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Assessing the Effects of the Dating Violence Prevention Program "Safe Dates" Using Random Coefficient Regression Modeling

Vangie A. Foshee,[1,4] Karl E. Bauman,[1] Susan T. Ennett,[1] Chirayath Suchindran,[2] Thad Benefield,[2] and G. Fletcher Linder[3]

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The Safe Dates Project is a randomized trial for evaluating a school-based adolescent dating violence prevention program. Five waves of data were used to examine the effects of Safe Dates over time including primary and secondary prevention effects, moderators, and mediators of program effects. Using random coefficients models, with multiple imputation of missing data, significant program effects were found at all four follow-up periods on psychological, moderate physical, and sexual dating violence perpetration and moderate physical dating violence victimization. Marginal effects were found on sexual victimization. Effects on severe physical perpetration at all four follow-up periods were moderated by prior involvement in that type of violence. Primary and secondary prevention effects were found and the program was equally effective for males and females and for whites and non-whites. Program effects were mediated by changes in dating violence norms, gender-role norms, and awareness of community services.

KEY WORD: adolescence; domestic violence; intervention studies.

INTRODUCTION

Adolescent dating violence is prevalent and results in serious physical, psychological, and developmental consequences (Avery-Leaf *et al.*, 1997; Bergman, 1992; Coker *et al.*, 2000; Foshee, 1996; Malik *et al.*, 1997; O'Keefe & Treister, 1998; O'Keeffe *et al.*, 1986; Silverman *et al.*, 2001). The Safe Dates Project is a randomized controlled trial for testing the effects of a school-based intervention on the primary and secondary prevention of adolescent dating violence victimization and perpetration. For the trial, 14 public schools in a North Carolina county with eighth or ninth grades were stratified by grade and matched on school size. One member of each matched pair was randomly assigned to either receive Safe Dates or to serve as a control. Adolescents in treatment and control groups completed questionnaires in school at baseline and then again in 1 month, 1 year, 2 years, 3 years, and 4 years after the program was completed.

Findings reported earlier suggested that 1 month after the intervention, Safe Dates prevented and reduced psychological abuse perpetration, reduced sexual dating violence perpetration, and positively changed cognitive mediating variables that were based on program content, such as dating violence norms, gender-role norms, conflict management skills, and awareness of community services for dating violence (Foshee *et al.*, 1998). One year

[1]Department of Health Behavior and Health Education, School of Public Health, University of North Carolina at Chapel Hill, North Carolina, 27599-7440.
[2]Department of Biostatistics, School of Public Health, University of North Carolina at Chapel Hill., North Carolina, 27599-7440.
[3]Department of Sociology & Anthropology, James Madison University, Virginia.
[4]Correspondence should be directed to Vangie A. Foshee Department of Health Behavior and Health Education, School of Public Health, 319B Rosenau Hall, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, 27599-7440; e-mail: foshee@email.unc.edu.

after the intervention, cognitive risk factor effects were maintained, but behavioral effects disappeared (Foshee *et al.*, 2000). Additional analyses assessed longer-term (4 years post-intervention) effects and a booster intervention with a sub-sample of our respondents (Foshee *et al.*, 2004).

The analyses assessing 1-month and 1-year follow-up effects were limited by the analytical strategy used to assess program effects. Mean outcome scores were calculated for each school by aggregating adolescent responses. The nonparametric Wilcoxon signed rank test was used to determine if the mean outcome scores for the treatment and control schools in each matched pair (N = 7) were significantly different. That analytical approach had several drawbacks. One is that with only seven matched pairs, there were few degrees of freedom for comparisons, resulting in low power (Murray & Hannah, 1989). Power was further limited because we assessed primary and secondary prevention effects by segmenting the sample into sub-samples based on the adolescent's level of involvement in dating violence prior to intervention. As a result, in some of the sub-samples, especially the secondary prevention sub-samples, school-level mean outcome scores were based on a small number of respondent's scores. Other limitations were the inability to directly control for covariates, making it impossible to determine if program effects were mediated by the proposed theoretical variables that were the foci of the program, and a loss of information due to the aggregation of responses. The analyses assessing the effects of Safe Dates 4-years after the intervention showed positive program effects on dating violence, but those analyses were restricted to the eighth grade cohort and did not assess proposed mediators of program effects. Additionally, in all earlier analyses, missing data were dealt with by listwise deletion, which can decrease power, produce biased estimates, and inflate standard errors (Patrician, 2002).

In this study, we extend our earlier work by (1) using four waves of follow-up data, assessing program effects up to 3 years post-intervention, (2) employing a different analytical strategy—random coefficient regression modeling, and (3) using multiple imputation procedures (Rubin, 1987) to account for missing data due to attrition. Using these procedures we (1) examine the effects of Safe Dates over time in preventing and reducing psychological, moderate physical, severe physical, and sexual dating violence victimization and perpetration, (2) determine if program effects over time are due to primary or secondary prevention by testing whether program effects are moderated by the adolescent's involvement in dating violence prior to the intervention, (3) determine if program effects over time are moderated by gender and race, and (4) determine whether the relationships between treatment condition and dating violence outcomes at each wave are explained by theoretically based, time-dependent, mediating variables that were the program foci.

