple developmental periods (Aim 1). Supporting a common cause hypothesis, we found that child physical abuse significantly predicted both partner violence and higher risk smoking behavior at age 24 even after accounting for other risk factors such as depression and alcohol dependence. This finding, linking early interpersonal violence with smoking in young adulthood, supports prior work of Topitzes et al. (2010) and Mersky and Topitzes (2010) and extends findings by linking child physical abuse with increased risk for smoking in young adulthood, a time when desistance is more normative. Linking two theoretical approaches, it is likely that the stress of early childhood interpersonal violence increases smoking behavior in a self-medication process, with maltreated youth adopting smoking as a coping tool.

The present findings suggest that even after controlling for potential common causes, an association persists between partner violence victimization and smoking behavior that is particularly salient in the developmental period of young adulthood. The finding that being the victim of partner violence at age 24 predicts higher risk smoking at age 27 lends support for the applicability of the self-medication hypothesis specific to the link between partner violence and smoking for both men and women (Aim 2). It may be that children who experience early interpersonal violence such as physical abuse adopt smoking to reduce mental health sequelae of their abuse, and rely on this coping tool when they experience future violence such as partner abuse.

Further, the current study was the first to find that higher risk smoking behavior at age 24, even after controlling for problematic alcohol use, uniquely predicted increased risk for partner violence in the transition from young adulthood and adulthood for both men and women (Aim 3). Studies drawing on the lifestyle theory have found that alcohol and illicit drug use increases the risk for partner violence victimization (Foshee et al., 2004; Huizinga

et al., 2003; Vézina et al., 2011). For alcohol and illicit substances this link most likely operates through the mechanisms of lowered inhibition and impaired judgment. It is unlikely that nicotine operates through these mechanisms but may operate through the third suggested mechanism of heightened exposure to antisocial peers. People who smoke are more likely to partner with other smokers (Banks, Kelly, & Smith, 2013) who, via their own smoking behavior, are also likely to use other substances and engage in delinquent behaviors in adulthood. Having a partner who uses alcohol and illicit drugs has been found to increase violence perpetration and victimization (Stuart et al., 2006; Stuart et al., 2008). More investigation is needed into the mechanisms that connect nicotine use via cigarette smoking with interpersonal violence over the life course.

The bi-directional relationship between smoking and partner violence victimization was only found in one cross-lag from young adulthood (age 24) to adulthood (age 27) (Aim 4). It is possible that the reciprocal relationship was found only in earlier development because there was no further variance left to be explained at later time periods due to the strong stability of these behaviors/experiences. Alternatively, there may be unique developmental risk factors or life events that occur in the transition from young adulthood to adulthood that strengthen the bidirectional link between partner violence victimization and smoking behavior.

One mechanism may be the nature of the individual's partnership. Crane et al. (2013) suggested that relationship status (i.e., dating vs. marriage) may explain developmental differences in the link between smoking and partner violence victimization experienced in younger age periods versus older age periods. However, it should be noted that their meta-analysis did not find that the association between smoking and partner violence victimization differed for dating partners (who are more likely to be younger) versus married partners across studies. Future research should also explore the influence of relationship stability and volatility on smoking adoption as a coping strategy for partner violence, and the influence of smoking on the selection of risky partners, which may increase the risk for partner violence victimization.

Finally, although gender differences were found in the risk factors for engaging in the smoking behavior pathway, there were no gender differences in the relationship between interpersonal violence, either child physical abuse or partner violence victimization, and smoking behavior (Aim 5). This points to the applicability of universal prevention and intervention efforts targeting the co-occurrence of interpersonal violence and smoking behavior across an individual's life course for both men and women.

The finding of gender symmetry in experiences of lower level physical violence in community samples using the CTS/CTS2 is common in the literature (Costa et al., 2015; Chan, 2011). Chan's (2011) review of two meta-analytic studies and 21 independent empirical studies investigating the prevalence of reported IPV across men and women found greater support for gender symmetry than gender asymmetry. Our findings that IPV factor scores were similar for men and women across time align with this conclusion. Chan (2011) attributes this symmetry to several factors, including measurement issues and reporting factors.

A diagnosis of alcohol abuse or dependence at age 21 was a stronger predictor of future smoking behavior for women than for men. Alcohol diagnosis or heavy drinking has been associated with more severe smoking behavior such as initiation, higher frequency smoking and nicotine dependence (Pomerleau, Aubin, & Pomerleau, 1997; Reed, Wang, Shillington, Clapp & Lange, 2007). Gender differences in this relationship may also be driven by an underlying mechanism such as Post-traumatic Stress Disorder (PTSD), which is more prevalent in women (Breslau, 2002). The consequences of reaching clinically problematic alcohol use are more negative for women than for men (Nolen-Hoeksema, 2004), which may become an additional stressor in and of itself that potentially exacerbates the adoption of smoking behavior among women.

