Preventive Medicine 129 (2019) 105844

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

# Predicting sexual behaviors from mid-adolescence to emerging adulthood: The roles of dating violence victimization and substance use

Ryan C. Shorey[a,*], Joseph R. Cohen[b], Haley Kolp[a], Paula J. Fite[c], Gregory L. Stuart[d], Jeff R. Temple[e]

[a] University of Wisconsin - Milwaukee, United States of America
[b] University of Illinois, United States of America
[c] University of Kansas, United States of America
[d] University of Tennessee - Knoxville, United States of America
[e] University of Texas Medical Branch – Galveston, United States of America

ARTICLE INFO

*Keywords:*
Sexual behavior
Dating violence
Alcohol
Marijuana

ABSTRACT

The purpose of the present study was to determine whether dating violence victimization (psychological, physical, and sexual) and substance use (alcohol and marijuana) predicted sexual behaviors that increase risk for poor outcomes from ages 15–19. Adolescents ($N$ = 1042; 56% female) were recruited from high schools in Southeast Texas in 2010 and followed annually for six years. The mean age of the sample at baseline was 15.09 ($SD$ = 0.79). Participants primarily identified as Hispanic (31.4%), White (29.4%), and Black/African American (27.9%). Participants completed measures of dating violence victimization, substance use, and sexual behaviors annually. We examined unique and interactive associations between substance use and dating violence victimization with sexual behaviors that increase risk for poor outcomes. Multilevel modeling demonstrated that, when examining predictors simultaneously, marijuana use and psychological victimization predicted sexual behaviors over time for males. For females, marijuana use, and physical and psychological victimization all predicted sexual behaviors over time, with marijuana exerting the strongest effect, particularly among females who also used alcohol. Prevention efforts for adolescent sexual behaviors that increase risk for poor outcomes should include a focus on reducing substance use, particularly marijuana, and the effects of dating violence victimization.

## 1. Introduction

Unprotected sexual intercourse (condom and contraceptive nonuse) and multiple partners at a young age are a public health concern among adolescents and emerging adults. Approximately 65% of adolescents in the United States (US) have sexual intercourse by the end of high school and 25% of these students report they had 4 or more sexual partners (Centers for Disease Control and Prevention (CDC), 2012). Moreover, half of adolescents report not using a condom during their last instance of sexual intercourse (Centers for Disease Control and Prevention, 2016). These sexual behaviors that increase risk for poor outcomes (referred to as "sexual behaviors" throughout) are associated with increased sexually transmitted infections, HIV, and unplanned pregnancies (Pflieger et al., 2013; Vasilenko et al., 2015) and has been shown to emerge and peak in adolescence, persisting into young adulthood (Mahalik et al., 2013). Although pregnancies during adolescence have declined over time in the US, adolescent pregnancy rates in the US remain among the highest in the developed world (Sedgh et al., 2015). Thus, addressing sexual behaviors (e.g., lack of contraception use) among sexually active adolescents and young adults is a public health priority.

Efforts aimed at preventing sexual behaviors are facilitated by research on its risk factors. Dating violence victimization (i.e., psychological, physical, and sexual violence) and substance use are robust predictors of adolescents' sexual behaviors (Alleyne et al., 2011; Bryan et al., 2012; Guo et al., 2002; Shorey et al., 2015). Utilizing the sample in the present manuscript, we demonstrated dating violence and substance use were associated with sexual behaviors across 1 year[citation masked]. Theoretically, these associations can be explained using Problem Behavior Theory (Ihongbe et al., 2017) or syndemic theories (Singer, 2009), which postulates that problematic behaviors "cluster" or co-occur (Jessor, 1991) (Problem Behavior Theory) or that two or more

* Corresponding author.
*E-mail address:* shorey@uwm.edu (R.C. Shorey).

https://doi.org/10.1016/j.ypmed.2019.105844
Received 16 January 2019; Received in revised form 19 July 2019; Accepted 9 September 2019
Available online 13 September 2019
0091-7435/ © 2019 Elsevier Inc. All rights reserved.

social or health problems synergistically interact to contribute to additional epidemics and disease burdens (syndemic theories) (Singer, 2009). However, there are several critical gaps in this literature. First, most of these studies have been cross-sectional (Alleyne et al., 2011) or spanned short follow-up periods (Shorey et al., 2015), limiting knowledge of how risk factors may change over developmental epochs. It is plausible these associations would remain across time, as dating violence and substance use both increase from mid-adolescence to emerging adulthood (Arnett, 2005; Shorey et al., 2017), and sexual behavior also increases during this transition (Liu et al., 2015).