Random coefficient modeling is appropriate for addressing study purposes because it allows for (1) assessing the effects of the intervention over time while considering and controlling for variation within individuals and correlated responses within schools over time, and (2) simultaneous modeling of covariates, such as mediators and moderators, without segmenting the sample. Missing data, common to longitudinal studies, can threaten both internal and external validity of randomized trials (Figueredo *et al.*, 2000). Recent computational advances allowed us to use multiple imputation procedures proposed by Rubin (1987) for filling in missing data. Multiple imputation procedures allow researchers to use available data to impute values that approximate the "real" value, while preserving the uncertainty of missing values and aspects of data distribution (Patrician, 2002; Schafer, 1999). Simulation exercises have demonstrated that the test statistics produced from data sets with missing values filled in using multiple imputation procedures were closer to the test statistics produced from complete data sets than were the test statistics produced from data sets that dealt with missing values with listwise deletion (Horton & Lipsitz, 2001; Patrician, 2002). Also, multiple imputation procedures are not hampered by the disadvantages of commonly used single imputation procedures, such as mean or median substitution, that can underestimate standard errors and bias parameter estimates (Patrician, 2002).

Despite the prevalence and negative consequences of adolescent dating violence and date rape, only a few evaluations of prevention programs designed to reduce those behaviors have been published. Nearly all used designs without random assignment to experimental and control groups (Avery-Leaf *et al.*, 1997; Jaffe *et al.*, 1992; Jones, 1991; Krajewski *et al.*, 1996; Lavoie *et al.*, 1995; Weisz & Black, 2001) and measured attitudes, knowledge, and/or intentions, but not behavior (Avery-Leaf *et al.*, 1997; Jaffe *et al.*, 1992; Jones, 1991; Krajewski *et al.*, 1996; Lavoie *et al.*, 1995; Macgowan,

1997; Weisz & Black, 2001). The only study other than ours to use a randomized design and measure dating violence behaviors was conducted by Wolfe and associates (2003). Their evaluation differs from ours in that a community—rather than a school-based program was evaluated, teens with a history of child maltreatment rather than the general population of adolescents were targeted, and intervention effects were assessed only through 2 years of follow-up.

METHODS

Design

Adolescents were eligible for the study if they were enrolled in the eighth or ninth grade in the fall of 1994 in one of the 14 public schools in a primarily rural county of North Carolina. The 14 schools were stratified by grade (eighth or ninth) and then matched on school size. One school from each matched pair was randomly assigned to treatment and the other to control conditions. Baseline data (wave 1) were collected in schools by trained research staff in October 1994 from 81% ($n = 1885$) of eligible adolescents. The adolescents in the seven treatment schools were exposed to Safe Dates program activities from November 1994 through March 1995. Safe Dates included a play performed by students, a curriculum of ten 45-minute sessions taught by health and physical education teachers, and a poster contest based on curriculum content. Based on monitoring data, 97% of the students enrolled in the Safe Dates schools were present for the play; the teachers covered 90.7% of the curriculum activities; and classroom attendance across sessions ranged from 95.0 to 97.0%. All students who were in school on the day of their school's poster contest were exposed to the messages in the posters because each student was required to vote for the three best posters in the school.

Follow-up data were collected from treatment and control adolescents 1 month (wave 2), 1 year (wave 3), 2 years (wave 4), 3 years (wave 5), and 4 years (wave 6) after Safe Dates was completed using the same procedures as for baseline data collection. Students who were absent for school data collection, including those who had dropped out of school, were mailed a questionnaire and 50% of those questionnaires were completed and returned. Across all follow-up waves, between 4 and 9% of the students completed questionnaires by mail. After wave 4, a random half of the adolescents who had been in the original treatment group were mailed a booster newsletter followed by a telephone call from a health educator.

The analyses for this paper are limited to adolescents who completed a baseline questionnaire and who were in either the original control group or the treatment group that received Safe Dates but not the booster ($n = 1566$). We eliminated booster-group adolescents because the focus of this paper is on evaluating the effects of Safe Dates, and not the booster, over-time. There were no significant differences on the baseline measures of dating abuse victimization and perpetration between adolescents who received Safe Dates only and those who received Safe Dates and the booster. For these analyses we use data from waves 1 through 5. Wave 6 data are not used because the ninth grade cohort had graduated from high school by then and therefore wave 6 data were not collected from them. Of the 1566 adolescents in our analyses, 1130 (72.2%) are white and 733 (46.8%) are males. The mean age at baseline was 13.9 years. Of the 1566, 636 (40.6%) are in the treatment group and 930 (59.4%) are in the control group. The imbalance in treatment and control group numbers is due to exclusion of adolescents who received the booster.

The Safe Dates Program

The Safe Dates program activities targeted behavioral outcomes through theoretically based mediating variables as shown in Fig. 1. Preventing the onset of dating violence victimization and perpetration indicates primary prevention and promoting cessation of dating violence victimization and perpetration indicates secondary prevention.

Changes in norms coupled with improvements in conflict management skills served as the theoretical base for primary prevention activities. Norms are instruments of social control and thus have a significant effect on behavior and conformity (Mizruchi & Perrucci, 1962). Norms are indicated by perceptions of the sanctions associated with a behavior (Solomon & Harford, 1984). Observed sanctions have more impact on an individual's perceptions of the norms when they are levied by someone important to the individual and for whom they have high motivation to comply (Fishbein & Ajzen, 1975). For adolescents, peers are a primary source of normative influence.