Limitations

This study is not without limitations. Our decision to focus on childhood physical abuse and physical partner violence, which did not explicitly include sexual violence dimensions, may have impacted our ability to detect gender differences. We chose to focus on childhood physical abuse to maximize the construct continuity that childhood physical violence has with later physical partner violence victimization. However, a sensitivity analysis revealed that among individuals reporting childhood abuse, only a small group ($n = 34$, 17%) reported sexual abuse only, with the majority of cases reporting either physical abuse ($n = 93$, 55%) or both physical and sexual abuse ($n = 42$, 25%). Thus, only a small subset of individuals was not included in the present analysis. The overlapping versus unique influence of differing forms of child maltreatment on later interpersonal violence victimization and smoking behavior is an important question that should be examined in future studies.

In addition, childhood physical abuse was measured retrospectively at age 24 which may have introduced recall bias. Similarly, the measure of partner violence victimization used in this study did not include measures of sexual violence in intimate partnerships. The inclusion of the sexual coercion scale of the CTS2 has been noted as an area of importance for the identification of gender differences in the experience of partner violence (Hamby, 2009). Future research using longitudinal studies should investigate whether the unique and reciprocal relationship of differing forms of physical violence with smoking behavior over time generalizes to other forms of violence, including childhood sexual abuse, sexual coercion, and assault, and if this differs for men and women.

Finally, information on partner violence in adolescence was not available in the current study. The first available reference point for partner violence victimization in this study was at age 24. The high continuity in participants' experience of partner violence victimization from young adulthood to adulthood as evidenced by the high autoregressive coefficients in the model (Figure 1) suggests that earlier partner violence in adolescence (age 12 - 18) may aid in explaining the relationship between childhood physical abuse before age 10 and partner violence in young adulthood. Since onset of smoking primarily occurs during adolescence it will be important to include earlier experiences of partner violence victimization in future work. This is particularly true in light of recent literature pointing to the significance and growth of dating violence among teens in the U.S., and the relationship dating violence has with smoking (Haynie et al., 2013). The addition of earlier violence

exposure could aid in identifying a critical age for partner violence prevention efforts, potentially having long-term impacts on reducing smoking and future engagement with violent others.

Conclusion

Substance use and interpersonal violence (e.g., child abuse and partner violence) are prevalent issues seen by social work practitioners (Barth, Lloyd, Christ, Chapman, & Dickinson, 2008; Danis, 2003; Kleinfelder, Price, Dake, Jordan, & Price, 2013; Pyles & Postmus, 2004). The confluence of these two issues is seen prominently in clinical samples, where approximately half of all women and one out of ten men currently engaged in substance use treatment report being victims of partner violence (Chase, O'Farrell, Murphy, Fals-Stewart, & Murphy, 2003; Chermack, Fuller, & Blow, 2000; Chermack, Walton, Fuller, & Blow, 2001; Drapkin, McCrady, Swingle, & Epstein, 2005; Najavits, Sonn, Walsh, & Weiss, 2004; Schneider, Burnette, Ilgen, & Timko, 2009), and between 46% to 70% of people in substance use treatment have been estimated to have experienced abuse as children (Fernández-Montalvo, López-Goñi, & Arteaga, 2015; Simpson & Miller, 2002). The overlap between violence and substance use is problematic given the fact that experiencing interpersonal violence such as partner violence has been linked to lowered substance use treatment success, higher treatment drop out, and increased likelihood of treatment re-entry (Fernández-Montalvo et al., 2015; Simpson & Miller, 2002). However, many substance use treatment centers do not offer services for partner violence (Capezza, Schumacher, & Brady, 2014), and few address patients' smoking behavior due to organizational barriers and clinical reluctance (Hammond & Gregoire, 2011).

Prevention efforts targeting these two phenomena have historically been conducted separately; however, findings from previous work and the current study support the integration of interpersonal violence prevention into substance treatment and integration of substance use intervention into violence programming (Vest et al., 2002; Murphy & Ting, 2010). Integrating treatments that address substance use and comorbid experiences of interpersonal violence, and trauma-related diagnosis, has previously been identified as a preferred treatment method in the addiction field (Finkelstein et al., 2004; Torchalla et al., 2012), and calls for the development of new innovative integrated treatments has become a national priority (Finkelstein et al., 2004).

Despite this very few integrated treatments for interpersonal violence and substance use have been developed and tested, and even fewer attend to the smoking-violence overlap (Klostermann et al., 2010). Successful interventions have been developed for the treatment of smoking among patients with Post-traumatic Stress Disorder (PTSD), the diagnostic manifestation of trauma commonly related to interpersonal violence such as partner violence victimization (e.g., McFall et al., 2010). The integrated PTSD- tobacco cessation intervention led to increased rates of smoking cessation among primarily male, military veterans with combat-related PTSD diagnosis.