Second, no known research has examined the interactive effects of these factors on sexual behaviors during the adolescent-adult transition. Research with young adults has shown alcohol and marijuana synergistically interact to increase the odds of sexual behaviors (Metrik et al., 2016) but it is not clear whether these findings extend downward to adolescence or how exposure to dating violence may influence sexual behaviors once accounting for substance use. Simultaneous tests of additive and interactive hypotheses for cumulative risk factors are understudied, but necessary for comprehensive etiological explanations of problematic adolescent behaviors (Menon et al., 2018; Rosen et al., 2018). By testing interactive and additive models of risk, we are able to examine the validity of using a cumulative risk approach for predicting future risky sexual behavior. Specifically, support for an interactive model would suggest that simply summing risk factors, as is commonly done within a public health context, minimizes the actual risk associated with multiple risk factors. Third, research has been mixed on whether dating violence victimization and substance use vary as predictors of sexual behaviors for males and females, with some research finding no sex differences (Bryan et al., 2012; Shorey et al., 2015) and others reporting sex differences (Alleyne et al., 2011).

Thus, the current study examined the unique and interactive effects of dating violence victimization (psychological, physical, and sexual) and substance use (alcohol and marijuana) as predictors of sexual behaviors from mid-adolescence to emerging adulthood. Based on prior research, we hypothesized that 1) dating violence victimization and substance use would independently predict sexual behaviors over time, supporting an additive risk model (Menon et al., 2018) and 2) alcohol and marijuana would interact to predict sexual behaviors, supporting an interactive model. No a priori hypotheses were made regarding sex differences.

## 2. Method

### 2.1. Participants

Participants included 1042 adolescents (56% female) in southeast Texas who were recruited from high schools. Data collection began in 2010, with participants being assessed annually for eight years (current study examined Waves 1–6). At baseline, the mean age was 15.09 ($SD$ = 0.79), and adolescents were in 9th ($n$ = 781), 10th ($n$ = 250), and 11th grade ($n$ = 11). The racial/ethnic makeup of the sample included 31.4% Hispanic, 29.4% White, 27.9% Black/African American, 3.6% Asian American/Pacific Islander, and 7.7% “other” (e.g., mixed race). Across the five follow-up assessments, retention was good (93%, 86%, 75%, 70%, and 73%, respectively). This sample has been reported on elsewhere (CITATION MASKED, n.d.).

### 2.2. Procedure

Adolescents were recruited from classes with mandatory attendance and all students were eligible. After a description of the study was provided to adolescents, an information packet, including informed consent, was sent home with adolescents to have their parents review. Sixty-two percent of adolescents returned signed parental consents and provided assent for participation. Participants completed surveys in a private classroom without teachers or school administrators present. Once participants graduated or finished high school, survey completion moved from paper-pencil to web-based. For completion of the surveys, participants received nominal compensation in the form of gift cards ($10 at years 1–3; $20 at years 4–5; and $30 at year 6).

### 2.3. Measures

#### 2.3.1. Sexual behaviors

At each assessment two questions were utilized to assess for sexual behaviors that increase risk for poor outcomes, which were (1) “During your life, how many people have you had sex (intercourse) with?” and (2) “The last time you had sex (intercourse), what methods did you or your partner use to prevent pregnancy?” The baseline assessment asked about lifetime behavior and follow-up assessments asked about behavior in the past year. Consistent with prior research (Shorey et al., 2015; Rosen et al., 2018; CITATION MASKED, n.d.; Caruthers et al., 2014) we dichotomized responses to both questions, as we were interested in the presence, and not frequency, of sexual behaviors. That is, at each assessment, having none or one sexual partner was coded as “0”, and having two or more sexual partners was coded with a “1.” At each assessment, any contraception use (e.g., condoms) was coded as a “0”, and no contraception use was coded as a “1”. We then summed the two items to create a total score for sexual behaviors at each assessment, with scores ranging from 0 to 2, and higher scores reflecting greater sexual behaviors. These questions are consistent with past research on sexual behaviors (Metzler et al., 1992; Barbee et al., 2016).

#### 2.3.2. Dating violence victimization

The psychological (10 items), physical (4 items), and sexual (4 items) dating violence victimization subscales from the Conflict in Adolescent Dating Relationships Inventory (CADRI (Wolfe et al., 2001)) were utilized at each assessment. At baseline, items inquired about lifetime victimization and each subsequent assessment inquired about victimization in the past year. Example items included “my partner threw something at me” (physical), “my partner touched me sexually when I didn't want him/her to” (sexual), and “my partner ridiculed or made fun of me in front of others” (psychological). Items were rated using a Yes/No response option to indicate whether the behavior occurred. Items for each subscale were summed, with higher scores indicating a greater number of violent acts experienced. The CADRI is a widely used measure of adolescent dating violence with established psychometric properties (Wolfe et al., 2001).