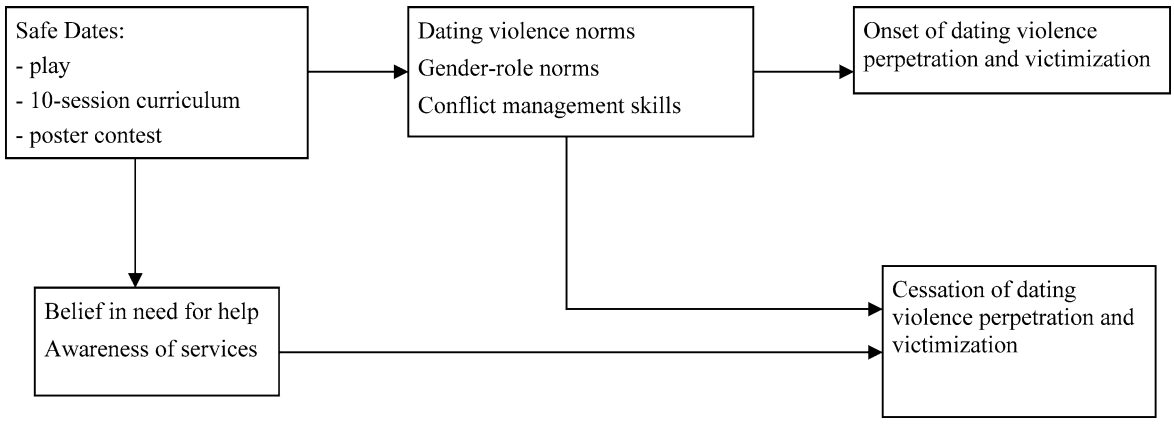

Fig. 1. Safe Dates conceptual model.

Several studies suggest that adolescents perceive few negative sanctions from their peers for dating violence (see Hotaling & Sugarman, 1986) and that acceptance of dating violence, which may indicate the norms associated with dating violence, is one of the strongest correlates of dating violence (Bergman, 1992; Deal & Wampler, 1986; O'Keeffe *et al.*, 1986). Program activities were designed to alter dating violence norms by increasing the adolescent's perception of negative consequences associated with dating violence and altering peer responses to dating violence.

Norms related to gender-roles also provide a framework for selecting future behaviors. According to cognitive-developmental theories, children form gender-role norms and then, as adolescents, they strive to become like the categories they created (Bem, 1981). Perceived gender-role norms have been found to influence many different adolescent behaviors, including academic performance, later career choices, and thus later income (Tallichet & Willits, 1986; Worell, 1982), likelihood of using contraceptives (Resnick & Blum, 1985), and sexual behavior (Foshee & Bauman, 1992). Traditional gender role norms put females in a submissive position relative to males and males in positions of power and authority. Acceptance of traditional gender-role expectations has been associated with the use of violence by males towards partners (Check & Malamuth, 1983; Finn, 1986) and with the likelihood of females remaining in an abusive relationship (Finn, 1986). Program activities were designed to decrease adolescent acceptance of traditional gender-role norms.

Violent couples report using faulty conflict management techniques (Lloyd, 1987). Negotiating techniques that leave a conflict unresolved are related to the use of violence as the "ultimate" conflict management tactic (Lloyd *et al.*, 1989). Weak conflict management skills have also been found to be associated with youth aggression in general (Slaby & Guerra, 1988). Thus, several program activities were designed to improve the adolescents' skills for managing conflict with dating partners.

Changes in dating violence and gender-role norms and conflict management skills also may influence adolescents in abusive relationships to leave those relationships or to stop being violent. In addition, secondary prevention activities targeted cognitive factors, which Weinstein's precaution adoption theory (1988) suggests influences the decision to take preventive action, in this case to seek help with leaving an abusive partner or to stop perpetrating dating violence. Central to precaution adoption theory are beliefs about the need for the preventive action and beliefs about the potential success of a given action. Program activities were designed to increase victims' and perpetrators' beliefs that they need help and to increase their awareness of the community services where they could seek help.

Measures

At each wave, eight behavioral outcomes (four pairs of parallel perpetration and victimization outcomes) anchored to the previous year were measured. Psychological abuse perpetration was measured by asking the adolescent "During the last year, how often have you done the following things to someone you had a date with?" Fourteen acts were

listed (e.g. "damaged something that belonged to them," "insulted them in front of others") and response options ranged from 0 for "never" to 3 for "very often" (Foshee, 1996). Items were summed to create a composite measure of psychological abuse perpetration (baseline alpha = .89). A parallel set of questions was used to assess psychological abuse victimization (baseline alpha = .91).

Moderate physical, severe physical, and sexual dating violence perpetration were measured by asking "During the last year, how many times have you done the following things to a person that you had a date with? Only include when you did it to him/her first. In other words, don't count it if you did it in self-defense." Eighteen acts were listed and response options ranged from 0 for "never" to 3 for "10 or more times." Composite measures for moderate physical (baseline alpha = .92), severe physical (baseline alpha = .89), and sexual dating violence perpetration (baseline alpha = .86) were created. Moderate physical violence included scratching, slapping, biting, pushing, grabbing, kicking, and shoving the partner, twisting the partner's arm, slamming the partner against the wall, bending back the partner's fingers, dumping them out of a car, and throwing something at the partner. Severe physical violence included choking, burning, and beating up a partner, hitting the partner with a fist or something else hard, and assaulting the partner with a knife or weapon. Sexual perpetration included forcing someone to have sex or to do something else sexual that the partner did not want to do. Parallel questions were used to measure moderate physical (baseline alpha = .90), severe physical (baseline alpha = .86) and sexual dating violence victimization (baseline alpha = .74).

