Gender Moderation and Social Developmental Mediation of the Effect of A Family-Focused Substance Use Preventive Intervention on Young Adult Alcohol Abuse

W. Alex Mason[a,b], **Rick Kosterman**[c,d], **Kevin P. Haggerty**[c], **J. David Hawkins**[c], **Cleve Redmond**[e], **Richard L. Spoth**[e], and **Chungyeol Shin**[e]

[a]National Research Institute for Child and Family Studies, Boys Town, 14100 Crawford Street, Boys Town, NE 68010, USA; 1 402-498-1269; 1 402-498-1315 (fax). W. Alex Mason (masonwa@boystown.org)

[c]Social Development Research Group, University of Washington, 9725 3rd Ave NE, Suite 401, Seattle, WA 98115, USA. 1 206-685-1197. Rick Kosterman (rickk@u.washington.edu), Kevin P. Haggerty (haggerty@u.washington.edu), J. David Hawkins (jdh@u.washington.edu)

[e]Partnerships in Prevention Science Institute, Iowa State University, 2625 North Loop Drive, Suite 500, Ames, IA 50010, USA; 1 515-294-3613; Cleve Redmond (cleve@iastate.edu), Richard L. Spoth (rlspoth@iastate.edu), Chungyeol Shin (cshin@iastate.edu)

Abstract

This study examined the long-term impact of Preparing for the Drug Free Years (PDFY) on young adult alcohol abuse disorder, addressing theory-based questions about how, and for whom, the program had its effects on the outcomes. Participants were 429 families of 6th graders enrolled in 33 rural schools located in the Midwestern United States. Schools were randomly assigned to conditions. Target adolescents (52% female) were interviewed periodically from age 11 to age 22; throughout adolescence, information was collected also from the youths' parents. Moderation and mediation analyses were conducted using regression analysis and structural equation modeling with covariates measured at baseline (age 11), mediators measured at posttest (age 12), and the outcome measured at the young adult follow-up (age 22). Results showed that PDFY reduced the rate of alcohol abuse among target young women, with evidence that this effect was mediated by increased prosocial skills. The rate of alcohol abuse among PDFY group men was not significantly different from that of control group men. Findings have implications for reducing the public health burden of alcohol abuse among young women.

Keywords

Alcohol Abuse; Prevention; Mediation; Longitudinal; Gender

---

1. Introduction

Although declining, the rate of alcohol use among adolescents in the United States remains high (Johnston, O'Malley, Bachman, & Schulenberg, 2005). A high rate of alcohol use persists into early adulthood (Naimi et al., 2003), and alcohol abuse peaks during this developmental period (Grant et al., 2004; Guo, Hawkins, Hill, & Abbott, 2001). Alcohol abuse, which refers to a maladaptive pattern of drinking that results in health consequences and social problems, is a major public health concern (Grant et al., 2004). Preventing such consequences and problems by reducing risk and enhancing protection can help avoid the costs of alcohol abuse among adults (Spoth, Guyll, & Day, 2002).

Of the many risk and protective factors associated with alcohol use and abuse among youths, psychosocial factors within the family are particularly important (Barnes, Farrell, & Banerjee, 1995; Brook, Cohen, Whiteman, & Gordon, 1992; Guo et al., 2001; Mason & Windle, 2001). For example, in a study of children followed from age 10 to age 21, Guo et al. (2001) found that parental monitoring, clear family rules, and parental rewards for good behavior in adolescence predicted lower risk for alcohol abuse/dependence in early adulthood. Thus, family-focused interventions that improve parenting and family interactions, and reduce teen alcohol use, may inhibit alcohol abuse among target participants as young adults.

This paper reports findings from a randomized controlled trial of Preparing for the Drug Free Years (PDFY, currently called Guiding Good Choices), a program for parents of children aged 8 – 14 years. The program's design was guided by the social development model (SDM, Catalano & Hawkins, 1996; Hawkins & Weis, 1985), which draws from social control theory in positing that a key protective factor against substance use is bonding to prosocial others, especially family members. Based on social learning and differential association theories, the SDM specifies the mechanisms through which bonds develop. Bonding is hypothesized to be determined by the levels of opportunities provided to the child for involvement in the family and actual prosocial involvement, the child's skills for involvement with family members, and the discipline received from parents. The model also hypothesizes that external constraints, such as monitoring, influence bonding and behavior.