#### 2.3.3. Substance use

At the first assessment participants were asked if they had ever used (1) alcohol (“more than just a few sips”) and (2) marijuana in their lifetimes using a Yes/No format. At each subsequent assessment, these same questions were asked with the reporting reference period being the previous year. These items are consistent with those used in other adolescent substance use research (Miech et al., 2018).

### 2.4. Data analytic plan

We used multilevel modeling to test our hypotheses. A random intercept mixed level model (Singer et al., 2003) with an autoregressive heterogeneous Level 1 covariance structure was used for all analyses. A time-lagged data analytic approach was utilized such that substance use (alcohol, marijuana) and dating violence victimization (psychological, physical, and sexual) were entered as time-varying covariates at *T-1* (i.e., ages 15–18) for predicting sexual behaviors at time *T* (i.e., ages 16–19), while controlling for sexual behaviors at age 15. Models were first created to examine whether our predictors of sexual behaviors were associated with increasing or decreasing trajectories of sexual behaviors over time (i.e., a significant interaction between predictors and time). Time was modeled flexibly to examine whether linear, quadratic, or cubic functions of time best fit the pattern of sexual

behaviors. In addition, we examined if our predictors were associated with elevated sexual behaviors across a four-year period (predictors were main effects with risky sexual behavior's intercept centered at 0). In cases in which a significant positive finding was identified in our intercept model, and a significant negative pattern was found in our slope models, the intercept was recentered to the final time point to help control for any regression to the mean effects.

Initial models established the pattern of findings for each predictor independently. However, due to past research demonstrating significant correlations between victimization and substance use (Temple and Freeman, 2011), we then entered significant predictors into a simultaneous model to assess the additive or interactive effects of these predictors. First, we created interaction terms between our predictors to see if the effects of any risk factor were exacerbated within the presence of an additional risk factor. To ensure enough power to detect a meaningful effect, only interaction terms with two risk factors were tested. If interaction terms between risk factors were non-significant, and multiple predictors were identified in our independent models, we entered risk factors simultaneously (i.e., as independent covariates) to see if the pattern of significance identified in the independent models maintained. If multiple risk factors were significant, the relationship could be described as additive, but if a given risk factor was significant in the independent model and not the simultaneous model, we would posit that the influence of that risk factor is not unique (Menon et al., 2018). All models examined if findings varied between males and females. Effect sizes were calculated to provide clinical context for our significant findings within our multilevel models. Analyses were conducted using SPSS. Supplemental Table 1 includes a stepwise narrative of our analytic approach.

As we were most interested in the associations between substance use and dating violence with sexual behaviors from mid-adolescence to young adulthood, we modeled analyses by age and not wave of assessment. This method is common when age varies within samples at a particular wave (Bollen and Curran, 2006) and has been used in recent studies on dating violence (Shorey et al., 2018; Wymbs et al., 2017). As an example, if a participant was 15 years old at the first assessment, and completed two consecutive assessments thereafter, their data at ages 15, 16, and 17 were included. Of the entire sample, 70.2% had data at age 15, 90.2% had data at age 16, 88.2% had data at age 17, 77.4% had data at age 18, and 67.2% had data at age 19.

## 3. Results

### 3.1. Preliminary analyses

Correlations at age 15 (baseline) and descriptive statistics across time among study variables are presented in Table 1. We ran Little's MCAR test to examine whether missing data was missing completely at random (MCAR). Our MCAR test was not significant (Chi-square = 2841.46, $df = 4004$, $p > .99$), suggesting that data was MCAR and data was subsequently imputed using the expectation-maximization (EM) function. Finally, we examined which function of time (linear, quadratic, or cubic) best described patterns of sexual behaviors. Overall, we found that both the linear ($F(3125) = 547.54$, $p < .001$) and the quadratic ($F(3124) = 4.38$, $p < .05$) models fit the model for sexual behaviors well. Thus, both time indices were entered as main effects into our models.