The five mediating variables also were assessed at each wave. Dating violence norms and gender-role norms were assessed by asking adolescents how strongly they agreed or disagreed with a series of statements. The dating violence norms items assessed the adolescent's acceptance of dating violence under certain situations. Eight items were listed, such as "It is ok for a boy to hit his girlfriend if she did something to make him mad," "It is ok for a girl to hit a boyfriend if he hit her first," and "A girl who makes her boyfriend jealous on purpose deserves to be hit." Responses to each item were averaged to create a composite score such that the higher the number the more accepting of dating violence under certain circumstances (baseline alpha = .78). Eleven items tapped acceptance of traditional gender-role norms, such as "In a dating relationship, the boy should be smarter than the girl," and "In general, the father should have greater authority than the mother in making decisions." Responses to the 11 items were averaged to create a composite score with the higher the score the more accepting of traditional gender-role norms (baseline alpha = .69).

Conflict management skills were assessed by asking, "During the last 6 months, when you had a disagreement with someone, how much of the time did you do the following things?" Seven skills that were taught in the Safe Dates curriculum were listed, such as "I told the person how I felt, "I tried to calm down before I talked to them," and "I asked lots of questions so that I could get the whole story." Response options ranged from 0 for "never" to 3 for "most of the time." The seven items were averaged to create a composite variable, with the higher the number indicating the better the conflict management skills (baseline alpha = .88).

Belief in need for help was assessed with two items. Adolescents indicated how strongly they agreed or disagreed with the statements "Teens who are victims of dating violence need to get help from others," and "Teens who are violent to their dates need to get help from others." Awareness of community services was assessed with a dichotomous variable that indicated whether the adolescent knew about the services in their community for helping teenagers involved in abusive dating relationships.

Missing Data

It is not uncommon to find 40–50% attrition in longitudinal school-based studies for reasons such as withdrawal of some schools, requirement that politically sensitive questionnaire items be omitted in some schools, and changes in consent procedures (Horton & Lipsitz, 2001). Our parental consent procedures had to be changed mid-study. We had obtained active parental consent at baseline for adolescents to complete multiple waves of data. For wave 4 we were required to repeat our active parental consent procedures, resulting in a drop in participation at waves 4 and 5. Attrition from baseline by wave 3 was only 12.0%, but by wave 5 was about 50%. There were no statistically significant treatment group differences in the amount of attrition at each follow-up wave.

Multiple imputation procedures (Rubin, 1987) are valuable under these circumstances because they allow for the use of data that are available and for the creation of plausible imputations of missing

data, so that complete-data methods of analysis can be used. Even with substantial attrition, multiple imputation procedures yield stable test statistics and standard errors (Horton & Lipsitz, 2001). Multiple imputation involves a three-step process. First, sets of plausible values for missing observations are created based on a specified missingness equation and an algorithm that preserves uncertainty about non-response. Second, each complete set of data is analyzed. Finally, the results are combined across sets in a way that allows for the uncertainty regarding imputation to be taken into account to produce a single set of test statistics, parameter estimates, and standard errors (Horton & Lipsitz, 2001). It is recommended that the missingness equation include all of the independent and dependent variables to be used in final analyses, variables that could be predictive of missing information, variables that describe special aspects of the sample, and factors that explain a considerable amount of the variance in the targeted variables (Allison, 2000; Schafer, 1999).

We used a within subjects multiple imputation procedure to decrease the likelihood that our findings would be biased by missing data (Rubin, 1987). The missingness equation specified for a particular outcome included the perpetration and victimization score on the particular outcome at all available waves, all mediating variables at all available waves, gender, race, mother's education, family structure (presence of two parents or not), and treatment condition. Missing values on each mediating variable at each wave were computed with the same equation. Two SAS procedures were used; Proc MI (to impute missing data based on the specified missingness equation) and PROC MIANALYZE (to combine the results of the imputations and derived parameter estimates and standard errors. (SAS Version 8, 1999). Schafer (1999) suggested that no more than 10 sets of imputations are usually required to obtain final stable parameter estimates and therefore, we specified 10 sets of imputations. For all models tested to address study aims, we inspected the multiple imputation relative frequency, which is useful for determining if the number of sets of imputations that are specified for the multiple imputation procedures is enough to achieve stable parameter estimates (Horton & Lipsitz, 2001). The potential values of relative frequency range from 0 to 1; the closer the value is to 1, the more stable the estimates. The relative efficiency was at least .93 in all models.

Analysis Strategy

Study aims were addressed using random coefficient regression analysis, which is a subset of the mixed model that is useful for longitudinal data. We conducted our analyses using SAS PROC MIXED (SAS Version 8, 1999). We used a nested error structure, accounting for correlation within individual's responses over time and of individual responses within schools.

We first determined the pattern of growth of each of the eight dating violence outcomes without consideration of covariates, such as treatment condition, to determine if there was enough inter-individual variability in the trajectories to conduct the models necessary for addressing study aims. Results from Wald Z tests of the asymptotic covariance parameters indicate that there is significant ($p < .0001$) inter-individual variability in the eight trajectories over time.

Next, each of the eight outcome variables was regressed on treatment condition (0 = control and 1 = treatment condition), time (waves 2–5), time-squared, the three potential moderator variables (gender (0 = male, 1 = female), race (0 = white and 1 = non-white), and prior involvement in dating violence (the baseline value of the outcome variable)), the four-way interactions between time-squared, treatment condition, and each of the three proposed moderator variables, the three-way interactions between time, treatment condition, and each of the three proposed moderator variables, and all interactions composing those four- and three-way interactions. In earlier analyses we observed that the relationship between dating violence and time was quadratic and therefore we include the time-squared term in our models. We used a backwards elimination procedure to eliminate non-significant interactions.

