Predictors of Latent Trajectory Classes of Dating Violence Victimization

Ashley Brooks-Russell, PhD[1], **Vangie Foshee, PhD**[2], and **Susan Ennett, PhD**[2]

[1]Prevention Research Branch, Division of Epidemiology, Statistics and Prevention Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development

[2]Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina at Chapel Hill

Abstract

This study identified classes of developmental trajectories of physical dating violence victimization from grades 8 to 12 and examined theoretically-based risk factors that distinguished among trajectory classes. Data were from a multi-wave longitudinal study spanning 8th through 12th grade ($n = 2,566$; 51.9% female). Growth mixture models were used to identify trajectory classes of physical dating violence victimization separately for girls and boys. Logistic and multinomial logistic regressions were used to identify situational and target vulnerability factors associated with the trajectory classes. For girls, three trajectory classes were identified: a low/non-involved class; a moderate class where victimization increased slightly until the 10th grade and then decreased through the 12th grade; and a high class where victimization started at a higher level in the 8th grade, increased substantially until the 10th grade, and then decreased until the 12th grade. For males, two classes were identified: a low/non-involved class, and a victimized class where victimization increased slightly until the 9th grade, decreased until the 11th grade, and then increased again through the 12th grade. In bivariate analyses, almost all of the situational and target vulnerability risk factors distinguished the victimization classes from the non-involved classes. However, when all risk factors and control variables were in the model, alcohol use (a situational vulnerability) was the only factor that distinguished membership in the moderate trajectory class from the non-involved class for girls; anxiety and being victimized by peers (target vulnerability factors) were the factors that distinguished the high from the non-involved classes for the girls; and victimization by peers was the only factor distinguishing the victimized from the non-involved class for boys. These findings contribute to our understanding of the heterogeneity in physical dating violence victimization during adolescence and the malleable risk factors associated with each trajectory class for boys and girls.

Keywords

adolescent dating violence; physical victimization; trajectories; growth mixture model

Address correspondence to: Ashley Brooks-Russell, Prevention Research Branch, Division of Epidemiology, Statistics, and Prevention Research, Eunice Kennedy Shriver National Institute of Child Health and Human Development, 6100 Executive Blvd Room 7B13C, Bethesda, MD 20892-7510, Phone: 301-435-6932, Fax: 301-402-2084, Ashley.russell@nih.gov.

Introduction

Almost one-tenth of teens are physically victimized by dating partners each year, with national prevalence estimates at 9.5% for boys and 9.3% for girls (Centers for Disease Control and Prevention, 2011). These teens experience physical force used by dating partners with the intent or perceived intent to cause harm or injury such as slapping, kicking, hitting, punching, shoving, beating up, or attacking with a weapon (Straus & Gelles, 1986). The serious consequences of physical dating violence victimization include injury (O'Leary, Slep, Avery-Leaf, & Cascardi, 2008), depression, substance use, suicidal behaviors (Ackard, Eisenberg, & Neumark-Sztainer, 2007; Ackard, Neumark-Sztainer, & Hannan, 2003; Coker et al., 2000; Magdol, Moffitt, Caspi, & Silva, 1998; O'Donnell et al., 2006; Raiford, Wingood, & Diclemente, 2007; Roberts, Klein, & Fisher, 2003) and increased risk of later physical dating violence victimization (Smith, White, & Holland, 2003). Even so, surprisingly little research has been conducted on adolescent dating violence victimization; the preponderance of adolescent dating violence research has been on dating violence perpetration (Foshee & Reyes, 2012a).

The studies that have been conducted on dating violence victimization primarily have used cross-sectional or two-wave longitudinal study designs, limiting the ability to understand how dating violence victimization develops across adolescence and to study factors that influence the development of dating violence victimization (for reviews, see Capaldi, Knoble, Shortt, & Kim, 2012; Foshee et al., 2012a). Even when multiple waves of data are used, examination of the development of dating violence victimization over time has been limited by the use of statistical approaches that determine the *average* pattern of development over time (Fritz & Slep, 2009; Wolfe et al., 2003), which may obscure important heterogeneity of victimization experiences among teens, and limit opportunities for discovering factors that might put only some subgroups of teens at risk.

The purposes of this study are to use data from a multi-wave longitudinal study to determine whether there are multiple developmental patterns of physical dating violence victimization from grades 8 to 12, if the developmental patterns of dating violence victimization are different for boys and girls, and whether theoretically-based risk factors distinguish developmental patterns of physical dating violence victimization. More specifically, growth mixture modeling is used to determine if there are discrete classes or subgroups of adolescents who share a common pattern of physical dating violence victimization across adolescence and logistic and multinomial logistic regression are used to test if theoretically-based risk factors conceptualized as situational and target vulnerabilities distinguish the subgroups. Understanding the pattern of physical dating violence victimization over time can inform the optimal time to implement prevention and/or intervention activities. Additionally, identifying risk factors can help distinguish the subgroups most at risk and can be useful in determining factors to target for prevention.

Growth Mixture Models as a Type of Latent Growth Curve Model

Latent growth curve modeling is a widely used statistical method for modeling individual differences in the progression of a behavior over time (Bollen & Curran, 2006). Latent growth curves estimate a starting point (intercept) and rate of change over time (slope) term

for each individual, creating an equation for an individual trajectory. The intercepts and slope parameters are pooled across individuals to estimate an average intercept and slope for the entire sample. Latent growth curve models provide a parsimonious description of the overall pattern of change within a sample. However, there is often variability around the average trajectory. An extension of the latent growth curve model is the growth mixture model. In this model, the heterogeneity, or variability in a trajectory, is expressed as discrete classes or subgroups of individuals who share a common pattern (Muthén & Shedden, 1999).

One prior study sought to characterize the heterogeneity in the pattern of change of psychological dating violence victimization. Orpinas and colleagues (2012) surveyed 550 students annually from sixth through 12th grade and measured psychological dating violence victimization. They used a latent class growth model, a restricted form of a growth mixture model, which allowed different subgroups of students to have distinct trajectories of psychological dating violence victimization over time. With boys and girls combined, three classes were identified: a class with low levels of psychological victimization over time, a class of increasing victimization over time, and a class in which there were consistently high levels of psychological victimization over time. Physical dating violence victimization was not measured, but considering the concurrent and longitudinal links between psychological and physical dating violence (O'Leary & Slep, 2003), the development of physical dating violence victimization is likely similar to that of psychological dating violence victimization.

In this study, we use growth mixture models to identify classes of physical dating violence victimization. This approach can identify latent trajectory classes and estimate variance around a trajectory class to allow individual variation within the trajectory classes. We hypothesize that there will be three classes of physical dating violence victimization: a low victimization class, an increasing victimization class, and a chronic/high victimization class.

Gender Differences

Numerous studies have found that both boys and girls are victimized by dating partners. However, very few studies have assessed gender differences in changes in victimization over time. The few studies that have assessed changes in physical dating violence victimization over time have been inconsistent in determining if developmental patterns differ for boys and girls. Wolfe and colleagues (2003) and Fritz and Slep (2009) used growth curve modeling to determine the average trajectory of dating violence victimization and then examined gender as a covariate of the trajectory. Wolfe and colleagues (2003) examined physical dating violence victimization of 14 to16 year old students over a two-year period in an intervention study of teenagers with a history of child maltreatment. Among the students in the control condition, girls reported less physical dating violence victimization from ages 14 to 16 whereas boys reported an increase in physical dating violence victimization during that time. Fritz and Slep (2009) did not find gender differences in physical dating violence victimization in a sample of 10th and 11th grade students surveyed three times over a year (baseline, 14 weeks later and 52 weeks later). Gender did not significantly affect the intercept or slope of physical dating violence victimization. Thus,

for both boys and girls there was stability (no increase or decrease) in physical dating violence victimization over the study period.

Orpinas and colleagues (2012) combined girls and boys when they conducted their analysis to extract latent trajectory classes of psychological dating violence victimization. However, once the classes were identified they found that boys and girls were in all three of the classes identified but that there were gender differences in the likelihood of class membership. Girls were less likely than boys to be in the low victimization class, more likely than boys to fall into the increasing victimization class, and girls and boys were equally likely to fall into the high victimization class.