### 3.2. Independent models

Regarding sexual behaviors trajectories, substance use did not predict increasing or decreasing sexual behaviors ($p > .10$) and this relation was invariant across males and females ($p > .10$). However, significant findings were identified for our intercept models. Specifically, alcohol use predicted elevated levels of sexual behaviors at baseline ($t(2929) = 5.84$, $p < .001$, $r_{\text{effect size}} = 0.11$) and the relation between marijuana use and levels of sexual behaviors varied as a function of sex ($t(3663) = -3.07$, $p = .002$, $r_{\text{effect size}} = 0.05$), such that females who used marijuana were more likely to report sexual behaviors ($t(1978) = 10.40$, $p < .001$; $r_{\text{effect size}} = 0.23$) compared to males ($t(1676) = 5.18$, $p < .001$; $r_{\text{effect size}} = 0.13$). Using the predictive probabilities from this model, we took the average sexual behaviors for males and females who reported or did not report marijuana use at baseline. These averages are displayed in Fig. 1.

Next, we examined the association between dating violence victimization and sexual behaviors. For sexual dating violence victimization, neither the slope nor intercept was significant ($p > .20$). For physical dating violence victimization, both the slope ($t(2438) = -2.53$, $p = .01$, $r_{\text{effect size}} = 0.05$) and intercept ($t(4108) = 4.42$, $p < .001$, $r_{\text{effect size}} = 0.07$) were significant. However, due to the positive intercept and negative slope, the intercept for sexual behaviors was subsequently recentered to the final time point, and the relation was no longer significant ($p > .10$). For psychological dating violence, the association between psychological victimization and sexual behaviors did not vary as a function of time ($p > .10$), but psychological victimization did significantly predict the intercept for sexual behaviors ($t(3930) = 5.59$, $p < .001$, $r_{\text{effect size}} = 0.04$). None of these models varied by sex ($p > .20$).

### 3.3. Simultaneous models

We next examined potential interactive and additive effects of our main predictors on trajectories of sexual behaviors. We first tested interactive hypotheses concerning risky sexual behavior trajectories. Initial models tested whether any potential interaction terms varied as a function of sex. Overall, we found that the interactive influence of alcohol and marijuana use on sexual behaviors trajectories varies as a function of sex ($t(2793) = -2.10$, $p = .04$, $r_{\text{effect size}} = 0.04$), such that females who reported alcohol and marijuana use were at increased risk for sexual behaviors over time ($t(1540) = 2.17$, $p = .03$, $r_{\text{effect size}} = 0.06$), while this relation was not significant for males ($t(1102) = -0.89$, $p > .30$). Estimated patterns of sexual behaviors for females who used alcohol and marijuana are displayed in Fig. 2. Median splits defined alcohol users (anyone who reported alcohol use three out of the four years) and marijuana users (anyone who reported any marijuana use). As shown, females who reported using alcohol and marijuana were at lower risk during adolescence for reporting sexual behaviors compared to males, but presented at elevated risk during the transition into emerging adulthood. None of our other predictors interacted to predict sexual behaviors trajectories ($p > .10$). We next examined interactive models regarding levels of sexual behaviors. Overall, we did not find that the interactive effects varied as a function of sex for predicting the sexual behaviors intercept ($p > .20$). Further, we did not find that multiple predictors interacted to forecast increased levels of sexual behaviors ($p > .05$).

Finally, we tested our additive models (Table 2). Due to the significant differences with the main effect of marijuana use (i.e., females more at risk for risk sexual behavior, but males not), these models were conducted separately for males and females. For females, findings suggested that marijuana use ($p < .001$), physical victimization ($p = .04$), and psychological victimization ($p = .02$) uniquely forecasted risk. Meanwhile, for males we found that both marijuana use ($p < .001$) and psychological victimization ($p < .05$) conferred risk for future sexual behaviors.

## 4. Discussion

Findings provided partial support for our hypotheses, demonstrating that, when examining predictors simultaneously, marijuana use and psychological dating violence victimization predicted sexual behaviors over time for males. For females, marijuana use, and physical and psychological dating violence victimization all predicted sexual

**Table 1**
Baseline (age 15) correlations and descriptive statistics across age among study variables.

| | 1. | 2. | 3. | 4. | 5. | 6. |
|---|---|---|---|---|---|---|
| 1. Sexual behaviors | – | 0.22*** | 0.30*** | 0.24*** | 0.28*** | 0.18*** |
| 2. Alcohol use | | – | 0.41*** | 0.21*** | 0.12** | 0.11** |
| 3. Marijuana use | | | – | 0.16*** | 0.13** | 0.11** |
| 4. Psychological victimization | | | | – | 0.43*** | 0.29*** |
| 5. Physical victimization | | | | | – | 0.35*** |
| 6. Sexual victimization | | | | | | – |