The four-way interactions of treatment by time by time by a moderator variable (i.e. race, gender, or prior involvement in dating violence) and the three-way interactions of treatment by time by a moderator variable were tested to determine if program effects vary over time by prior involvement in dating violence, race, and gender. If one of these interactions is significant, it indicates that the effects of treatment vary over time depending on values of the moderator variable and that the pattern of dating violence over time is either quadratic (in the four-way interactions) or linear (in the three-way interaction).

Non-significant interactions including moderator variables were dropped from models and we proceeded to determine if program effects vary over time. A significant treatment by time by time or a significant treatment by time interaction indicates that the effects of treatment vary across follow-up periods with the pattern of dating violence over time being quadratic or linear, respectively. If the interactions of treatment with time and time-squared are not significant and the treatment main effect is significant, this would indicate that there are significant main effects of treatment at all follow-up waves and the pattern of dating violence over time would depend on whether there were significant time or time-squared main effects. If the interactions of treatment with time and time-squared are not significant and the treatment main effect is not significant, this would indicate that there are no significant treatment effects at any of the follow-up waves with the pattern of dating violence over time, again, depending on whether there were significant time or time-squared main effects.

When statistically significant interactions remained in the reduced models, we probed the interactions as follows. We calculated the predicted mean of the outcome at each wave for each treatment condition based on the parameters of the reduced models (keeping all other variables in the model at the mean level). We then calculated the difference in those predicted means at each wave at each level of the moderator variable. For these analyses, prior involvement in dating violence was reduced to three strata: no prior involvement, the mean level of involvement (average prior involvement), and the mean level of involvement plus one standard deviation (high prior involvement). Statistical tests were computed to determine if the differences in predicted means at each wave between the treatment conditions for each level of the moderator were statistically significant. Multiple testing effects were accommodated by Bonferroni corrections to adjust the significance levels.

After determining program effects and moderators of those effects, we conducted analyses to determine whether the effects of treatment over time are explained by time dependent mediating variables. First we followed the same procedures as above to determine if treatment effects on mediating variables vary over time and if treatment effects on mediating variables vary over time by race and gender. Those analyses controlled for the baseline value of the mediating variable. The results from these models are purely descriptive. To determine mediation, we compared the effects of treatment condition on the dating violence outcomes over time (from the reduced models described earlier) to the effects of treatment condition on dating violence outcomes over time controlling for the five mediating variables measured at the five time periods. Mediation was indicated if previously significant treatment effects decreased to non-significance with controls for the time-dependent mediating variables (MacKinnon *et al.*, 2000).

RESULTS

Safe Dates Effects and Moderators of Effects on Perpetration

The mean and standard deviation for each perpetration outcome at each of the five waves by treatment condition are presented in Table 1. Table 2 presents the results from the reduced models examining program effects and moderators of program effects on the four perpetration outcomes. Because neither race nor gender moderated program effects on any of the perpetration outcomes at any of the follow-up waves, these interactions are not considered further.

As shown in Table 2, there are significant main effects of treatment condition on psychological abuse perpetration ($p = .0005$), moderate physical violence perpetration ($p = .02$), and sexual violence perpetration ($p = .04$). Those findings indicate that adolescents who received Safe Dates reported perpetrating significantly less psychological, moderate physical, and sexual dating violence perpetration at all four follow-up periods than those in the control group. The absence of any significant treatment condition by baseline outcome interactions suggests that there are both primary and secondary prevention effects on those three outcomes; in other words, the treatment effects were the same for those who did and did not report using those forms of violence against a dating partner prior to intervention exposure.

When considering severe physical perpetration, there was a significant two-way interaction between treatment and baseline severe physical perpetration ($p = .04$). Adolescents who reported at baseline no severe physical perpetration ($p = .001$) or average amounts of severe physical perpetration ($p = .005$) reported significantly less severe physical perpetration than control group adolescents at each of the four follow up waves. For adolescents who reported

Table 1. Means and Standard Deviations for Each Outcome at Each Wave

	Wave 1		Wave 2		Wave 3		Wave 4		Wave 5	
	N	Mean (*SD*)	*N*	Mean (*SD*)	*N*	Mean (*SD*)	*N*	Mean (*SD*)	*N*	Mean (*SD*)
Perpetration										
Psychological										
Treatment	681	3.65 (5.92)	598	3.16 (6.06)	645	4.04 (7.18)	428	3.05 (5.64)	492	2.88 (5.41)
Control	651	3.54 (5.63)	586	4.19 (6.97)	615	4.84 (7.90)	448	3.25 (6.94)	473	3.08 (5.81)
Moderate physical										
Treatment	680	1.06 (3.26)	606	0.89 (3.08)	648	1.44 (4.45)	427	1.13 (3.25)	491	0.91 (2.91)
Control	641	0.86 (2.96)	591	1.22 (3.72)	612	1.77 (5.03)	447	1.39 (4.44)	473	0.89 (2.72)
Severe physical										
Treatment	680	0.30 (1.55)	605	0.34 (1.76)	648	0.56 (2.52)	427	0.33 (1.63)	491	0.25 (1.32)
Control	641	0.31 (1.68)	591	0.58 (2.54)	612	0.70 (2.84)	447	0.64 (2.72)	473	0.27 (1.37)
Sexual										
Treatment	680	0.10 (0.67)	604	0.07 (0.59)	648	0.17 (0.91)	427	0.06 (0.42)	491	0.05 (0.44)
Control	641	0.07 (0.53)	591	0.18 (0.92)	612	0.21 (0.96)	447	0.19 (0.93)	473	0.07 (0.47)
Victimization										
Psychological										
Treatment	686	6.91 (8.34)	606	6.50 (8.31)	648	7.83 (9.85)	429	7.21 (8.93)	493	6.93 (8.49)
Control	653	6.75 (8.10)	593	7.07 (8.62)	615	7.63 (9.60)	448	6.86 (8.87)	476	6.45 (8.05)
Moderate physical										
Treatment	686	1.90 (3.98)	605	1.71 (4.30)	648	2.13 (4.88)	429	1.83 (4.09)	492	1.65 (3.84)
Control	653	1.77 (3.71)	596	1.93 (4.21)	616	2.57 (5.79)	448	1.90 (4.91)	477	1.68 (4.30)
Severe physical										
Treatment	686	0.51 (1.84)	605	0.60 (2.31)	648	0.81 (2.93)	429	0.52 (1.97)	492	0.41 (1.61)
Control	653	0.38 (1.43)	596	0.64 (2.22)	616	1.02 (3.26)	447	0.72 (2.75)	447	0.45 (1.90)
Sexual										
Treatment	684	0.24 (0.85)	605	0.24 (0.90)	647	0.35 (1.15)	429	0.26 (0.99)	492	0.15 (0.64)
Control	653	0.22 (0.78)	596	0.29 (1.04)	616	0.42 (1.25)	447	0.28 (1.01)	477	0.20 (0.74)