Results of the current study underscore the need for smoking cessation and relapse (secondary) prevention efforts for those individuals with comorbid smoking and partner

violence victimization, a sub-population of smokers who are increasingly resistant to smoking cessation (Cohen & Lichtenstein, 1990; McFall et al., 2010). Findings suggest that people with interpersonal violence exposures, both in childhood and adulthood, are particularly in need of integrated treatments that attend to smoking. Though gender differences in the etiological pathway between interpersonal violence and smoking were not found, for women in particular, who report higher rates of interpersonal violence in their lifetime, the development of integrated interventions may have a large impact. Findings here also underscore the need for coordinated primary prevention of smoking and interpersonal violence, an intersection that social workers are uniquely poised to address.

Acknowledgments

Funding support for this project was provided by grant numbers 1R01DA02441-07, 5R01DA003721-08, & 5R01DA021426-11 from the National Institute on Drug Abuse; RWJ21548 from the Robert Wood Johnson Foundation; and by an NIH Interdisciplinary training grant #TL1 TR000422, which supported the time of the corresponding author.

References

- Ackerson LK, Kawachi I, Barbeau EM, Subramanian SV. Exposure to domestic violence associated with adult smoking in India: A population based study. *Tobacco Control: An International Journal*. 2007; 16:378–383.
- Arbuckle, JL., Marcoulides, GA., Schumacker, RE. Full information estimation in the presence of incomplete data.. In: Marcoulides, GA., Schumacker, RE., editors. *Advanced structural equation modeling: Issues and techniques*. Lawrence Erlbaum Associates; Mahwah, NJ: 1996. p. 243–278.
- Baker TB, Piper ME, McCarthy DE, Majeskie MR, Fiore MC. Addiction motivation reformulated: An affective processing model of negative reinforcement. *Psychological Review*. 2004; 111:33–51. [PubMed: 14756584]
- Banks, J., Kelly, E., Smith, JP. Spousal health effects—the role of selection (No. w19438). National Bureau of Economic Research; Cambridge, MA: 2013.
- Barth RP, Lloyd EC, Christ SL, Chapman MV, Dickinson NS. Child welfare worker characteristics and job satisfaction: A national study. *Social Work*. 2008; 53:199–209. [PubMed: 19275116]
- Begle AM, Hanson RF, Danielson CK, McCart MR, Ruggiero KJ, Amstadter AB, Kilpatrick DG. Longitudinal pathways of victimization, substance use, and delinquency: findings from the National Survey of Adolescents. *Addictive Behaviors*. 2011; 36:682–689. [PubMed: 21377805]
- Bentler PM. Comparative fit indexes in structural models. *Psychological Bulletin*. 1990; 107:238–246. [PubMed: 2320703]
- Bernstein DP, Stein JA, Newcomb MD, Walker E, Pogge D, Ahluvalia T, Zule W. Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse and Neglect*. 2003; 27:169–190. [PubMed: 12615092]
- Black MC, Breiding MJ. Adverse health conditions and health risk behaviors associated with intimate partner violence--United States, 2005. *JAMA: Journal of the American Medical Association*. 2008; 300:646–649.
- Breslau N. Gender differences in trauma and posttraumatic stress disorder. *The Journal of Gender-Specific Medicine*. 2002; 5:34–40.
- Breslau N, Peterson EL, Schultz LR, Chilcoat HD, Andreski P. Major depression and stages of smoking: A longitudinal investigation. *Archives of General Psychiatry*. 1998; 55:161–166. [PubMed: 9477930]
- Brooks-Russell A, Foshee VA, Ennett ST. Predictors of latent trajectory classes of physical dating violence victimization. *Journal of Youth and Adolescence*. 2013; 42:566–580. [PubMed: 23212350]