| Means (Standard Deviations) | Sexual behaviors | Alcohol use | Marijuana use | Psychological victimization | Physical victimization | Sexual victimization |
|---|---|---|---|---|---|---|
| Age 15 | 0.32 (0.58) | 0.56 (0.49) | 0.25 (0.43) | 3.34 (2.68) | 0.37 (0.86) | 0.26 (0.60) |
| Age 16 | 0.36 (0.57) | 0.58 (0.49) | 0.32 (0.46) | 3.31 (2.75) | 0.39 (0.90) | 0.24 (0.56) |
| Age 17 | 0.39 (0.55) | 0.63 (0.48) | 0.37 (0.48) | 3.39 (2.88) | 0.38 (0.91) | 0.20 (0.55) |
| Age 18 | 0.46 (0.58) | 0.66 (0.47) | 0.41 (0.49) | 3.15 (2.93) | 0.34 (0.91) | 0.21 (0.59) |
| Age 19 | 0.55 (0.61) | – | – | – | – | – |

Note: Substance use and dating violence victimization were examined as longitudinal predictors of sexual behaviors and, thus, these variables were not examined at age 19.
** $p < .01$.
*** $p < .001$.

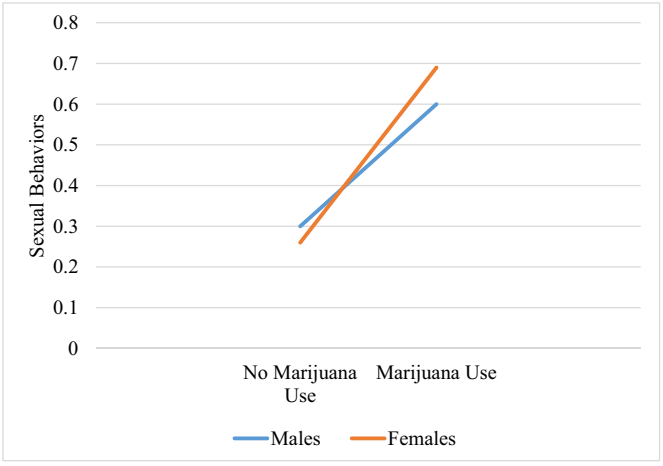


**Fig. 1.** Effects of marijuana on levels of sexual behaviors in males and females.

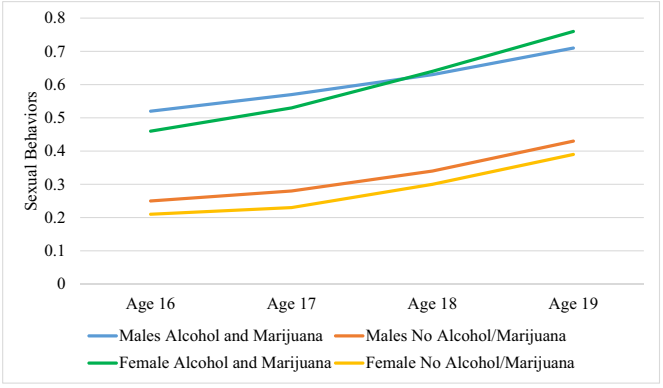


**Fig. 2.** Interactive influence of alcohol and marijuana on sexual behaviors in males and females.

behaviors over time, with marijuana exerting the strongest effect. While this latter finding is consistent with research that shows marijuana to predict sexual behaviors among adolescents and young adults (Bryan et al., 2012; Metrik et al., 2016), this is the first study to demonstrate that this relationship is stable across mid-adolescence to emerging adulthood while also considering the simultaneous impact of dating violence victimization. Risk of marijuana use leading to risky sexual

**Table 2**
Multilevel models of simultaneous effects on sexual behaviors levels (intercept models).

| Predictors | *B* | *SE* | *t* | $R_{\text{effect size}}$ |
|---|---|---|---|---|
| Female model | | | | |
| Time | 0.00 | 0.03 | −0.06 | 0.00 |
| Quad | 0.02 | 0.01 | 2.46** | 0.06 |
| Baseline sexual behaviors | 0.31 | 0.03 | 12.27** | 0.44 |
| Marijuana use | 0.24 | 0.03 | 8.58** | 0.19 |
| Alcohol use | 0.04 | 0.03 | 1.71 | 0.04 |
| Physical victimization | 0.01 | 0.02 | 2.10* | 0.04 |
| Sexual victimization | −0.02 | 0.03 | −1.36 | 0.03 |
| Psychological victimization | 0.01 | 0.01 | 2.33* | 0.05 |
| Male model | | | | |
| Time | 0.05 | 0.03 | 1.58 | 0.05 |
| Quad | 0.00 | 0.01 | 0.55 | 0.02 |
| Baseline sexual behaviors | 0.36 | 0.03 | 10.64** | 0.44 |
| Marijuana use | 0.12 | 0.03 | 4.17** | 0.10 |
| Alcohol use | 0.02 | 0.03 | 0.72 | 0.02 |
| Physical victimization | 0.01 | 0.02 | 0.82 | 0.02 |
| Sexual victimization | −0.02 | 0.03 | −0.81 | 0.02 |
| Psychological victimization | 0.01 | 0.01 | 2.31* | 0.05 |