No study has determined if there are different developmental patterns of dating violence victimization for boys and girls. In the current study, we conduct the growth mixture model analyses separately for boys and girls. Given that Orpinas and colleagues (2012) found boys and girls in all three classes, we hypothesize that there will be the three classes of victimization for both boys and girls. However, we expected the likelihood of class membership in each of the classes may vary for boys and girls with a larger "increasing victimization class" for girls than the "increasing victimization class" among boys. Since this is the first study to examine gender differences in classes of dating violence victimization over time, even lack of support for this hypothesis, as evidenced by findings different classes for boys and girls, will provide a greater understanding of adolescent dating violence victimization.

Theoretical Base

In this study, we determine if substance use (alcohol and marijuana), level of parental monitoring, emotional distress (depression, anxiety, and body image), being victimized by peers, and family conflict distinguish the hypothesized trajectory classes. Three theoretical frameworks guided the selection of these predictors: lifestyle theory, routine activities theory, and social learning theory. Lifestyle theory originally was developed to explain risk for criminal victimization (Hindelang, Gottfredson, & Garofalo, 1978). The theory focuses on a victim's social activities that put the individual in situations of higher risk for victimization and increase exposure to possible offenders. One such lifestyle risk is substance use. Substance use increases situational risk for victimization because alcohol or marijuana use occurs in environments with low supervision, given the illegality for teens of both substances (DiClemente et al., 2001; Steinberg, Fletcher, & Darling, 1994). Moreover, teens under the influence of alcohol or marijuana have impaired judgment and thus may not be as adept at avoiding or resolving conflict. Empirical research supports this association; substance use has been found to predict dating violence victimization among girls (Magdol et al., 1998; O'Donnell et al., 2006; Raiford et al., 2007), and among boys, alcohol use was found to predict chronic physical dating violence victimization (Foshee, Benefield, Ennett, Bauman, & Suchindran, 2004). Furthermore, a recent meta-analysis found that alcohol use was associated with dating violence perpetration (Rothman, Reyes, Johnson, & LaValley, 2012). Teens who drink alcohol are likely to sometimes drink in the company of a dating partner, which may increase the risk of dating violence perpetration.

Routine activities theory also originated in the criminology field and it focuses on explicating factors that increase the likelihood of committing a crime (Cohen & Felson, 1979). The theory proposes that crime occurs when there is a lack of guardians, a presence of offenders, and an availability of targets. As applied to teen dating violence victimization, lack of parental guardianship, or low parental monitoring, may increase the likelihood that a teen could be victimized by a date. Through monitoring, parents help their teens avoid risky situations and exposure to abusive dating partners. Teens who spend a great deal of unsupervised time with dating partners may be more vulnerable to victimization. Previous research supports this association between parental monitoring and lower risk of physical dating violence victimization (Howard, Qiu, & Boekeloo, 2003).

In adapting the routine activities theory to explain increased vulnerability to victimization, Finkelhor and Asdigian (1996) re-conceptualized the concept of "availability of targets" to "target vulnerability." Target vulnerability refers to characteristics that put individuals at higher risk for victimization because of their lower ability to deter victimization, or their appearance as easy targets (Cohen et al., 1979; Finkelhor & Asdigian, 1996). Teens who are depressed, anxious, or have poor body image may have a diminished ability to deter victimization because their general lack of self-worth may increase their tolerance for being victimized (Vicary, Klingaman, & Harkness, 1995), making them an easy target for victimization. Depression, anxiety and poor body image have each have been linked to dating violence victimization (Chase, Treboux, & O'Leary, 2002; Foshee et al., 2004; Howard & Wang, 2003b; Howard & Wang, 2003a; Howard, Wang, & Yan, 2008; Lehrer, Buka, Gortmaker, & Shrier, 2006). Foshee and colleagues (2004) found that low self-worth predicted chronic dating violence victimization for boys and depression predicted chronic sexual dating violence victimization for girls.

Being victimized by peers also may increase a teen's vulnerability to being victimized by dates because they may be viewed by dates as easy targets. Teens who have been victimized by peers may be habituated to such treatment and be less likely to leave violent relationships. Although strong associations have been found between the perpetration of violence against peers and perpetration of violence against dates (Ellis, Crooks, & Wolfe, 2009; Foshee et al., 2011; Ozer, Tschann, Pasch, & Flores, 2004; Swahn, Bossarte, & Sullivent, 2008), and the perpetration of violence against peers has been found to predict later dating violence victimization (Foshee et al., 2004; O'Donnell et al., 2006), little is known about the relationship between being victimized by peers and being victimized by dates.

Finally, families can socialize teens to be more tolerant and accepting of aggressive behaviors, in turn increasing the likelihood of dating violence victimization. Bandura's (1977) social learning theory is often used to explain how exposure to conflict in the home can increase the risk of later victimization. Increased exposure to family conflict would convey the acceptability of aggressive behaviors to the teen. In a prior study, family conflict at age seven to nine was associated with increased risk of physical dating violence victimization for males at age 21 and family conflict at age 15 was associated with increased risk of physical dating violence victimization for females at age 21 (Magdol et al., 1998). Foshee and colleagues (2004) found that having been hit by an adult with the intention of

harm predicted chronic physical dating violence victimization from severe forms of physical dating violence victimization for both boys and girls. In summary, prior empirical evidence suggests that family conflict may increase an individual's vulnerability to dating violence victimization.

Current Study

The current study seeks to extend previous research on physical dating violence victimization by determining if there are discrete classes of adolescents who share a common pattern of physical dating violence victimization across adolescence and if situational and target vulnerabilities distinguish the classes. We hypothesize that there will be three classes of physical dating violence victimization: a low victimization class, an increasing victimization class, and a chronic/high victimization class. We expect these classes to exist for boys and girls but the likelihood of class membership in each of the classes may vary for boys and girls.

In the current study, substance use and low parental monitoring are conceptualized as "situational vulnerabilities" because they create situations where dating violence is more likely, and emotional distress (depression, anxiety, and body image), victimization by peers, and family conflict are categorized as "target vulnerabilities" because they are characteristics that lower a teen's ability to deter victimization or increase their appearance as an easy target. We hypothesize that the situational vulnerabilities will distinguish the increasing victimization class from the low victimization class and we expect this to be the case for both boys and girls (see Figure 1). The target vulnerabilities include risk factors that are more chronic in nature, and as such, they may be related to victimization throughout adolescence. Also, each of the target vulnerability variables has been associated with victimization of both boys and girls (Foshee et al., 2012a). Thus, we hypothesize that for boys and girls, the target vulnerabilities will distinguish the chronic/high victimization class from the low victimization class (Figure 1).

Analyses examining whether the risk factors are associated with the victimization classes will control for race/ethnicity, socioeconomic status, and family structure. Although findings are mixed, several studies have found that these three sociodemographic characteristics have been associated with physical dating violence victimization. African Americans and Latinos generally report higher rates physical dating violence victimization compared to white teens (Centers for Disease Control and Prevention, 2011), although some studies have found no association (O'Leary et al., 2008; Silverman, Raj, Mucci, & Hathaway, 2001). Socioeconomic status has been both related positively (Malik, Sorenson, & Aneshensel, 1997a), related negatively (Halpern, Oslak, Young, Martin, & Kupper, 2001; Spriggs, Halpern, Herring, & Schoenbach, 2009), or un-related (Malik, Sorenson, & Aneshensel, 1997b; Spriggs et al., 2009) to dating violence victimization. And, living in a single-parent home has consistently been seen as a risk factor for dating violence victimization (Foshee et al., 2004; Halpern et al., 2001; Magdol et al., 1998).

Understanding how patterns of physical dating violence victimization differ or are the same for boys and girls and for different subgroups during adolescence can inform the optimal

time to implement intervention activities for each group. Additionally, this study will examine theoretically-based risk factors which can be useful in distinguishing the subgroups most at risk and for determining factors to target for prevention.

Method

Design

The data come from a longitudinal study, spanning middle and high school conducted in public school systems located in two predominately rural counties (Ennett et al., 2006). Questionnaires covered a range of health risk behaviors including dating violence. At wave one, three cohorts of students were surveyed in the fall of 2003 when students were in grades eight, nine and ten. Questionnaires were completed every six months for three waves and then one year later for an additional wave. During the fourth and final wave of data collection in the fall of 2005, students were in 10th, 11th, and 12th grades. Thus, due to the cohort sequential study design there were four waves of data spanning 8th through 12th grade.