- Browne, MW., Cudeck, R. Alternative ways of assessing model fit.. In: Bollen, KA., Long, JS., editors. Testing structural equation models. Sage; Newbury Park, CA: 1993. p. 136-162.
- Byrne DG, Mazanov J. Adolescent stress and future smoking behavior: A prospective investigation. *Journal of Psychosomatic Research*. 2003; 54:313–321. [PubMed: 12670608]
- Campaign for Tobacco-Free Kids. The toll of tobacco in the United States of America. 2012. Retrieved from <http://www.tobaccofreekids.org/research/factsheets/pdf/0072.pdf>
- Campbell JC. Health consequences of intimate partner violence. *The Lancet*. 2002; 359:1331–1336.
- Capezza NM, Schumacher EC, Brady BC. Trends in intimate partner violence services provided by substance abuse treatment facilities: Findings from a national sample. *Journal of Family Violence*. 2014; 30:85–91.
- Chan KL. Gender differences in self-reports of intimate partner violence: A review. *Aggression and Violent Behavior*. 2011; 16:167–175.
- Chase KA, O'Farrell TJ, Murphy CM, Fals-Stewart W, Murphy M. Factors associated with partner violence among female alcoholic patients and their male partners. *Journal of Studies on Alcohol*. 2003; 64:137–149. [PubMed: 12608494]
- Chassin L, Presson C, Rose J, Sherman SJ, Prost J. Parental smoking cessation and adolescent smoking. *Journal of Pediatric Psychology*. 2002; 27:485–496. [PubMed: 12177249]
- Chermack ST, Fuller BE, Blow FC. Predictors of expressed partner and non-partner violence among patients in substance abuse treatment. *Drug and Alcohol Dependence*. 2000; 58:43–54. [PubMed: 10669054]
- Chermack ST, Walton MA, Fuller BE, Blow FC. Correlates of expressed and received violence across relationship types among men and women substance abusers. *Psychology of Addictive Behaviors*. 2001; 15:140–151. [PubMed: 11419230]
- Cho H. Examining gender differences in the nature and context of intimate partner violence. *Journal of Interpersonal Violence*. 2012; 27:2665–2684. [PubMed: 22366476]
- Cohen S, Lichtenstein E. Perceived stress, quitting smoking, and smoking relapse. *Health Psychology*. 1990; 9:466–478. [PubMed: 2373070]
- Coid J, Petrukevitch A, Feder G, Chung W, Richardson J, Moorey S. Relation between childhood sexual and physical abuse and risk of revictimisation in women: A cross-sectional survey. *Lancet*. 2001; 358:450–454. [PubMed: 11513908]
- Costa BM, Kaestle CE, Walker A, Curtis A, Day A, Toumbourou JW, Miller P. Longitudinal predictors of domestic violence perpetration and victimization: A systematic review. *Aggression and Violent Behavior*. 2015; 24:261–272.
- Covington SS. Women and addiction: A trauma-informed approach. *Journal of Psychoactive Drugs*. 2008; (Suppl 5):377–385. [PubMed: 19248395]
- Crane CA, Hawes SW, Weinberger AH. Intimate partner violence victimization and cigarette smoking: A meta-analytic review. *Trauma, Violence, & Abuse*. 2013; 14:305–315.
- Danis FS. Guest editorial - Domestic violence and social work education: What do we know, what do we need to know? *Journal of Social Work Education*. 2003; 39:215–224.
- Desai S, Arias I, Thompson MP, Basile KC. Childhood victimization and subsequent adult revictimization assessed in a nationally representative sample of women and men. *Violence and Victims*. 2002; 17:639–653. [PubMed: 12680680]
- Devries KM, Child JC, Bacchus LJ, Mak J, Falder G, Graham K, Heise L. Intimate partner violence victimization and alcohol consumption in women: a systematic review and meta-analysis. *Addiction*. 2014; 109:379–391. [PubMed: 24329907]
- Diehl M, Coyle N, Labouvie-Vief G. Age and sex differences in strategies of coping and defense across the life span. *Psychology and Aging*. 1996; 11:127–139. [PubMed: 8726378]
- DiStefano C, Zhu M, Mindrila D. Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment, Research & Evaluation*. 2009; 14(20)
- Draper B, Pfaff JJ, Pirkis J, Snowdon J, Lautenschlager NT, Wilson I, Almeida OP. Long-term effects of childhood abuse on the quality of life and health of older people: Results from the Depression and Early Prevention of Suicide in General Practice Project. *Journal of the American Geriatrics Society*. 2008; 56:262–271. [PubMed: 18031482]