* $p < .05$.
** $p < .01$.

behavior was also enhanced among adolescent females who used alcohol, which parallels research with young adults that shows the synergistic effect of alcohol and marijuana increasing the risk for sexual behaviors (Metrik et al., 2016). This finding is also concerning due to the increasing legalization of marijuana for both medical and recreational purposes, which will make access to marijuana easier for adolescents (Paschall et al., 2017) and potentially more likely to be used in conjunction with alcohol. Future research is needed to determine whether increasing legalization of marijuana increases sexual behaviors and the mechanisms behind this potential association, such as social norms for using marijuana prior to sex.

For both males and females, marijuana use and psychological dating violence victimization were significant predictors of sexual behaviors over time. The role of marijuana in sexual behaviors is well established (Bryan et al., 2012; Metrik et al., 2016), although less research has elucidated the role of psychological dating violence victimization on this public health problem. Indeed, the mechanisms responsible for this association are not known and warrant investigation in future research. As psychological dating violence victimization is associated with increased negative emotion, such as shame (Shorey et al., 2011), and

negative emotion, including shame, is an established correlate of high-risk sexual behavior (Stuewig et al., 2015), it is possible that negative emotions serve as a mechanism for engagement in sexual behaviors. Psychological victimization may also be linked with fear of one's partner, which may increase sexual behaviors due to coercion from, and fear of, the abusive partner. However, continued research is needed in this area to explicate the mechanisms of this association. Still, our findings are largely consistent with Problem Behavior Theory and syndemic theories, suggesting that risky behaviors tend to co-occur and synergistically interact, as demonstrated by significant additive and interactive findings.

Several implications can be drawn from the current study. Marijuana use seems to be an important facet of substance use to target in mid-adolescence into emerging adulthood to reduce sexual behaviors. Further, our results suggest that it may be especially imperative to target marijuana use in female adolescents, as this was the strongest predictor of their risky sexual behavior from ages 15–19. Thus, multiple outcomes associated with sexual behaviors may be reduced, such as sexually transmitted infections, by reducing marijuana use. With the increasing legalization of marijuana, it is imperative to examine ways to intervene upon problematic marijuana use, including simultaneous or concurrent use with alcohol, to reduce sexual behaviors and related outcomes in adolescents. Second, our findings highlight the importance of including dating violence as an intervention target in programs aimed at reducing sexual behaviors among adolescents. As discussed previously (Shorey et al., 2015), and supported by our findings, interventions for sexual behaviors have the difficult task of targeting multiple high-risk public health behaviors (i.e., substance use, violence), and research is sorely needed on programs that incorporate intervention components targeting each of these behaviors. Third, by demonstrating the stability of several predictors of sexual behaviors across time, findings provide useful information for intervention programs on when certain risk factors should be targeted in development. Finally, it should be noted that individual-level interventions for sexual behaviors, while needed, should occur in concert with structural-level interventions aimed at reducing sexual behaviors, such as easier access to contraception and comprehensive sexual health education initiatives.

Our study had several limitations. The sample of adolescents was drawn from one geographic region of the US and may not be representative of the larger population. For instance, Texas has one of the highest rates of pregnancy among 15–19-year-old teens in the US (Romero, 2016). Thus, future research should employ a nationally representative sample of adolescents. There are other important predictors of adolescent sexual behaviors noted in the literature that were not included in the current study (e.g., parental influences, mental health symptoms) which future research should include. Our measures of substance use lacked granularity (e.g., severity, consequences) which will be important for future research to include. Although our measure of sexual behaviors is consistent with a large body of research, it is not without limitations. The lower cutoff selected to try to capture sexual behaviors that would increase health risk (two or more lifetime partners rather than four or more lifetime partners as with the Youth Risk Behavior Surveillance data) could also include adolescents engaging in serial monogamy. Future investigations should utilize a comprehensive measure of this construct. Heteronormative bias may also impact findings, as contraception to prevent pregnancy is not necessarily relevant for same-sex relationships. This heteronormative bias may therefore underestimate sexual behaviors that increase risk for poor outcomes among individuals in same-sex relationships. Future studies should utilize more inclusive assessment of sexual behaviors and include questions regarding sexual attraction and sexual orientation at each assessment.