high amounts of severe physical perpetration at baseline, there were no significant differences between the treatment and control groups in severe physical perpetration at any of the four follow-up waves ($p = .80$). Thus, there appears to be both primary and secondary prevention effects on severe physical violence perpetration, but secondary prevention effects were not observed for adolescents who were using high amounts of severe physical violence against their dating partners prior to the intervention.

Table 2. Reduced Models When Predicting Perpetration of Dating Violence

	Psychological perpetration		Moderate physical perpetration		Severe physical perpetration		Sexual perpetration	
	b	95% CI	*b*	95% CI	*b*	95% CI	b	95% CI
Intercept	0.80	−1.48, 3.08	−0.42	−1.56, 0.71	−0.17	−0.92, 0.59	0.03	−0.24, 0.30
Treatment	−0.95	−1.48, −.41***	−0.36	−0.66, −0.06*	−0.29	−0.47, −0.11***	−0.05	−0.11, 0.00*
Gender	−0.51	−1.05, 0.02	−0.38	−0.63, −0.13**	−0.34	−0.52, −0.16***	−0.17	−0.23, −.12***
Race	1.03	0.35, 1.70**	0.88	0.56, 1.19***	0.38	0.14, 0.62**	0.08	0.01, 0.15*
Baseline outcome	0.90	0.58, 1.23***	0.41	0.35, 0.46***	0.31	0.23, 0.40***	0.29	0.24, 0.35***
Time	1.36	0.00, 2.72*	0.87	0.19, 1.55**	0.54	0.10, 0.98*	0.11	−0.04, 0.26
Treatment × baseline outcome					0.12	0.01, 0.24*		
Time × baseline outcome	−0.25	−0.45, −0.05**					−0.02	−0.04, 0.00
Time × time	−0.20	−0.39, −0.02*	−0.12	−0.22, −0.03**	−0.08	−0.14, −0.02**		
Time × time × baseline outcome	0.03	0.00, 0.06*						

Note: Analyses control for the correlation between individuals in the same school and between times within an individual
*$p < .05$; **$p < .01$; ***$p < .001$

Table 3. Reduced Models When Predicting Dating Violence Victimization

	Psychological victimization		Moderate physical victimization		Severe physical victimization		Sexual victimization	
	b	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI
Intercept	0.99	−1.68, 3.66	−0.69	−2.33, 0.95	−0.85	−1.76, 0.06	−0.03	−0.29, 0.23
Treatment	−0.48	−1.16, 0.20	−0.49	−0.86, −0.11**	−0.19	−0.44, 0.07	−0.06	−0.13, 0.00
Gender	0.60	−0.25, 1.45	0.12	−0.71, 0.94	1.23	−0.06, 2.51	−0.14	−0.23, −0.05**
Race	0.80	−0.09, 1.68	0.38	−0.06, 0.83	0.23	0.01, 0.45*	0.02	−0.05, 0.09
Baseline outcome	0.59	0.50, 0.68***	0.66	0.56, 0.77***	0.41	0.36, 0.47***	0.29	0.24, 0.33***
Time	1.64	0.11, 3.17*	1.30	0.36, 2.25**	1.02	0.46, 1.58***	0.21	0.05, 0.37**
Gender × time			−0.22	−0.43, −0.00*	−1.05	−1.84, −0.25**		
Time × baseline outcome	−0.03	−0.05, −0.00*	−0.03	−0.06, −0.00*				
Time × time	−0.20	−0.42, 0.02	−0.16	−0.30, −0.03*	−0.15	−0.23, −0.06***	−0.03	−0.05, −0.01**
Gender × time × time					0.15	0.03, 0.26*		

Note: Analyses control for the correlation between individuals in the same school and between times within an individual.
*$p < .05$; **$p < .01$; ***$p < .001$.

Safe Dates Effects and Moderators of Effects on Victimization

The mean and standard deviation for each victimization outcome at each of the five waves by treatment condition are presented in Table 1. Table 3 presents the results from the reduced models examining program effects and moderators of program effects on the four victimization outcomes. Race, gender, and prior involvement in dating violence did not moderate Safe Dates effects on any of the victimization outcomes and therefore those interactions are not considered further.