- Drapkin ML, McCrady BS, Swingle JM, Epstein EE. Exploring bidirectional couple violence in a clinical sample of female alcoholics. *Journal of Studies on Alcohol*. 2005; 66:213–219. [PubMed: 15957672]
- Easton CJ, Weinberger AH, George TP. Age of onset of smoking among alcohol dependent men attending substance abuse treatment after a domestic violence arrest. *Addictive Behaviors*. 2007; 32:2020–2031. [PubMed: 17300874]
- Falk DE, Yi HY, Hiller-Sturmhofel S. An epidemiologic analysis of cooccurring alcohol and tobacco use and disorders: Findings from the National Epidemiologic Survey on Alcohol and Related Conditions. *Alcohol Research & Health*. 2006; 29:162–171. [PubMed: 17373404]
- Fals-Stewart W, Kennedy C. Addressing intimate partner violence in substance-abuse treatment. *Journal of Substance Abuse Treatment*. 2005; 29:5–17. [PubMed: 15979527]
- Fang X, Corso PS. Child maltreatment, youth violence, and intimate partner violence: Developmental relationships. *American Journal of Preventive Medicine*. 2007; 33:281–290. [PubMed: 17888854]
- Fergusson DM, Goodwin R, Horwood L. Major depression and cigarette smoking: Results of a 21-year longitudinal study. *Psychological Medicine*. 2003; 33:1357–1367. [PubMed: 14672244]
- Fernández-Montalvo J, López-Goñi JJ, Arteaga A. Psychological, physical, and sexual abuse in addicted patients who undergo treatment. *Journal of Interpersonal Violence*. 2015; 30:1279–1298. [PubMed: 24992952]
- Finkelstein, N., VandeMark, N., Fallot, R., Brown, V., Cadiz, S., Heckman, J. Enhancing substance abuse recovery through integrated trauma treatment. 2004. Retrieved from <http://casat.unr.edu/docs/FinkelsteinVandeMarkFallotBrownCadizandHeckman2004EnhancingSArecoverythroughintegratedtrauma.pdf>
- Fletcher J. The effects of intimate partner violence on health in young adulthood in the United States. *Social Science & Medicine*. 2010; 70:130–135. [PubMed: 19819603]
- Foshee VA, Benefield TS, Ennett ST, Bauman KE, Suchindran C. Longitudinal predictors of serious physical and sexual dating violence victimization during adolescence. *Preventive Medicine: An International Journal Devoted to Practice and Theory*. 2004; 39:1007–1016.
- Frisman L, Ford J, Lin H-J, Mallon S, Chang R. Outcomes of trauma treatment using the TARGET model. *Journal of Groups in Addiction & Recovery*. 2008; 3:285–303.
- Gilman SE, Abrams DB, Buka SL. Socioeconomic status over the life course and stages of cigarette use: Initiation, regular use, and cessation. *Journal of Epidemiology and Community Health*. 2003; 57:802–808. [PubMed: 14573586]
- Hamby S. The gender debate about intimate partner violence: Solutions and dead ends. *Psychological Trauma: Theory, Research, Practice, and Policy*. 2009; 1:24–34.
- Hammond GC, Gregoire TK. Breaking ground in treating tobacco dependence at a women's treatment center. *Journal of Social Work Practice in the Addictions*. 2011; 11:1–16.
- Hansen WB, Tobler NS, Graham JW. Attrition in substance abuse prevention research: A meta-analysis of 85 longitudinally followed cohorts. *Evaluation Review*. 1990; 14:677–685.
- Hawkins, JD., Catalano, RF., Morrison, DM., O'Donnell, J., Abbott, RD., Day, LE. The Seattle Social Development Project: Effects of the first four years on protective factors and problem behaviors.. In: McCord, J., Tremblay, RE., editors. *Preventing antisocial behavior: Interventions from birth through adolescence*. Guilford Press; New York: 1992. p. 139-161.
- Haynie DL, Farhat T, Brooks-Russell A, Wang J, Barbieri B, Iannotti RJ. Dating violence perpetration and victimization among U.S. Adolescents: Prevalence, patterns, and associations with health complaints and substance use. *Journal of Adolescent Health*. 2013; 53:194–201. [PubMed: 23664626]
- Hien DA, Cohen LR, Miele GM, Litt LC, Capstick C. Promising treatments for women with comorbid PTSD and substance use disorders. *The American Journal of Psychiatry*. 2004; 161:1426–1432. [PubMed: 15285969]
- Hindelang, MJ., Gottfredson, MR., Garofaio, J. *Victims of personal crime: An empirical foundation for a theory of personal victimization*. Ballinger; Cambridge, MA: 1978.
- Hirschi, T., Gottfredson, MR., editors. *The generality of deviance in late adolescence and early adulthood*. Transaction; New Brunswick, NJ: 1994.