All students enrolled in the grade cohorts of interest were eligible to participate in the study, except for students in special education classes or those unable to complete the questionnaire in English. The data were collected using self-administered questionnaires. Each classroom had at least one trained research staff member to serve as a data collector. Students were allowed approximately one hour to complete the questionnaire. There was no monetary incentive for students to participate. The study and data collection procedures were approved by the Institutional Review Board of the University of North Carolina at Chapel Hill, School of Public Health.

A total of 2,636 students completed data at wave one, when students were in 8th (n = 889), 9th (n = 894), and 10th grade (n = 783). The proportion of adolescents who completed a survey out of those eligible was 79% (6% of parents refused consent, 6% of adolescents declined to participate and 8% were absent on the days when data collection occurred). The analysis sample was limited to students who participated at the first wave and those who were not missing gender or all of the dating violence measures at all four waves (n = 70) for a final analysis sample of 2,566 (97.3%). Most of the students (93%) participated at two or more of the possible four waves of data collection and 53% participated at all four waves. We used multivariate logistic regression to compare those students who participated in all four waves (53%) to those who participated in fewer than four waves on wave one gender, race, age, parent education (as a proxy for SES; Goodman, 1999), family structure and physical dating violence victimization. All demographic factors were significantly associated with the completion of fewer than four waves compared to all four waves. However, dating violence victimization was not associated with the completion of fewer than four waves compared to all four waves. This suggests that missing data was not related to the baseline levels of physical dating violence victimization after adjusting for the effects of demographic covariates.

At the first wave, approximately half of the respondents were girls (51.9%), the race/ ethnicity distribution was 44.3% White and 55.7% African American or other race, 12%

reporting living with one parent, and 59% reported at least one of their parents had pursued some education beyond completing high school. The average age at wave one (8th to 10th grade) was 14.6 years old. None of the demographics characteristics (gender, race, family structure, and parental education) significantly differed by grade level.

Measures

Physical dating violence victimization—Physical dating violence victimization was measured by asking the adolescents to complete the modified Safe Dates victimization and perpetration scales (Dahlberg, Toal, Swahn, & Behrens, 2005; Foshee, 1996). Students were asked, "During the past three months, how many times has anyone you were dating or on a date with done the following things to you? Don't count it if they did it to you in self-defense or in play." A date was defined as an "informal activity like meeting someone at the mall, a park, or at a basketball game as well as more formal activities like going out to eat or to a movie together." The following six items were used to assess physical dating violence victimization: "slapped or scratched you," "physically twisted your arm or bent back your fingers," "pushed, grabbed, shoved, or kicked you," "hit you with their fist or with something else hard," "beat you up," and "assaulted you with a knife or gun." The response options for all items were on a five point scale ranging from (0) "none" to (4) "10 times or more." The scale (α = .92 at wave one) was calculated as the sum of the items with higher values indicating more physical dating violence victimization. Due to non-normality, the scale was log transformed after the addition of a constant.

Alcohol use—Alcohol use was measured with the item, "How much alcohol have you ever had in your life?" with response options ranging from (0) "none at all" to (6) "more than 20 whole drinks.

Marijuana use—Marijuana use was assessed with one item, "Have you ever used marijuana in your life?" with response options "yes" or "no."

Low parental monitoring—Low parental monitoring was measured with a three item scale assessing the mother's behavior (Jackson, Henriksen, & Foshee, 1998). The response options ranged from (0) "just like her" to (3) "not like her." Responses to the following three items were averaged: "She tells me times when I must come home," "She has rules I must follow," and "She makes sure I don't stay up too late" (α = .82).

Anxiety—Anxiety was assessed by the average of seven items (e.g., "I was worried when I went to bed at night" and "I felt sick to my stomach"; Reynolds & Richmond, 1979) with responses ranging from (0) "strongly disagree" to (4) "strongly agree" (α = .88).

Depression—Depression was measured with the average of three items of how often in the past three months the participant agreed with the following statements: "I hated myself," "I was a bad person," and "I did everything wrong" (Angold, Costello, Messer, & Pickles, 1995). Responses ranged from (0) "strongly disagree" to (4) "strongly agree" (α = .92).

Body image—Body image was measured by the average agreement with three statements, "Most of the time I am happy with how I look," "I am proud of my body," and "I am strong

and healthy" (Petersen, Schulenberg, Abramowitz, Offer, & Jarcho, 1994). Responses ranged from (0) "strongly agree" to (3) "strongly disagree" (α = .88).

Victimization by peers—Victimization by peers was determined by the sum of five items in response to the question, "During the past 3 months, how many times has anyone about the same age as you that you were NOT dating, done the following things to you?" Example items included, "pushed, grabbed, shoved, or kicked you" and "beat you up." Responses ranged from (0) "none" to (4) "10 times or more" (α = .87).

Family conflict—Family conflict was measured by the average agreement to three statements: "We fight a lot in our family," "Family members sometimes get so angry they throw things," and "Family members sometimes hit each other" (Bloom, 1985). Responses ranged from (0) "strongly disagree" to (3) "strongly agree" (α = .87).

Demographic factors—The demographic factors were gender, race/ethnicity, family structure, and socioeconomic status. Gender was coded as boy (1) or girl (0). Race was coded with White as the reference group (0) and minority (1; Black/African-American, Latino, and other). Family structure was a dichotomous variable reflecting if the adolescent reported living in a two-parent household which could include a stepmother or stepfather (0) versus living with one parent (1). Socioeconomic status was based on the student's report of the highest level of education achieved by either parent on a six point scale that ranged from "did not graduate from high school" (0), to "graduate or professional school" (5). All demographic and risk factors were assessed at wave one.

Analysis Strategy

Although there was not a large amount of missing data, multiple imputation procedures were used with the independent variables (Rubin, 1987). All independent variables were included in the imputation model and were centered to reduce multi-collinearity. Five sets of imputations were used and variables had relative efficiencies larger than .97 indicating stable parameter estimates. The software SAS version 9.3 (SAS Institute, 2010) was used for multiple imputation in all bivariate and multivariate analyses.

Growth mixture modeling was used to identify classes of trajectories of physical dating violence victimization. All latent growth curve models were estimated with Mplus version 6.12 (Muthén & Muthén, 2011) using the robust maximum likelihood (MLR) estimator, which is robust to non-normality in the data. To create a trajectory of physical dating violence victimization, the measure was reorganized by grade instead of wave resulting in eight time points from the fall of 8th grade through the fall of 12th grade. Using procedures described by Miyazaki and Raudenbush (2000), we tested for cohort differences and found statistical evidence for combining the growth curves of the three cohorts into one common growth curve ranging from grade 8 through 12. The intercept was set at the first time point, the fall of eighth grade. The factor loadings for the linear slope factor were spaced such that a one unit increase would represent one year in time. The final wave of assessment occurred one year after the previous wave; therefore, the final two factors loadings were one unit apart.

Our expectations were to find a three class model but we tested successive models with one to four classes to determine the best fit for each gender. As each class was added to the model we examined slope parameters, residuals, and plots to ensure that the shape of the trajectory was appropriate for each class. We relied on the comparison of several indices to evaluate the optimal number of trajectory classes. These indices included the Bayes Information Criterion (BIC; Schwarz, 1978), sample-size adjusted BIC (aBIC; Sclove, 1987), and the Akaike Information Criterion (AIC; Akaike, 1987). For all three of criteria, smaller values suggest a better fitting model. We also considered entropy and average classification probabilities. Entropy and average classification probabilities range from zero to one and values close to one indicate distinguishable classes. Third, we present results of the Vuong-Lo-Mendell-Rubin test (VLMR-LRT; Lo, Mendell, & Rubin, 2001), which compares a particular model to a model with one fewer classes (a more parsimonious model). A significant p value indicates that the estimated model provides a better fit to the data than the more parsimonious model with fewer classes. Finally, we examined plots of each class to identify areas of misfit and the most appropriate shape (functional form) as well as the interpretability of classes. Linear and non-linear models were considered.