## 5. Conclusions

Overall, the current study is the first to investigate independent and interactive effects of dating violence victimization and substance use as predictors of sexual behaviors from mid-adolescence to emerging adulthood. Results demonstrated that marijuana use was a robust predictor of sexual behaviors, especially in females aged 15–19 who also used alcohol. Psychological dating violence victimization predicted sexual behaviors in males and females, and physical victimization predicted sexual behaviors in females. Future studies should continue to examine the mechanisms underlying these relationships as well as comprehensive intervention programs aimed at reducing sexual behaviors that increase risk for poor outcomes.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.105844.

## Declaration of competing interest

The authors have no conflicts of interest to disclose

## Acknowledgments

The current manuscript was supported by grant 2016-R2-CX-0035 from the National Institute of Justice (NIJ) awarded to the first author and from grant K23HD059916 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development and award 2012-WG-BX-0005 from NIJ awarded to the last author. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or NIJ.

## References

Alleyne, B., Coleman-Cowger, V., Crown, L., Gibbons, M.A., Vines, L.N., 2011. The effects of dating violence, substance use and risky sexual behavior among a diverse sample of Illinois youth. J. Adolesc. 34 (1), 11–18. http://doi.org/10.1016/j.adolescence.2010.03.006.

CITATION MASKED.

Arnett, J.J., 2005. The developmental context of substance use in emerging adulthood. J. Drug Issues 35 (2), 235–254.

Barbee, A.P., Cunningham, M.R., van Zyl, M.A., Antle, B.F., Langley, C.N., 2016. Impact of two adolescent pregnancy prevention interventions on risky sexual behavior: a three-arm cluster randomized control trial. Am. J. Public Health 106 (S1), S85–S90.

Bollen, K.A., Curran, P.J., 2006. Latent Curve Models. A Structural Equation Perspective. John Wiley & Sons, Inc, Hoboken, NJ.

Bryan, A.D., Schmiege, S.J., Magnan, R.E., 2012. Marijuana use and risky sexual behavior among high-risk adolescents: trajectories, risk factors, and event-level relationships. Dev. Psychol. 48 (5), 1429–1442. http://doi.org/10.1037/a0027547.

Caruthers, A.S., Van Ryzin, M.J., Dishion, T.J., 2014. Preventing high-risk sexual behavior in early adulthood with family interventions in adolescence: outcomes and developmental processes. Prev. Sci. 15 (1), 59–69.

Centers for Disease Control and Prevention, 2016. Youth Risk Behavior Surveillance — United States, 2015. MMWR, 65 (No. SS-6). U.S. Department of Health and Human Services, Atlanta.

Centers for Disease Control and Prevention (CDC), 2012. Youth Risk Behavior Surveillance—United States, 2011. MMWR, 61 (No. SS-4). U.S. Department of Health and Human Services, Atlanta.

Guo, J., Chung, I., Hill, K.G., Hawkins, J.D., Catalano, R.F., Abbott, R.D., 2002. Developmental relationships between adolescent substance use and risky sexual behavior in young adulthood. J. Adolesc. Health 31 (4), 354–362. http://doi.org/10.1016/S1054-139X(02)00402-0.

Ihongbe, T.O., Cha, S., Masho, S.W., 2017. Age of sexual debut and physical dating violence victimization: sex differences among US high school students. J. Sch. Health 87 (3), 200–208.

Jessor, R., 1991. Risk behavior in adolescence: a psychosocial framework for understanding and action. J. Adolesc. Health 12, 597–605.

Liu, G., Hariri, S., Bradley, H., Gottlieb, S.L., Leichliter, J.S., Markowitz, L.E., 2015. Trends and patterns of sexual behaviors among adolescents and adults aged 14 to 59 years, United States. Sex. Transm. Dis. 42 (1), 20–26.

Mahalik, J.R., Levine Coley, R., McPherran Lombardi, C., Doyle Lynch, A., Markowitz, A.J., Jaffee, S.R., 2013. Changes in health risk behaviors for males and females from early adolescence through early adulthood. Health Psychol. 32 (6), 685–694. https://doi.org/10.1037/a0031658.

Menon, S.V., Cohen, J.R., Shorey, R.C., Temple, J.R., 2018. The impact of intimate partner violence exposure in adolescence and emerging adulthood: a developmental psychopathology approach. J. Clin. Child Adolesc. Psychol. 0 (0), 1–12. https://doi.org/10.1080/15374416.2018.1437736.

Metrik, J., Caswell, A.J., Magill, M., Monti, P.M., Kahler, C.W., 2016. Sexual risk behavior and heavy drinking among weekly marijuana users. J. Stud. Alcohol Drugs 77 (1), 104–112.