- Howard DE, Wang MQ. Psychosocial factors associated with adolescent boys' reports of dating violence. *Adolescence*. 2003; 38:519–533. [PubMed: 14768995]
- Huizinga, D., Weiher, AW., Espiritu, R., Esbensen, FA. Delinquency and crime: Some highlights from the Denver Youth Survey.. In: Thornberry, TP., Krohn, M., editors. *Taking stock of delinquency: An overview of findings from contemporary longitudinal studies*. Kluwer/Plenum; New York: 2003. p. 47-85.
- Jones DJ, Runyan DK, Lewis T, Litrownik AJ, Black MM, Wiley T, Nagin DS. Trajectories of childhood sexual abuse and early adolescent HIV/AIDS risk behaviors: The role of other maltreatment, witnessed violence, and child gender. *Journal of Clinical Child and Adolescent Psychology*. 2010; 39:667–680. [PubMed: 20706919]
- Jun H-J, Rich-Edwards JW, Boynton-Jarrett R, Wright RJ. Intimate partner violence and cigarette smoking: Association between smoking risk and psychological abuse with and without co-occurrence of physical and sexual abuse. *American Journal of Public Health*. 2008; 98:527–535. [PubMed: 17600272]
- Khantzian EJ. The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry*. 1985; 142:1259–1263. [PubMed: 3904487]
- Khantzian EJ. The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry*. 1997; 4:231–244. [PubMed: 9385000]
- Kleinfelder J, Price JH, Dake JA, Jordan TR, Price JA. Tobacco training in clinical social work graduate programs. *Health & Social Work*. 2013; 38:173–181. [PubMed: 24437023]
- Kristman-Valente AN, Brown EC, Herrenkohl TI. Child physical and sexual abuse and cigarette smoking in adolescence and adulthood. *Journal of Adolescent Health*. 2013; 53:533–538. [PubMed: 23871801]
- Kristman-Valente AN, Wells EA. The role of gender in the association between child maltreatment and substance use behavior: A systematic review of longitudinal research from 1995 to 2011. *Substance Use & Misuse*. 2013; 48:645–660. [PubMed: 23750770]
- Lansford JE, Dodge KA, Pettit GS, Bates JE. Does physical abuse in early childhood predict substance use in adolescence and early adulthood? *Child Maltreatment*. 2010; 15:190–194. [PubMed: 20019026]
- Lau JTF, Chan KK, Lam PKW, Choi PYW, Lai KYC. Psychological correlates of physical abuse in Hong Kong Chinese adolescents. *Child Abuse & Neglect*. 2003; 27:63–75. [PubMed: 12510031]
- Lehrer JA, Buka S, Gortmaker S, Shrier LA. Depressive symptomatology as a predictor of exposure to intimate partner violence among US female adolescents and young adults. *Archives of Pediatrics and Adolescent Medicine*. 2006; 160:270–276. [PubMed: 16520446]
- McDonald RP, Marsh HW. Choosing a multivariate model: Noncentrality and goodness of fit. *Psychological Bulletin*. 1990; 107:247–255.
- McFall M, Saxon AJ, Malte CA, Chow B, Bailey S, Baker DG, Lavori PW. Integrating tobacco cessation into mental health care for posttraumatic stress disorder: A randomized controlled trial. *JAMA: Journal of the American Medical Association*. 2010; 304:2485–2493. [PubMed: 21139110]
- McFall M, Saxon AJ, Thompson CE, Yoshimoto D, Malte C, Straits-Troster K, Steele B. Improving the rates of quitting smoking for veterans with Posttraumatic Stress Disorder. *The American Journal of Psychiatry*. 2005; 162:1311–1319. [PubMed: 15994714]
- Mersky JP, Topitzes J. Comparing early adult outcomes of maltreated and nonmaltreated children: A prospective longitudinal investigation. *Children and Youth Services Review*. 2010; 32:1086–1096. [PubMed: 27667886]
- Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *JAMA: Journal of the American Medical Association*. 2004; 291:1238–1245. [PubMed: 15010446]
- Moore TM, Stuart GL, Meehan JC, Rhatigan D, Hellmuth JC, Keen SM. Drug abuse and aggression between intimate partners: A meta-analytic review. *Clinical Psychology Review*. 2008; 28:247–274. [PubMed: 17604891]