To ease the computational burden of estimating classes of trajectories, we started by fixing the variances and covariances of latent factors to zero. This approach is commonly called a "latent class growth model" (Muthén & Muthén, 2000; Nagin, 1999) and is a restricted case of a growth mixture model. Growth mixture models allow estimation of variances and covariances of latent factors. In latent class growth models, the variances and covariances are fixed to zero which reduces computation burden. After arriving at a final model, we freed variance and covariance parameters to test if allowing individual variation around intercept and slope factors of each trajectory class would provide additional information. In each instance, the variance and covariance parameters were not significant indicating there was not significant individual variability beyond that captured in the multiple classes; thus, we proceeded with the more restricted case of the growth mixture model: the latent class growth model.

After determining the optimal number of trajectory classes, each participant was assigned to a class based on the posterior class membership probability. This membership status was then used as an outcome in logistic and multinomial logistic regression analyses with demographic, and situational and target vulnerability factors as predictors. The models were run with and without imputed values for the predictor variables to assess the stability of imputed estimates. Parameters were very similar with and without imputed values and only one parameter changed from non-significant to significant after imputation. The parameters presented are those estimated using imputation for the independent variables.

Results

Prevalence of Physical Dating Violence Victimization

Table 1 presents the prevalence of any physical dating violence victimization by gender at each of the grade levels included in the study. Due to the cohort sequential study design described above, the study sample varies at each time point. Note that these prevalences do not necessarily match trajectories because they are an average over all respondents and

reflect the prevalence at each grade and not the change in an individual's victimization over time.

Extraction of Classes

We tested several successive models, with one to four classes. We started with a one class model to determine the average shape of the trajectory and as each class was added we checked that the shape of the trajectory was appropriate. Table 2 presents fit indices for a selection of the successive models. Girls and boys were modeled separately and the process of determining the optimal model is described separately.

Girls—For girls, the one class trajectory model had a quadratic form, with an increasing and then decreasing rate of physical dating violence victimization. The two class model significantly improved fit according to the VLMR-LRT ($p = .02$). The two class model had a class with a low level of physical dating violence victimization throughout the time period and a class that increased and then decreased over the study time period. The three class model continued to show large improvements in fit indices (i.e., LL, BIC, aBIC, AIC). Entropy for this model was high (.959) suggesting that the classes were distinguishable from each other. Reinforcing the entropy value, the three class model had high average class membership probabilities indicating that the vast majority of individuals were clearly classified into a trajectory class. The average class membership probabilities for the three class model (.954 to .989) were better than the two class model (.842 to .937). Additionally, the three class model provided a marginally significant improvement over the two class model (VLMR-LRT: $p = .06$). In the three class model one of the classes was characterized by a low level of physical dating violence victimization that only slightly increased over the study. The second class had levels of victimization that started low, increased to a moderate level throughout the study, and then decreased to low levels at the end of the study. The third class had higher levels of physical victimization that increased to a high level by the middle of the study and then decreased to lower levels by the end of the study. Adding a fourth class did not improve model fit or interpretability. Therefore, as expected, the three class model was chosen as the final model for girls, though the shape of the three classes was different than hypothesized.

A plot of observed and estimated trajectories is shown in Figure 2. The class with a low level of physical dating violence victimization (labeled "non-involved") represented 88.9% of the sample. The second class was labeled "moderate victimization" because the low levels of victimization increased to moderately high by the middle of the study time period before decreasing again at the end. The moderate victimization class represented 7.8% of the sample. The third class (3.4% of the sample) was labeled the "high victimization" class because the level of physical dating violence started higher and increased to a high level before decreasing again. All three classes had significant linear and quadratic slope parameters. Thus, the pattern of victimization across adolescence was the same for all victimized girls in that victimization increased and then decreased; the classes were distinguished by how much victimization occurred at each time point.

Boys—For boys, the overall (one class) trajectory had a stable rate of physical victimization (non-significant slope) over time. The addition of a quadratic slope factor was not significant. In the two class model, one class had a low level of physical victimization throughout the grades and the second class had moderate level of victimization that increased then deceased over time, but not to a low level. The observed values of the victimization class did not fit well with either a linear or quadratic curve. A cubic model was considered and this curve matched the observed values that increased and then decreased over the first five time point and then increased again over the last two time points. Allowing the involved class to take a cubic form provided a slightly better fit than the two class quadratic model according to the LL, AIC, BIC and aBIC and a substantially better fit according to plots of estimated and observed trajectories. Other models (three class quadratic or cubic, four class linear, quadratic, or cubic) did not significantly improve fit and added substantial complexity without adding meaningful classes. Therefore, the two class model was selected as the final model for boys. One class showed a low level of physical dating violence victimization throughout adolescence (labeled "non-involved") and the other class started moderately high, increased during the 8th and 9th grade, decreased until the 11th grade when it began to increase again (labeled the "victimized class"). The non-involved class represented 94.3% of the sample and the victimized class was 5.7% of the sample. A plot of observed and estimated trajectories is shown in Figure 2. More girls were represented in the two victimization classes (11.2%) than the percent of boys represented in the victimized class (5.7%).

Situational and Target Vulnerability Factors

Table 3 presents bivariate relationships between situational and target vulnerability factors and the trajectory classes of physical dating violence victimization, controlling for demographic factors.[1] Table 4 presents the relationships between the predictors and trajectory classes, including all predictors in one model. The odds ratios are a comparison of the victimized class(es) to the non-involved class, which is the reference group. Results for girls and boys are presented separately.

Girls—For girls, substance use (alcohol, marijuana), low parental monitoring, depression, anxiety, victimization by peers, and family conflict were associated with increased odds of being in the moderate as compared to the non-involved class (Table 3). These same variables, with the exception of low parental monitoring, also were associated with increased odds of being in the high as compared to non-involved classes. All of the relationships distinguishing the high as compared to the non-involved class were stronger than the associations distinguishing the moderate from the non-involved class. When all risk factors were included in a single multivariate model, alcohol use was predictive of membership in the moderate victimization class whereas anxiety and victimization by peers were predictive of the high victimization class (Table 4).

---

[1]Of those reporting African American or other race ($n = 1,461$), 85.4% ($n = 1,248$) were African American and 14.6% ($n = 213$) were Latino or another race/ethnicity. We ran analyses excluding all but White and African American teens and the exclusion of those teens did not alter the shape or number of trajectory classes and, with one exception, did not change the significance level of the predictors in either the bivariate or multivariate analysis (Tables 3 and 4). The exception was that in the bivariate analysis, depression was borderline associated with the moderate victimization trajectory class for girls ($p = .08$) when limiting the sample to only African American and White adolescents, whereas before the significance level was $p < .05$.

Boys—For boys, all of the risk factors were significantly associated with increased likelihood of membership in the victimization class as compared to the non-involved class (Table 3). When all factors were included in the same model, only victimization by peers was significantly associated with membership in the victimized class as compared to the non-involved class (Table 4).

Discussion

Previous studies on teen dating violence victimization have been limited in the ability to examine how dating violence victimization develops across adolescence or the factors that influence the development over time (for reviews, see Capaldi et al., 2012; Foshee et al., 2012a). Understanding how the pattern of physical dating violence victimization during adolescence differs or is the same for boys and girls, and for different subgroups, is critical for determining the optimal time to implement intervention activities for each group. Furthermore, examining risk factors is useful for distinguishing subgroups most at risk and for identifying malleable risk factors. The current study extends previous research by using growth mixture modeling to examine gender differences in trajectory classes of dating violence victimization and the risk factors associated with each trajectory class. The results suggest that girls and boys have different developmental patterns of dating violence victimization, both in terms of the number of classes and the shape of the trajectories. The results also suggest that alcohol use and anxiety for girls, and victimization by peers for both boys and girls, may contribute to vulnerability to physical dating violence victimization throughout adolescence. These findings indicate there may be a greater role for interventions that target high risk subgroups or use different approaches for girls and boys to increase effectiveness and efficiency of intervention resources.

Trajectory Classes

We hypothesized that there would be three classes of physical dating violence victimization: a low victimization class, an increasing victimization class, and a chronic/high victimization class, based on the work by Orpinas and colleagues (2012), and we hypothesized that these three patterns would be the same for boys and girls. Three trajectory classes of victimization were identified for girls, a low/non-involved class, moderate class, and high class that increased and then decreased over the study. Although two victimization patterns were identified for girls, the pattern of development was the same for both, with victimization increasing from grades 8th through 10th and then decreasing through 12th grade. The difference in the two victimization classes for girls was in the amount of victimization that was experienced at each grade with the amount being higher at each grade for girls in the high victimization class.