As shown in Table 3, there are significant main effects of treatment condition on moderate physical violence victimization ($p = .01$). Compared to controls, adolescents who received Safe Dates reported less victimization from moderate physical dating violence at all four follow-up waves. The absence of a significant treatment condition by baseline outcome interaction suggests that there are both primary and secondary prevention effects on that outcome. There was a marginal program effect on sexual victimization ($p = .07$) in the expected direction. Treatment condition was not associated with psychological abuse victimization ($p = .17$) or severe physical victimization ($p = .14$) at any of the four follow-ups.

Assessment of Mediation

As shown in Table 4, there are significant main effects of treatment condition on dating violence norms ($p < .0001$), gender-role norms ($p < .0001$), and beliefs in need for help ($p = .02$). Those findings indicate that adolescents who received Safe Dates reported less acceptance of prescribed dating violence norms, less acceptance of traditional gender-role norms, and greater belief in need for help at all four follow-up periods than those in the control group. When predicting awareness of community services, there was a significant interaction between treatment condition and time-squared ($p < .0001$). The significant interaction reflects the fact that treatment and control differences were greatest at wave 2 and the least at wave 4. However, there were statistically significant ($p < .0001$) treatment effects in the expected direction at all four follow-up periods. There were no effects of treatment on conflict resolution skills at any of the follow-up waves ($p = .09$).

Table 5 presents a summary of our analyses for determining mediation. In the table, we report the beta coefficient and *p*-values associated with the significant program effects presented in Tables 3 and 4 and discussed above when (1) no mediating variables were included in the reduced models, (2) when all five mediating variables were included in the reduced models, and (3) when each of the five mediating variables were entered into the reduced models one at a time. In all cases, the addition of the five mediating variables measured at the five waves decreased significant program effects to non-significance, providing evidence for mediation. However, as can be seen from the models in which each mediator variable was added one at a time, some variables accounted for more of the attenuation in the beta coefficients and *p*-values for the treatment and dating violence associations than others. Dating violence norms mediated all program effects. Gender-role norms mediated

Table 4. Reduced Models When predicting the Mediator Variables

	Dating violence norms		Gender role norms		Conflict management skills		Belief in need for help		Awareness of community services	
	b	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI
Intercept	7.96	6.85, 9.08***	3.91	2.64, 5.18***	5.56	4.88, 6.24***	2.72	2.32, 3.11***	0.34	0.17, 0.50***
Treatment	−0.71	−0.99, −0.42***	−0.93	−1.29, −0.56***	0.35	−0.05, 0.76	0.13	0.02, 0.24*	1.32	1.05, 1.59***
Gender	−1.86	−2.14, −1.58***	−3.39	−3.76, −3.02***	2.35	1.95, 2.76***	0.44	0.33, 0.55***	0.12	0.09, 0.16***
Race	0.62	0.30, 0.95***	0.73	0.31, 1.14***	−0.22	−0.68, 0.23	−0.23	−0.35, −0.11***	−0.04	−0.08, −0.00*
Baseline mediator	0.40	0.36, 0.44***	0.49	0.45, 0.53***	0.34	0.30, 0.37***	0.23	0.19, 0.27***	0.23	0.19, 0.27***
Time	−3.32	−3.99, −2.64***	1.04	0.30, 1.79**	0.76	0.63, 0.89***	0.71	0.50, 0.92***	−0.13	−0.23, −0.03**
Treatment × time									−0.56	−0.73, −0.39***
Time × time	0.54	0.45, 0.64***	−0.14	−0.25, −0.03**			−0.10	−0.13, −0.07***	0.03	0.13, 0.04***
Treatment × time × time									0.07	0.04, 0.09***

Note: Analyses control for the correlation between individuals in the same school and between times within an individual.
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 5. Parameter Estimates and *p*-Values of Significant Program Effects from Tables 3 and 4 with the Addition of Mediator Variables

	Psychological perpetration (main effect)		Moderate physical perpetration (main effect)		Severe physical perpetration (treatment × baseline × outcome)		Sexual perpetration (main effect)		Moderate physical victimization (main effect)	
	b	*p*-value	*b*	*p*-value	*b*	*p*-value	*b*	*p*-value	*b*	*p*-value
Significant treatment effects from Tables 3 and 4 with no mediators added	−0.95	0.0005	−0.36	0.02	0.12	0.04	−0.05	0.04	−0.49	0.01
Significant treatment effects from Tables 3 and 4 with the addition of all 5 mediators	−0.02	0.92	0.05	0.73	0.09	0.12	0.01	0.70	0.07	0.69
Significant treatment effects from Tables 3 and 4 with the addition of:										
Prescribed norms	−0.34	0.16	−0.09	0.51	0.10	0.09	−0.01	0.81	−0.13	0.46
Gender stereotyping	−0.49	0.06	−0.19	0.19	0.12	0.05	−0.02	0.34	−0.19	0.29
Conflict management skills	−0.95	0.0005	−0.36	0.02	0.12	0.04	−0.05	0.04	−0.49	0.01
Belief in the need for help	−0.85	0.001	−0.31	0.04	0.11	0.05	−0.05	0.07	−0.41	0.03
Awareness of community services	−0.71	0.01	−0.23	0.13	0.12	0.05	−0.04	0.15	−0.5	0.08

all of the program effects except for the effects on severe physical perpetration, and awareness of community services mediated all of the program effects except for the effects on psychological and severe physical perpetration. Conflict management skills and belief in the need for help mediated few of the program effects.