- Moses, DJ., Reed, BG., Mazelis, R., D'Ambrosio, B. Creating trauma services for women with co-occurring disorders. Substance Abuse and Mental Health Services Administration; Washington, DC: 2003.
- Murphy CM, Ting L. The effects of treatment for substance use problems on intimate partner violence: A review of empirical data. *Aggression and Violent Behavior*. 2010; 15:325–333.
- Najavits LM, Sonn J, Walsh M, Weiss RD. Domestic violence in women with PTSD and substance abuse. *Addictive Behaviors*. 2004; 29:707–715. [PubMed: 15135552]
- Nolen-Hoeksema S. Gender differences in risk factors and consequences for alcohol use and problems. *Clinical Psychology Review*. 2004; 24:981–1010. [PubMed: 15533281]
- Plichta SB. Intimate partner violence and physical health consequences: Policy and practice implications. *Journal of Interpersonal Violence*. 2004; 19:1296–1323. [PubMed: 15534333]
- Pomerleau CS, Aubin H-J, Pomerleau OF. Self-reported alcohol use patterns in a sample of male and female heavy smokers. *Journal of Addictive Diseases*. 1997; 16:19–24. [PubMed: 9243336]
- Pyles L, Postmus JL. Addressing the problem of domestic violence: How far have we come? *Affilia*. 2004; 19:376–388.
- Ramiro LS, Madrid BJ, Brown DW. Adverse childhood experiences (ACE) and health-risk behaviors among adults in a developing country setting. *Child Abuse & Neglect*. 2010; 34:842–855. [PubMed: 20888640]
- Riley D. Time and crime: The link between teenager lifestyle and delinquency. *Journal of Quantitative Criminology*. 1987; 3:339–354.
- Reed MB, Wang R, Shillington AM, Clapp JD, Lange JE. The relationship between alcohol use and cigarette smoking in a sample of undergraduate college students. *Addictive behaviors*. 2007; 32(3): 449–464. [PubMed: 16844313]
- Roberts ME, Fuemmeler BF, McClernon FJ, Beckham JC. Association between trauma exposure and smoking in a population-based sample of young adults. *Journal of Adolescent Health*. 2008; 42:266–274. [PubMed: 18295135]
- Robins, LN., Cottler, LB., Bucholz, KK., Compton, WM. Diagnostic Interview Schedule for DSM-IV. Washington University; St. Louis, MO: 1995.
- Schafer JL, Graham JW. Missing data: Our view of the state of the art. *Psychological Methods*. 2002; 7:147–177. [PubMed: 12090408]
- Schneider R, Burnette ML, Ilgen MA, Timko C. Prevalence and correlates of intimate partner violence victimization among men and women entering substance use disorder treatment. *Violence and Victims*. 2009; 24:744–756. [PubMed: 20055212]
- Scott-Storey K, Wuest J, Ford-Gilboe M. Intimate partner violence and cardiovascular risk: Is there a link? *Journal of Advanced Nursing*. 2009; 65:2186–2197. [PubMed: 20568323]
- Simpson TL, Miller WR. Concomitance between childhood sexual and physical abuse and substance use problems. A review. *Clinical Psychology Review*. 2002; 22:27–77. [PubMed: 11793578]
- Smith PH, White JW, Holland LJ. A longitudinal perspective on dating violence among adolescent and college-age women. *American Journal of Public Health*. 2003; 93:1104–1109. [PubMed: 12835193]
- Steiger JH. Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*. 1990; 25:173–180. [PubMed: 26794479]
- Stene LE, Jacobsen GW, Dyb G, Tverdal A, Schei B. Intimate partner violence and cardiovascular risk in women: A population-based cohort study. *Journal of Women's Health*. 2013; 22:250–258.
- Stuart GL, Meehan JC, Moore TM, Morean M, Hellmuth J, Follansbee K. Examining a conceptual framework of intimate partner violence in men and women arrested for domestic violence. *Journal of Studies on Alcohol*. 2006; 67:102–112. [PubMed: 16536134]
- Stuart GL, Temple JR, Follansbee KW, Bucossi MM, Hellmuth JC, Moore TM. The role of drug use in a conceptual model of intimate partner violence in men and women arrested for domestic violence. *Psychology of Addictive Behaviors*. 2008; 22:12–24. [PubMed: 18298227]
- Stueve A, O'Donnell L. Continued smoking and smoking cessation among urban young adult women: findings from the Reach for Health longitudinal study. *American Journal of Public Health*. 2007; 97:1408–1411. [PubMed: 17600241]

- Sunday S, Kline M, Labruna V, Pelcovitz D, Salzinger S, Kaplan S. The role of adolescent physical abuse in adult intimate partner violence. *Journal of Interpersonal Violence*. 2011; 26:3773–3789. [PubMed: 21602201]
- Thun MJ, Carter BD, Feskanich D, Freedman ND, Prentice R, Lopez AD, Gapstur SM. 50-year trends in smoking-related mortality in the United States. *The New England Journal of Medicine*. 2013; 368:351–364. [PubMed: 23343064]
- Topitzes J, Mersky JP, Reynolds AJ. Child maltreatment and adult cigarette smoking: A long-term developmental model. *Journal of Pediatric Psychology*. 2010; 35:484–498. [PubMed: 19995869]
- Torchalla I, Nosen L, Rostam H, Allen P. Integrated treatment programs for individuals with concurrent substance use disorders and trauma experiences: A systematic review and meta-analysis. *Journal of Substance Abuse Treatment*. 2012; 42:65–77. [PubMed: 22035700]
- Tucker LR, Lewis C. A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*. 1973; 38:1–10.
- U.S. Department of Health and Human Services. The health consequences of smoking— 50 Years of Progress: A Report of the Surgeon General. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; Atlanta, GA: 2014.
- Vander Weg MW. Adverse childhood experiences and cigarette smoking: The 2009 Arkansas and Louisiana Behavioral Risk Factor Surveillance Systems. *Nicotine & Tobacco Research*. 2011; 13:616–622. [PubMed: 21447839]
- Vest JR, Catlin TK, Chen JJ, Brownson RC. Multistate analysis of factors associated with intimate partner violence. *American Journal of Preventive Medicine*. 2002; 22:156–164. [PubMed: 11897459]
- Vézina J, Hébert M, Poulin F, Lavoie F, Vitaro F, Tremblay RE. Risky lifestyle as a mediator of the relationship between deviant peer affiliation and dating violence victimization among adolescent girls. *Journal of Youth and Adolescence*. 2011; 40:814–824. [PubMed: 21080045]
- Widom CS, Ireland T, Glynn PJ. Alcohol abuse in abused and neglected children followed-up: Are they at increased risk? *Journal of Studies on Alcohol*. 1995; 56:207–217. [PubMed: 7760568]
- Widom CS, Marmorstein NR, White HR. Childhood victimization and illicit drug use in middle adulthood. *Psychology of Addictive Behaviors*. 2006; 20:394–403. [PubMed: 17176174]
- Widom CS, White HR. Problem behaviours in abused and neglected children grown up: Prevalence and co-occurrence of substance abuse, crime and violence. *Criminal Behaviour and Mental Health*. 1997; 7:287–310.
- Widom CS, White HR, Czaja SJ, Marmorstein NR. Long-term effects of child abuse and neglect on alcohol use and excessive drinking in middle adulthood. *Journal of Studies on Alcohol and Drugs*. 2007; 68:317–326. [PubMed: 17446970]
- Yoshihama M, Horrocks J, Bybee D. Intimate partner violence and initiation of smoking and drinking: A population-based study of women in Yokohama, Japan. *Social Science & Medicine*. 2010; 71:1199–1207. [PubMed: 20692081]