Perhaps the difference in shape of trajectories between this study and that of Orpinas and colleagues (2012) could be due to the different victimization outcomes (psychological versus physical victimization). The linear increasing class of psychological victimization found by Orpinas and colleagues (2012) is similar to the shape of psychological perpetration found by Foshee and colleagues (2009a). However, the physical dating violence victimization pattern for girls found in the current study mirrors the results of trajectories of

physical dating violence perpetration. Foshee and colleagues (2009a) found that, for both boys and girls, moderate physical, severe physical and sexual dating violence perpetration increased to a peak around 16 to 17 years old and then decreased. In another longitudinal study of dating violence perpetration, Reyes and colleagues (2011) found that physical dating violence perpetration increased from 8th to 10th grade and then decreased through 12th grade. Nocentini and colleagues (2010) examined change in physical dating aggression among a sample of 181 Italian adolescents with a current or past dating relationship and found a significant decrease from age 16 to 18. These studies present a consistent pattern of average physical dating violence perpetration increasing in early adolescence and beginning to decrease after around 16 or 17 years old. This suggests that there may be more similarity in the development of physical *victimization* and *perpetration* than there is between *physical* and *psychological* victimization.

The current study found two trajectory classes for boys, not three as expected. One trajectory class was characterized by low levels of victimization across all grades. The victimized class for boys took on a complex shape, increasing through 8th grade, decreasing through 11th grade and then increasing again. Orpinas and colleagues (2012) did not separate boys and girls for analysis and therefore it was not possible for there to be gender differences in trajectory shape or classes. The current results suggest distinct variability in dating violence victimization experience of boys. If the data for girls and boys had been pooled together, it is likely that the complex shape would have been masked. In fact, in the one class solution for boys, we found that there was no significant linear or quadratic change over time. Only after allowing non-involved teens and victimized teens to have distinct trajectories was there significant change in victimization over time. The unexpected shape of the victimized trajectory class for boys indicates that more research is needed to understand the dating violence victimization experience for adolescent boys and these findings need to be replicated in other studies.

Situational and Target Vulnerabilities

Based on lifestyle, routine activities, and social learning theories, situational and target vulnerability risk factors, were hypothesized to distinguish membership in trajectory classes for both boys and girls. The situational vulnerabilities (substance use and low parental monitoring) were hypothesized to be associated with a pattern of dating violence that increased linearly over time whereas the target vulnerabilities (depression, anxiety, body image, victimization by peers, and family conflict) were hypothesized to be associated with a pattern of chronic/high victimization throughout adolescence. Consistent with our expectations, when all risk factors and control variables were included in the model, we found that a situational variable (alcohol use) related to a less severe pattern of victimization than the high victimization class for girls whereas target vulnerabilities (anxiety for girls and victimization by peers for both girls and boys) were related to the high victimization class for girls and the victimized class for boys. Although the high victimization class had a different shape then hypothesized (increasing and then decreasing instead of chronically high), the target vulnerability predictors distinguished the class of girls with the high level of victimization from those who were not involved.

In bivariate analysis, almost all of the situational and target vulnerability risk factors distinguished the victimization classes from the non-involved classes; the exceptions were that body image did not distinguish either victimization class from the non-involved class for girls and parental monitoring did not distinguish the high class from the non-involved class for girls. That many of the predictive factors decreased to non-significance when included together indicate the overlap and interrelatedness of the factors. Alcohol use for girls emerged as a marker of increased risk for moderate victimization. Victimization by peers was a predictor of dating violence victimization for boys and girls and predicted the high victimization class for girls. Given the little research on the continuity and co-occurrence of victimization across multiple contexts, victimization by peers is a topic that warrants further exploration and may be a means of preventing dating abuse in later adolescence. Future research could explore the relationship between peer and dating partner victimization over time and how experiences of victimization in one domain can increase vulnerability to victimization in another domain.

Study Implications

The majority of dating violence interventions are universal interventions provided to a wide audience of teens (Foshee & Reyes, 2009b). There have been a few randomized control trials of indicated and selective programs (for a review, Foshee & Reyes, 2012b) and the current findings suggest that there may be a greater role for interventions that target high risk subgroups or use different approaches for girls and boys to increase effectiveness and efficiency of intervention resources. The results of this study indicate that the developmental pattern of dating violence victimization may be different for boys and girls, with different timing of increase and decrease in victimization during adolescence. For boys, the increasing, decreasing, and then increasing pattern suggests that activities to prevent violence against boys needs to be sustained later in adolescence. The developmental pattern for boys also indicates that more research is needed to understand the physical dating violence victimization experience for adolescent boys so that intervention approaches can be better tailored to prevent victimization among boys. The current study findings indicate there may be certain subgroups of boys and girls at higher risk of physical dating violence victimization. In particular, victimization by peers emerged as a marker of increased risk to a victimized trajectory for both boys and girls and alcohol use was associated with risk of a victimized trajectory for girls. This is useful information for intervention programs in both identifying youth who may be at greater risk of dating violence victimization and suggesting that preventing alcohol use and victimization by peers may be one way of lowering the risk of dating violence victimization.

Strengths and Limitations

This study had several strengths. Multi-wave longitudinal data offers the opportunity to study individual change over time. Growth mixture modeling is a powerful tool to allow individual heterogeneity in change over time while studying groups of individuals who share a similar pattern of change. Another strength of this study is that it examined boys and girls separately, allowing each gender to have a different number of trajectory classes and different trajectory shapes. No previous study has used growth mixture modeling to study physical dating violence victimization and no previous study has examined growth curves of

dating violence victimization separately for boys and girls. Previous studies have included gender as a covariate, which may have obscured important gender differences in trajectory patterns. Finally, this study used theoretically-based predictors to distinguish prospectively among trajectory classes.

Several limitations to this study should be noted. Though growth mixture modeling has been applied successfully in the areas of adolescent tobacco use (Colder et al., 2001; White, Pandina, & Chen, 2002), alcohol use (Colder, Campbell, Ruel, Richardson, & Flay, 2002; Hill, White, Chung, Hawkins, & Catalano, 2000; Li, Barrera, Hops, & Fisher, 2002), and delinquency (Odgers et al., 2008; White, Bates, & Buyske, 2001; Wiesner & Windle, 2004), there are limitations of its use. When data are non-normal (as is the case with dating violence), some have cautioned that an over extraction of trajectory classes can occur (Bauer & Curran, 2003). However, others have developed new tests like the VLMR-LRT, used in the current study, to deal with the non-normality to address some concerns (Cudeck & Henly, 2003; Muthén, 2003). Future research could explore if developmental trajectories of dating violence victimization vary by other demographic factors besides gender. One possibility is same-sex verses heterosexual relationships. This could not be examined in the current study because, although the survey questions were worded in a way that same-sex relationships were not excluded from consideration by the teen, this study did not specifically include questions about same-sex dating relationships. Another possibility is to examine racial/ethnic differences in trajectories. The sample size of the current study was too limited to further distinguish among racial/ethnic subgroups in addition to gender.

Conclusion

Our findings highlight the importance of studying heterogeneity in physical dating violence victimization over time and the importance of separately considering girls and boys. Understanding the change in victimization over adolescence and the differences in subgroups at risk can be useful for designing prevention and intervention activities, particularly when deciding on the timing and how to target efforts. Alcohol use, anxiety for girls, and victimization by peers for both boys and girls, may contribute to vulnerability to physical dating violence victimization throughout adolescence. These risk factors can be further explored as factors that may be amenable to change in order to prevent physical dating violence victimization for subgroups of teens.

References

Ackard DM, Eisenberg ME, Neumark-Sztainer D. Long-term impact of adolescent dating violence on the behavioral and psychological health of male and female youth. The Journal of pediatrics. 2007; 151:476–481. [PubMed: 17961688]

Ackard DM, Neumark-Sztainer D, Hannan P. Dating violence among a nationally representative sample of adolescent girls and boys: Associations with behavioral and mental health. Journal of Gender-Specific Medicine. 2003; 6:39–48. [PubMed: 14513575]

Akaike H. Factor Analysis and AIC. Psychometrika. 1987; 52:317–322.