Metzler, C.W., Noell, J., Biglan, A., 1992. The validation of a construct of high-risk sexual

behavior in heterosexual adolescents. J. Adolesc. Res. 7 (2), 233–249.
Miech, R.A., Johnston, L.D., O'Malley, P.M., Bachman, J.G., Schulenberg, J.E., Patrick, M.E., 2018. Monitoring the Future National Survey Results on Drug Use, 1975–2017: Volume I, Secondary School Students. Institute for Social Research, The University of Michigan, Ann Arbor.
Paschall, M.J., Grube, J.W., Biglan, A., 2017. Medical marijuana legalization and marijuana use among youth in Oregon. J. Prim. Prev. 38 (3), 329–341.
Pflieger, J.C., Cook, E.C., Niccolai, L.M., Connell, C.M., 2013. Racial/ethnic differences in patterns of sexual risk behavior and rates of sexually transmitted infections among female young adults. Am. J. Public Health 103 (5), 903–909.
Romero, L., 2016. Reduced disparities in birth rates among teens aged 15–19 years—United States, 2006–2007 and 2013–2014. MMWR Morb. Mortal. Wkly Rep. 65, 409–414.
Rosen, A.L., Handley, E.D., Cicchetti, D., Rogosch, F.A., 2018. The impact of patterns of trauma exposure among low income children with and without histories of child maltreatment. Child Abuse Negl. 80, 301–311. https://doi.org/10.1016/j.chiabu.2018.04.005.
Sedgh, G., Finer, L.B., Bankole, A., Eilers, M.A., Singh, S., 2015. Adolescent pregnancy, birth, and abortion rates across countries: levels and recent trends. J. Adolesc. Health 56 (2), 223–230. https://doi.org/10.1016/j.jadohealth.2014.09.007.
Shorey, R.C., Sherman, A.E., Kivisto, A.J., Elkins, S.R., Rhatigan, D.L., Moore, T.M., 2011. Gender differences in depression and anxiety among victims of intimate partner violence: the moderating effect of shame proneness. J. Interpers. Violence 26 (9), 1834–1850.
Shorey, R.C., Fite, P.J., Choi, H., Cohen, J.R., Stuart, G.L., Temple, J.R., 2015. Dating violence and substance use as longitudinal predictors of adolescents' risky sexual behavior. Prev. Sci. 16, 853–861.
Shorey, R.C., Cohen, J.R., Lu, Y., Fite, P.J., Stuart, G.L., Temple, J.R., 2017. Age of onset for physical and sexual teen dating violence perpetration: a longitudinal investigation. Prev. Med. 105, 275–279.
Shorey, R.C., Wymbs, B., Torres, L., Cohen, J.R., Fite, P.J., Temple, J.R., 2018. Does change in perceptions of peer teen dating violence predict change in teen dating violence perpetration over time? Aggress. Behav. 44 (2), 156–164.
Singer, M., 2009. Introduction to Syndemics: A Systems Approach to Public and Community Health. Jossey-Bass, San Francisco, CA.
Singer, J.D., Willett, J.B., Willett, J.B., 2003. Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence. Oxford University Press.
Stuewig, J., Tangney, J.P., Kendall, S., Folk, J.B., Meyer, C.R., Dearing, R.L., 2015. Children's proneness to shame and guilt predict risky and illegal behaviors in young adulthood. Child Psychiatry Hum. Dev. 46 (2), 217–227.
Temple, J.R., Freeman Jr., D.H., 2011. Dating violence and substance use among ethnically diverse adolescents. J. Interpers. Violence 26 (4), 701–718. http://doi.org/10.1177/0886260510365858.
Vasilenko, S.A., Kugler, K.C., Butera, N.M., Lanza, S.T., 2015. Patterns of adolescent sexual behavior predicting young adult sexually transmitted infections: a latent class analysis approach. Arch. Sex. Behav. 44 (3), 705–715.
Wolfe, D.A., Scott, K., Reitzel-Jaffe, D., Wekerle, C., Grasley, C., Straatman, A.L., 2001. Development and validation of the conflict in adolescent dating relationships inventory. Psychol. Assess. 13 (2), 277–293.
Wymbs, B.T., Walther, C.A., Cheong, J., Belendiuk, K.A., Pedersen, S.L., Gnagy, E.M., Molina, B.S., 2017. Childhood ADHD potentiates the association between problematic drinking and intimate partner violence. J. Atten. Disord. 21, 997–1008. https://doi. org/10.1177/1087054714557358.