Accordingly, PDFY (Hawkins & Catalano, 1988) emphasizes parenting and parent-child interactional skills for: creating opportunities for involvement and interaction in the family (e.g., in family meetings); establishing clear family rules, monitoring the behavior of children, and disciplining children; teaching children skills to resist peer influences to use drugs; and expressing positive feelings and developing bonding while reducing anger and conflict.

This paper reports young adult data from the long-term Project Family prevention trial (Spoth & Redmond, 2002), which has followed target children throughout adolescence, from age 11 through age 18, and into adulthood, at age 22. A series of prior PDFY analyses, focused primarily on the adolescent years, has demonstrated improved parenting and parent-child interactional skills (Kosterman, Hawkins, Haggerty, Spoth, & Redmond, 2001; Kosterman, Hawkins, Spoth, Haggerty, & Zhu, 1997; Spoth, Redmond, & Shin, 1998). PDFY also has been shown to reduce alcohol (Park et al., 2000; Spoth, Redmond, & Shin, 2001), marijuana (Spoth et al., 2001), and polysubstance use (Mason, Kosterman, Hawkins, Haggerty, & Spoth, 2003) during adolescence, with the strongest and most consistent substance-related intervention effects occurring for alcohol involvement among teens. Next steps in this long-term trial have been to examine young adult outcomes.

Another paper, currently under review, reports intervention main effects across a range of problematic substance use outcomes in early adulthood (drunkenness, alcohol-related

problems, cigarette use, illicit drug use, polysubstance use), along with indirect effects via adolescent growth trajectories of substance initiation (Spoth, Trudeau, Guyll, Shin, & Redmond, under review). In addition, an earlier supplemental report examined prescription drug misuse among late adolescents and young adults, using data from this prevention trial and a separate one (Spoth, Trudeau, Shin, & Redmond, 2008). These two papers did not consider clinical diagnostic outcomes, theoretically-specified mediators, or moderators. Here, previous and ongoing work is extended by testing hypothesized social developmental mediators of the long-term effect of PDFY, implemented at age 11, on the diagnostic assessment of alcohol abuse disorder among participants as young adults, at age 22. In general, and particularly with respect to the alcohol outcomes in the main effects paper, measures were selected to capture public health impact of young adult substance use, rather than clinical or diagnostic outcomes. The public health oriented alcohol measures and the alcohol abuse diagnostic measure correlate only modestly, indicating that while they are related, they by no means tap identical constructs.

Research that considers how distal intervention effects are achieved in long-term prevention trials is needed, but few direct tests of mediation have been conducted (Ennett et al., 2001; MacKinnon et al., 1991; Orlando, Ellickson, McCaffery, & Longshore, 2005), and it can be difficult to demonstrate indirect effects of an intervention over an extended period of time (Shrout & Bolger, 2002). Indeed, existing prevention studies sometimes have revealed relatively weak support for hypothesized intervention mechanisms (e.g., Ennett et al., 2001). This study examined SDM constructs and a measure of intervention-targeted family management as possible mediators of the PDFY effect on alcohol abuse. We expected that increased prosocial opportunities, involvement, skills, rewards, bonding, and family management at posttest (age 12) would mediate the effect of PDFY on alcohol abuse at age 22. We examined changes in these processes at posttest, immediately after the intervention, because this corresponds to early adolescence, during which our family-focused substance use intervention was expected to have its most direct and strongest impact.

The possible moderating influence of gender also was explored. This was not an *a priori* hypothesis of the prevention trial, therefore prior project analyses have not examined gender moderation of intervention effects. However, less is known about alcohol abuse among women than men (National Center on Addiction and Substance Abuse, 2006). Although the prevalence of alcohol abuse is lower among young women than young men (Grant et al., 2004), many health-related consequences of alcohol abuse are more severe for females than males (Nolen-Hoeksema, 2004). Some studies have reported that psychosocial risk and protective factors have stronger effects on alcohol abuse for females than males (Guo et al., 2001; Yeh, Chiang, & Huang, 2006). For example, Guo et al. (2001) found that family opportunities at age 10 had a stronger negative effect on a measure of alcohol abuse and dependence at age 21 for young women compared to young men. Although additional potential moderators deserve systematic attention, an emerging literature highlights gender moderation as particularly promising, suggesting that psychosocial preventive interventions may have a greater impact for females than males. Drawing on the strengths of our gender-balanced sample, the current analyses focus on testing possible gender differences in the effects of PDFY.