Angold A, Costello EJ, Messer SC, Pickles A. Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents. International Journal of Methods in Psychiatric Research. 1995; 5:237–249.

Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review. 1977; 84:191–215. [PubMed: 847061]

Bauer DJ, Curran PJ. Distributional assumptions of growth mixture models: Implications for overextraction of latent trajectory classes. Psychological Methods. 2003; 8:338–363. [PubMed: 14596495]

Bloom BL. A factor analysis of self-report measured of family functioning. Family Process. 1985; 24:225–239. [PubMed: 4018243]

Bollen, KA.; Curran, PJ. Latent curve models: A structural equations perspective. Hoboken, New Jersey: John Wiley & Sons, Inc; 2006.

Capaldi DM, Knoble NB, Shortt JW, Kim HK. A systematic review of risk factors for intimate partner violence. Partner Abuse. 2012; 3:231–280. [PubMed: 22754606]

Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance - United States. Atlanta, GA: Office of Surveillance, Epidemiology and Laboratory Services; 2011. (Rep. No. 61 (No. 4))

Chase KA, Treboux D, O'Leary KD. Characteristics of high-risk adolescents' dating violence. Journal of Interpersonal Violence. 2002; 17:33–49.

Cohen LE, Felson M. Social change and crime rate trends: A routine activity approach. American Sociological Review. 1979; 52:170–183.

Coker AL, McKeown RE, Sanderson M, Davis KE, Valois RF, Huebner ES. Severe dating violence and quality of life among South Carolina high school students. American Journal of Preventive Medicine. 2000; 19:220–227. [PubMed: 11064224]

Colder CR, Campbell RT, Ruel E, Richardson JL, Flay BR. A finite mixture model of growth trajectories of adolescent alcohol use: Predictors and consequences. Journal of Consulting and Clinical Psychology. 2002; 70:976–985. [PubMed: 12182281]

Colder CR, Mehta P, Balanda K, Campbell RT, Mayhew K, Stanton WR, et al. Identifying trajectories of adolescent smoking: An application of latent growth mixture modeling. Health Psychology. 2001; 20:127–135. [PubMed: 11315730]

Cudeck R, Henly SJ. A realistic perspective on pattern representation in growth data: Comment on Bauer and Curran (2003). Psychological Methods. 2003; 8:378–383. [PubMed: 14596498]

Dahlberg, LL.; Toal, SB.; Swahn, M.; Behrens, CB. Measuring violence-related attitudes, behaviors, and influences among youths: A compendium of assessment tools. 2. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2005.

DiClemente R, Wingood GM, Crosby R, Sionean C, Cobb BK, Harrington K, et al. Parental monitoring: Association with adolescents' risk behaviors. Pediatrics. 2001; 6:1363–1368. [PubMed: 11389258]

Ellis WE, Crooks CV, Wolfe DA. Relational aggression in peer and dating relationships: Links to psychological and behavioral adjustment. Social Development. 2009; 18:253–269.

Ennett ST, Bauman KE, Hussong A, Faris R, Foshee VA, Cai L, et al. The peer context of adolescent substance use: Findings from social network analysis. Journal of Research on Adolescence. 2006; 16:159–186.

Finkelhor D, Asdigian NL. Risk factors for youth victimization: Beyond a lifestyles theoretical approach. Violence & Victims. 1996; 11:3–20. [PubMed: 8870212]

Foshee VA. Gender differences in adolescent dating violence abuse prevalence, types and injuries. Health Education Research. 1996; 11:275–286.

Foshee VA, Benefield T, Suchindran C, Ennett ST, Bauman KE, Karriker-Jaffe KJ, et al. The development of four types of adolescent dating abuse and selected demographic correlates. Journal of Research on Adolescence. 2009a; 19:380–400.

Foshee VA, Benefield TS, Ennett ST, Bauman KE, Suchindran C. Longitudinal predictors of serious physical and sexual dating violence victimization during adolescence. Preventive Medicine. 2004; 39:1007–1016. [PubMed: 15475036]

Foshee, VA.; Reyes, HLM. Preventing Partner Violence: Research and Evidence-Based Intervention Strategies. Washington, D.C: American Psychological Association; 2009b. Primary prevention of dating abuse: When to begin, whom to target, and how to do it; p. 141-168.

Foshee, VA.; Reyes, HLM. Adolescent dating abuse: Primary prevention efforts. In: Levesque, JR., editor. Encyclopedia of Adolescence. Springer; 2012b.

Foshee, VA.; Reyes, HLM. Dating abuse: Prevalence, consequences, and predictors. In: Levesque, JR., editor. Encyclopedia of Adolescence. Springer; 2012a. p. 602-615.

Foshee VA, Reyes HLM, Ennett ST, Suchindran C, Mathias J, Karriker-Jaffe KJ, et al. Risk and protective factors distinguishing profiles of adolescent peer and dating violence perpetration. Journal of Adolescent Health. 2011; 48:344–350. [PubMed: 21402262]

Fritz PAT, Slep AMS. Stability of physical and psychological adolescent dating aggression across time and partners. Journal of Clinical Child and Adolescent Psychology. 2009; 38:303–314. [PubMed: 19437292]

Goodman E. The role of socioeconomic status gradients in explaining differences in US adolescents' health. American Journal of Public Health. 1999; 89:1522–1528. [PubMed: 10511834]

Halpern CT, Oslak SG, Young ML, Martin SL, Kupper LL. Partner violence among adolescents in opposite-sex romantic relationships: Findings from the national longitudinal study of adolescent health. American Journal of Public Health. 2001; 91:1679–1685. [PubMed: 11574335]

Hill KG, White HR, Chung IJ, Hawkins JD, Catalano RF. Early adult outcomes of adolescent binge drinking: person- and variable-centered analyses of binge drinking trajectories. Alcoholism: Clinical and Experimental Research. 2000; 24:892–901.

Hindelang, MS.; Gottfredson, M.; Garofalo, J. Victims of Personal Crime. Cambridge, MA: Ballinger; 1978.

Howard D, Qiu Y, Boekeloo B. Personal and social contextual correlates of adolescent dating violence. Journal of Adolescent Health. 2003; 33:9–17. [PubMed: 12834992]

Howard DE, Wang MQ. Risk profiles of adolescent girls who were victims of dating violence. Adolescence. 2003a; 38:1–14. [PubMed: 12803450]

Howard DE, Wang MQ. Psychosocial factors associated with adolescent boys' reports of dating violence. Adolescence. 2003b; 38:519–533. [PubMed: 14768995]

Howard DE, Wang MQ, Yan F. Psychosocial factors associated with reports of physical dating violence victimization among U.S. adolescent males. Adolescence. 2008; 43:449–460. [PubMed: 19086663]

Jackson C, Henriksen L, Foshee VA. The authoritative parenting index: Predicting health risk behaviors among children and adolescents. Health Education and Behavior. 1998; 25:319–337. [PubMed: 9615242]

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]

Li F, Barrera M, Hops H, Fisher KJ. The longitudinal influence of peers on the development of alcohol use in late adolescence: A growth mixture analysis. Journal of Behavioral Medicine. 2002; 25:293–315. [PubMed: 12055779]

Lo Y, Mendell NR, Rubin DB. Testing the number of components in a normal mixture. Biometrika. 2001; 88:767–778.

Magdol L, Moffitt TE, Caspi A, Silva PA. Developmental antecedents of partner abuse: A prospective-longitudinal study. Journal of Abnormal Psychology. 1998; 107:375–389. [PubMed: 9715573]

Malik S, Sorenson SB, Aneshensel CS. Community and dating violence among adolescents: Perpetration and victimization. Journal of Adolescent Health. 1997a; 21:291–302. [PubMed: 9358292]

Malik S, Sorenson SB, Aneshensel CS. Community and dating violence among adolescents: Perpetration and victimization. Journal of Adolescent Health. 1997b; 21:291–302. [PubMed: 9358292]

Miyazaki Y, Raudenbush SW. Tests for linkage of multiple cohorts in an accelerated longitudinal design. Psychological Methods. 2000; 5:44–63. [PubMed: 10937322]

Muthén BO. Statistical and substantive checking in growth mixture modeling: Comment on Bauer and Curran (2003). Psychological Methods. 2003; 8:369–377. [PubMed: 14596497]

Muthén BO, Muthén LK. Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. Alcoholism: Clinical and Experimental Research. 2000; 24:882–891.