Figure 1.

The conceptual models of interpersonal violence and smoking over time. **Panel A.** Common cause model assuming within-time relationships between smoking and partner conflict are driven by the shared experience of childhood violence. **Panel B.** Self-medication model where partner violence precedes smoking. **Panel C.** Lifestyle hypothesis where smoking predicts engagement in partner violence at later time points. **Panel D.** Bidirectional model where smoking and partner violence influence mutually unfolds over time.

Figure 2.

Cross-lag model of child physical abuse, partner violence victimization, and smoking behavior from ages 24-33.

NOTES: **SES:** Socioeconomic status defined by eligibility for free and reduced-price lunch during Grades 5, 6 and 7. **Physical Abuse:** Childhood physical abuse before age 10. **Alcohol Diagnosis:** Meeting criteria for alcohol abuse or dependence diagnosis at age 21.

Depression Diagnosis: Meeting criteria for Major Depression at age 21.

*** $p < .001$; ** $p < .01$; * $p < .05$

Figure 3.

Cross-Lag model of child physical abuse, partner violence victimization, and smoking behavior from ages 24-33 by gender. *** $p < .001$; ** $p < .01$; * $p < .05$

Table 1

Demographic Information of Partner Violence Victimization, Smoking, and Covariates by Age/Gender

Variable	Age	Full sample n=808	Males n=412	Females n=396
Childhood physical abuse				
	10	138 (17%)	80 (19%)	58 (15%)
Any partner violence victimization				
	24	201 (25%)	88 (21%)	113 (29%)
	27	167 (21%)	84 (20%)	83 (21%)
	30	288 (36%)	139 (34%)	149 (38%)
	33	285 (35%)	134 (33%)	151 (38%)
Smoking behavior				
	24			
	Nonsmoker	159 (20%)	74 (18%)	85 (22%)
	Past, not current	364 (45%)	173 (42%)	191 (48%)
	Casual	46 (6%)	26 (6%)	20 (6%)
	Daily	164 (20%)	91 (22%)	73 (18%)
	Nicotine Dx.	53 (7%)	34 (8%)	19 (5%)
	27			
	Nonsmoker	140 (17%)	60 (15%)	80 (20%)
	Past, not current	389 (48%)	195 (47%)	194 (49%)
	Casual	45 (6%)	18 (4%)	27 (7%)
	Daily	95 (12%)	60 (15%)	35 (9%)
	Nicotine Dx.	117 (15%)	65 (16%)	52 (13%)
	30			
	Nonsmoker	127 (16%)	53 (13%)	74 (19%)
	Past, not current	404 (50%)	204 (50%)	200 (51%)
	Casual	38 (5%)	22 (5%)	16 (4%)
	Daily	116 (14%)	65 (16%)	51 (13%)
	Nicotine Dx.	92 (11%)	51 (12%)	41 (10%)
	33			
	Nonsmoker	127 (16%)	52 (13%)	75 (19%)
	Past, not current	438 (54%)	216 (52%)	222 (56%)
	Casual	27 (3%)	16 (4%)	11 (3%)
	Daily	66 (8%)	42 (10%)	24 (6%)
	Nicotine Dx.	124 (15%)	72 (18%)	52 (13%)
Major depression	21	150 (19%)	66 (16%)	84 (21%)
Alcohol abuse or Dx.	21	203 (25%)	136 (33%)	67 (17%)

Note: Significant gender differences are in **bold**.