DISCUSSION

In summary, adolescents who were exposed to Safe Dates in the eighth or ninth grade, as compared to those who were not, reported less psychological, moderate physical, and sexual dating violence perpetration and less moderate physical dating violence victimization at all four follow-up periods. Additionally, there was a marginal program effect ($p = .07$) on sexual dating violence victimization at all four follow-up periods. Also, in comparison to controls, adolescents exposed to Safe Dates and who reported at baseline no or average prior involvement in severe physical perpetration reported less severe physical perpetration at all four follow-up periods. Safe Dates had both primary and secondary prevention effects on all six of these outcomes and the program was equally effective for males and females and for whites and non-whites. Program effects were mediated primarily by changes in dating violence norms, gender-role norms, and awareness of community services.

The experimental design that was used controls for most threats to internal validity. However, threats imposed by differential attrition and/or differential predictors of attrition by treatment condition are not controlled by design. Even so, it is unlikely that our favorable effects are due to those factors because the amount of attrition was similar for the treatment and control groups and because we used multiple imputation procedures to fill in missing data, thus eliminating the possibility of differential predictors of attrition. Another potential explanation for the favorable effects not controlled by design is that adolescents in the treatment group as compared to those in the control group provided more socially desirable responses to the behavioral measures. However, the consistency of findings across multiple waves and the long time period (3 years) between program exposure and the final follow-up period would suggest that this is an unlikely explanation. A likely remaining explanation for the favorable effects is that Safe Dates caused the changes observed.

In the present study, we found positive program effects at all four follow-up periods, with the final period being 3 years after program exposure. In earlier analyses of the eighth grade cohort, we found positive program effects 4 years after exposure to Safe Dates (Foshee *et al.*, 2004). Evaluations of school-based prevention programs targeted at other adolescent problem behaviors, like substance use, rarely show lasting effects; behavioral effects typically

fade while effects on cognitive risk factors persist (Dusenbury *et al.*, 1997). Consistent and long-term effects may have been realized because Safe Dates was offered at the beginning of the adolescent's dating careers (eighth and ninth grades) and included information and skills that could be incorporated into individual dating practices that continued through the high school years.

Mediation is directly empirically assessed by examining the effect that the inclusion of the time-dependent mediating variable has on the coefficient and significance level associated with the program to outcome relationships (MacKinnon *et al.*, 2000). Assessment of mediation is essential for further development and refinement of programs and for guiding clinical practice. In the present study, we found that program effects were mediated by dating violence norms, gender-role norms, and awareness of community services. These are the same mediators of program effects that we found in earlier analyses of the 1-month follow-up data when attrition was very low (Foshee *et al.*, 1998). Conflict management skills and belief in need for help did not mediate program effects. These findings can be directly applied to revise Safe Dates and to develop future dating violence prevention efforts.

Safe Dates did not prevent or reduce psychological victimization at any of the follow-up periods. While the Safe Dates curriculum incorporated examples of psychological abuse, more examples and emphasis were given to physical and sexual violence. The play focused on the negative consequences of a physically abusive relationship and sources of help for those in physically abusive relationships. Thus, Safe Dates might have inadvertently sent a message to adolescents that the consequences of dating a psychologically abusive partner are not severe, decreasing the adolescent's motivation to leave those kinds of relationships. These findings have additional implications for revising the Safe Dates program.

Safe Dates also did not prevent or reduce severe physical victimization at any of the follow-up periods and it did not reduce severe physical perpetration at any of the follow-up periods by those who had perpetrated many severe physical acts prior to program exposure. Adolescents who are being victimized by very abusive partners, such as those who frequently use severe forms of violence, may feel too powerless, afraid, and trapped to leave those relationships. Perpetrators who frequently use severe forms of physical dating violence may have patterns of abuse that resist change. Victims and perpetrators of severe physical violence may require more intensive one-on-one types of intervention for change than the Safe Dates program provides.

Although many strengths of multiple imputation procedures have been mentioned throughout this paper, that approach to filling in missing data is not without issues. Although the theory guiding those procedures has been around for approximately 40 years, the computational capabilities are very recent. Thus, there have been relatively few practical applications of the theory and, as a result, the body of knowledge on problems encountered in practical applications and solutions to those problems is limited. As one example, Horton and Lipsitz (2001) suggest that if a missingness equation is mis-specified it can bias study conclusions. As described earlier, there are guidelines as to which types of variables should be specified in the missingness equation (Allison, 2000; Schafer, 1999) but those guidelines are general. Little research has examined how variations in the missingness equation can influence study conclusions. Another issue with using multiple imputation procedures is that it is impossible to directly test its primary assumption that missing values are not dependent on the value itself (Horton & Lipsitz, 2001; Patrician, 2002) because there is no way of knowing the values of the missing data. This is a common, if not automatic, assumption made in many statistical applications. In many intervention trials for preventing adolescent problem behaviors it is possible that data are not missing at random. Additionally, studies have not thoroughly investigated the impact that the amount of missing data has on the stability of parameter estimates. Despite these issues, as discussed above, multiple imputation procedures have several advantages over other approaches to dealing with missing data.

In conclusion, our findings suggest that Safe Dates prevented and reduced dating violence among adolescents. Program effects were evidenced as many as 3 years post intervention, which is an unusually long time for sustained program effects on an adolescent problem behavior. Program effects were not moderated by gender or race but some effects were moderated by prior involvement in dating violence. Our findings suggest that implementation of the Safe Dates program to reduce dating violence is warranted. Additionally, the results from the assessment of mediator variables provide direct guidance for the development of future dating violence prevention programs and for the modification of the Safe Dates program. They suggest that efforts at changing dating violence norms, gender-role norms, and

awareness of community services hold promise for preventing adolescent dating violence and that the content from Safe Dates focused on teaching conflict resolution skills and altering beliefs in the need for help need to be modified.

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