Muthén BO, Shedden K. Finite mixture modeling with mixture outcomes using the EM algorithm. Biometrics. 1999; 55:463–469. [PubMed: 11318201]

Muthén, LK.; Muthén, BO. Mplus Users Guide. 6. Los Angeles, CA: Muthén & Muthén; 2011.

Nagin DS. Analyzing developmental trajectories: A semiparametric, group-based approach. Psychological Methods. 1999; 4:139–157.

Nocentini A, Menesini E, Pastorelli C. Physical dating aggression growth during adolescence. Journal of Abnormal Child Psychology. 2010; 38:353–365. [PubMed: 19957026]

O'Donnell L, Stueve A, Myint U, Duran R, Agronick G, Wilson-Simmons R. Middle school aggression and subsequent intimate partner physical violence. Journal of Youth and Adolescence. 2006; 35:693–703.

O'Leary KD, Slep AMS. A dyadic longitudinal model of adolescent dating aggression. Journal of Clinical Child & Adolescent Psychology. 2003; 32:314–327. [PubMed: 12881021]

O'Leary KD, Slep AMS, Avery-Leaf S, Cascardi M. Gender differences in dating aggression among multiethnic high school students. Journal of Adolescent Health. 2008; 42:473–479. [PubMed: 18407042]

Odgers CL, Moffitt TE, Broadbent JM, Dickson N, Hancox RJ, Harrington H, et al. Female and male antisocial trajectories: From childhood origins to adult outcomes. Development and Psychopathology. 2008; 20:673–716. [PubMed: 18423100]

Orpinas P, Nahapetyan L, Song X, Mcnicholas C, Reeves PM. Psychological dating violence perpetration and victimization: Trajectories from middle to high school. Aggressive Behavior. 2012; 38:510–520. [PubMed: 23044936]

Ozer EJ, Tschann JM, Pasch LA, Flores E. Violence perpetration across peer and partner relationships: Co-occurrence and longitudinal patterns among adolescents. Journal of Adolescent Health. 2004; 34:64–71. [PubMed: 14706407]

Petersen AC, Schulenberg JE, Abramowitz RH, Offer D, Jarcho HD. A self-image questionnaire for young adolescents (SIQYA): Reliability and validity studies. Journal of Youth and Adolescence. 1994; 13:93–111. [PubMed: 24306573]

Raiford JL, Wingood GM, Diclemente RJ. Prevalence, incidence, and predictors of dating violence: A longitudinal study of African American female adolescents. Journal of Women's Health. 2007; 16:822–832.

Reyes HLM, Foshee VA, Bauer DJ, Ennett ST. The role of heavy alcohol use in the developmental process of desistance in dating aggression during adolescence. Journal of Abnormal Child Psychology. 2011; 39:239–250. [PubMed: 20838876]

Reynolds CR, Richmond BO. Factor structure and construct validity of "What I think and feel": The Revised Children's Manifest Anxiety Scale. Journal of Personality Assessment. 1979; 43:281–283. [PubMed: 469706]

Roberts TA, Klein JD, Fisher S. Longitudinal effect of intimate partner abuse on high-risk behavior among adolescents. Archives of Pediatrics and Adolescent Medicine. 2003; 157:875–881. [PubMed: 12963592]

Rothman EF, Reyes HLM, Johnson RM, LaValley M. Does the alcohol make them do it? Dating violence perpetration and drinking among youth. Epidemiologic Reviews. 2012; 34:103–119. [PubMed: 22128086]

Rubin, DB. Multiple imputation for nonresponse in surveys. New York: Wiley; 1987.

SAS Institute. Statistical Analysis Software (SAS) (Version 9.3) [Computer software]. Cary, NC: SAS Institute Inc; 2010.

Schwarz G. Estimating the dimension of a model. Annals of Statistics. 1978; 6:461–464.

Sclove SL. Application of model-selection criteria to some problems in multivariate analysis. Psychometrika. 1987; 52:333–343.

Silverman JG, Raj A, Mucci LA, Hathaway JE. Dating violence against adolescent girls and associated substance use, unhealthy weight control, sexual risk behavior, pregnancy, and suicidality. Journal of the American Medical Association. 2001; 286:572–579. [PubMed: 11476659]

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]

Spriggs AL, Halpern CT, Herring AH, Schoenbach VJ. Family and school socioeconomic disadvantage: Interactive influences on adolescent dating violence victimization. Social Science and Medicine. 2009; 68:1956–1965. [PubMed: 19375207]

Steinberg L, Fletcher A, Darling N. Parental monitoring and peer influences on adolescent substance use. Pediatrics. 1994; 93:1060–1064. [PubMed: 8197008]

Straus MA, Gelles RJ. Societal change and change in family violence from 1975 to 1985 as revealed by two national surveys. Journal of Marriage and the Family. 1986; 48:465–479.

Swahn MH, Bossarte RM, Sullivent EE. Age of alcohol use initiation, suicidal behavior, and peer and dating violence victimization and perpetration among high-risk, seventh-grade adolescents. Pediatrics. 2008; 121:297–305. [PubMed: 18245421]

Vicary JR, Klingaman LR, Harkness WL. Risk factors associated with date rape and sexual assault of adolescent girls. Journal of Adolescence. 1995; 18:289–306.

White HR, Bates ME, Buyske S. Adolescence-limited versus persistent delinquency: Extending Moffitt's hypothesis into adulthood. Journal of Abnormal Psychology. 2001; 110:600–609. [PubMed: 11727949]

White HR, Pandina RJ, Chen PH. Developmental trajectories of cigarette use from early adolescence into young adulthood. Drug and Alcohol Dependence. 2002; 65:167–178. [PubMed: 11772478]

Wiesner M, Windle M. Assessing covariates of adolescent delinquency trajectories: A latent growth mixture modeling approach. Journal of Youth and Adolescence. 2004; 33:431–442.

Wolfe DA, Wekerle C, Scott K, Straatman AL, Grasley C, Reitzel-Jaffe D. Dating violence prevention with at-risk youth: A controlled outcome evaluation. Journal of Consulting and Clinical Psychology. 2003; 71:279–291. [PubMed: 12699022]
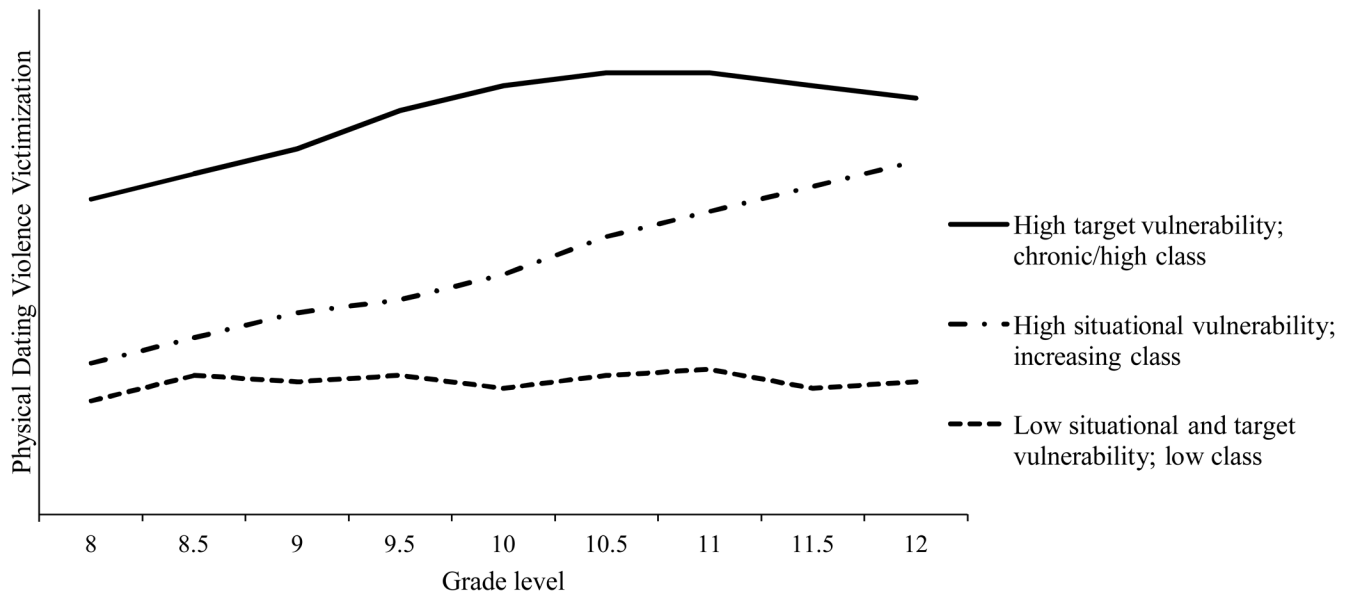
Figure 1.
Hypothesized relationships between predictors and patterns of dating violence over time. Target vulnerability is hypothesized to distinguish a chronic/high class of physical dating violence victimization from a low class and situational vulnerability is hypothesized to distinguish an increasing class of physical dating violence victimization from a low class.
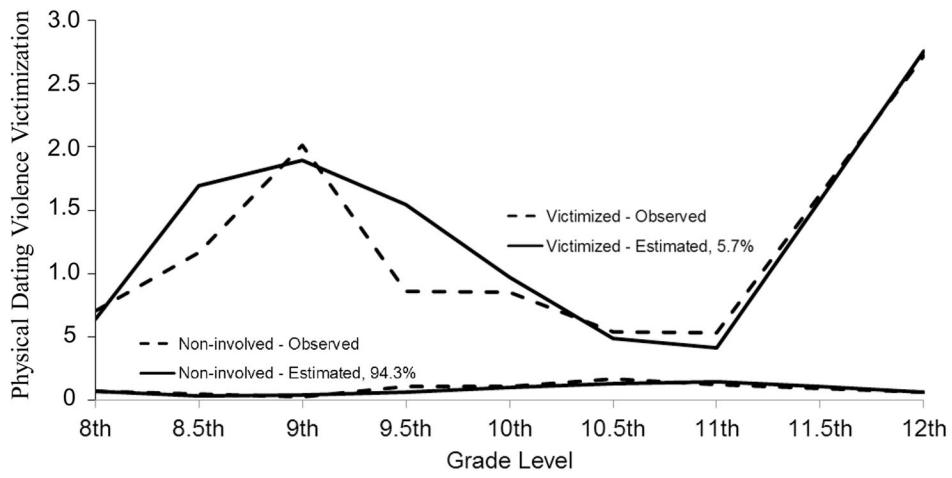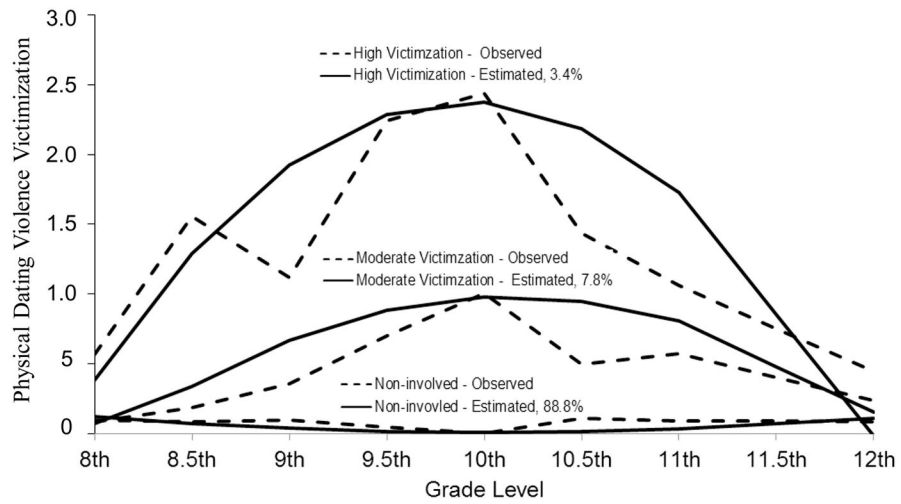
Figure 2.
Trajectories of physical dating abuse victimization. Girls (top) and boys (bottom). The estimated (log) units of dating abuse are shown on the y axis and grade is shown on the x axis.

Table 1

Prevalence of physical dating violence victimization by grade and gender

Grade	Total N	Boys %	Girls %
8 Fall	810	7.9	8.4
8 Spring	689	6.7	8.9
9 Fall	1369	10.0	10.9
9 Spring	691	8.2	11.3
10 Fall	1864	8.6	11.0
10 Spring	601	12.1	11.3
11 Fall	1083	11.1	12.0
12 Fall	431	11.3	8.0

Note. Percentages indicate reporting of at least one act of physical dating violence victimization

Table 2

Model fit indices for latent class growth models for girls and boys

Model	LL	No. of free parameters	AIC	BIC	Adjusted BIC	E	Range of ACPs	VLMR-LRT
			Girls (N= 1332)					
1 class (quadratic)	−2792.3	11	5606.6	5663.7	5628.8	--	--	--
2 classes (quadratic)	−2052.2	15	4134.4	4212.3	4164.6	.974	.842–.937	p=.02
3 classes (quadratic) *	−1601.7	19	3241.4	3340.1	3279.8	.959	.954–.989	p=.06
4 classes (quadratic)[a]	−1188.4	23	2422.9	2542.3	2459.3	.964	.925–.989	p=.24
			Boys (N= 1234)					
1 class (linear)	−2613.0	11	5248.0	5304.3	5269.4	--	--	--
2 class (linear)	−2176.4	13	4378.8	4445.3	4404.0	.979	.962–.996	p=.12
2 class (quadratic)	−2612.1	15	4354.1	4430.9	4383.2	.972	.945–.997	p=.25
2 classes (cubic) *	−2081.2	17	4196.4	4283.4	4229.5	.961	.968–.992	p=.02
3 class (linear)	−1931.1	16	3894.2	3976.1	3925.3	.958	.898–.989	p=.60
3 classes (quadratic)	−1817.9	19	3673.7	3770.9	3710.6	.930	.954–.980	p=.56
3 classes (cubic)	−1717.7	21	3477.4	3584.9	3518.1	.956	.947–.988	p=.52

Note. LL = log likelihood, AIC = Akaike Information Criterion, BIC = Bayes Information Criterion; E = entropy, ACP = Average posterior class membership probability, VLMR-LRT = Vuong-Lo-Mendell-Rubin test

[a] Best LL was not replicated after 1000 iterations

* Final model

Table 3

Adjusted associations (aOR's) between risk factors and physical dating violence victimization trajectory classes

	Girls		Boys
	Moderate victimization Class (aOR)	**High Victimization Class (aOR)**	**Victimization Class (aOR)**
Situational Vulnerabilities			
Alcohol use	1.20[***]	1.31[***]	1.15[**]
Marijuana use	2.10[**]	3.91[***]	2.29[**]
Low parental monitoring	1.36[**]	1.05	1.47[*]
Target Vulnerabilities			
Depression	1.16[*]	1.29[*]	1.42[***]
Anxiety	1.37[**]	1.42[***]	1.44[**]
Body image	.95	1.29	1.45[*]
Victimized by peers	1.11[*]	1.24[***]	1.17[***]
Family conflict	1.21[*]	1.48[**]	1.33[*]

Note. The "non-involved" class is the reference group for girls and boys, respectively.

aOR = adjusted Odds Ratio (models control for age, race, parental education, and family structure)

[*]
$p < .05$;

[**]
$p < .01$;

[***]
$p < .001$

Table 4

Multivariate relationships between risk factors and physical dating violence victimization trajectory classes

	Girls		Boys
	Moderate victimization Class (aOR)	High Victimization Class (aOR)	Victimization Class (aOR)
Situational Vulnerabilities			
Alcohol use	1.13[*]	1.13	1.03
Marijuana use	1.26	2.06	1.22
Low parental monitoring	1.27	.88	1.30
Target Vulnerabilities			
Depression	1.02	.82	1.09
Anxiety	1.30	1.81[**]	.96
Body image	.77	1.06	.95
Victimized by peers	1.06	1.18[***]	1.13[***]
Family conflict	1.04	1.16	.96

Note. The "non-involved" class is the reference group for girls and boys, respectively.

aOR = adjusted Odds Ratio (models control for age, race, parental education, and family structure)

[*]
$p < .05$;

[**]
$p < .01$;

[***]
$p < .001$