2. Methods

2.1. Sample

Participants were families of sixth graders enrolled in 33 rural schools in 19 counties throughout Iowa. Selection criteria for the schools included school lunch program eligibility (15% or more of district families eligible for free or reduced cost lunches) and community size (populations less than 8,500). Blocked on the proportion of lower income students and

school size, 11 schools each were randomly assigned to one of three conditions: a minimal-contact control condition, the PDFY condition, and the Iowa Strengthening Families Program (ISFP) condition. Analyses were restricted to PDFY and control group data because a key aim was to examine intervention mediators drawn from the SDM, which is the underlying theory for PDFY, and because ISFP data were unavailable to the current investigative team.[1]

All families with sixth graders enrolled in the selected schools were invited to participate (*n* = 883 from the 22 schools assigned to the PDFY and control conditions). Forty-nine percent (*n* = 429) of invited families completed pretesting, including 221 PDFY families and 208 control families. Refusal rates across conditions were similar. Participating families were not aware of the condition to which their child's school had been assigned until after pretesting. The trial was age-specific, therefore only one child per family was recruited into the study.

Families had an average of three children. The average age of target children was 11.35 years and 52% were female. Most (86%) families were dual-parent. The average age of mothers and fathers at baseline was 36.91 and 39.56 years, respectively; 61% of mothers and 58% of fathers reported having some post-high school education. The median annual household income was $32,000 in 1993. Over 95% of the participants were White.

2.2. External Validity

Analyses from a participation factor survey with a 90% participation rate demonstrated the representativeness of the sample on family demographic and psychosocial characteristics. Only parent educational attainment was significantly associated with participation; participating parents reported 0.7 years more education on average than nonparticipating parents (Spoth et al., 1998; Spoth, Redmond, Kahn, & Shin, 1997).

Eighty-five percent (*n* = 363) of pretested families participated at posttest (age 12), 73% (*n* = 311) at the 7th-grade follow-up (age 13), 67% (*n* = 286) at the 8th-grade follow-up (age 14), 69% (*n* = 295) at the 10th-grade follow-up (age 16), and 71% (*n* = 305) at the 12th-grade follow-up (age 18). At the young adult follow-up, 73% (*n* = 313) of target respondents completed the young adult survey at an average age of 21.56 years, including 152 PDFY group and 161 control group respondents. There has been little evidence from extensive attrition analyses (e.g., comparing those who completed all assessments with those who attrited after the pretest on a range of demographic characteristics and psychosocial variables) of selective attrition from the longitudinal trial; however, adolescent alcohol drinkers were more likely to leave the study than nondrinkers, and families of more highly educated parents were more likely to stay in the study than families of less highly educated parents.

2.3. Internal Validity

Pretest equivalence of conditions across a range of family, school, student, community, and psychosocial characteristics has been established (Spoth, Goldberg, & Redmond, 1999; Spoth et al., 1998). Current analyses tested for pretest equivalence on SDM constructs, family management, and the alcohol risk covariate at age 11. Results showed only two significant effects among the 19 comparisons examined: Mean levels on two of the three indicators of the prosocial opportunities construct at pretest were lower among control

---

[1]This research project involved the merger of two separately funded program evaluation trials, one of which was to be conducted as a collaboration between investigators at Iowa State University (ISU) and the University of Washington (UW), from which the current analyses were derived, and the other to be conducted as a collaboration between ISU and another university (not part of the current investigation). The ISU-UW collaboration was established to enable the UW team to examine outcomes and other factors related to PDFY, which was designed by and based on theory developed by UW investigators.

versus PDFY families. As a control, each analysis included an adjustment for pretest level of the SDM construct under consideration.

Differential attrition across experimental conditions from pretest to the young adult follow-up was examined by conducting 2 (Experimental Condition) X 2 (Attrition) analyses of variance on over 15 demographic (e.g., family income, marital status) and psychosocial (e.g., substance use) characteristics, the risk covariate, and indicators of all SDM constructs and family management. None of the condition–by-attrition interaction effects was statistically significant. Only one statistically significant interaction effect was found in gender subgroup analyses. For females, the condition-by-pretest-to-posttest attrition product term had a statistically significant (p = .047) effect on one indicator of prosocial rewards, with control group stayers having a slightly higher mean level of prosocial rewards compared to other groups. Thus, bias due to differential attrition across conditions is not likely to be a concern.

2.4. Intervention Implementation and Fidelity

Four of the five weekly PDFY sessions involved parents only, whereas one session, which focused on peer resistance skills to avoid problem behavior, involved parents and children. Fundamental program content was provided via videotape. Nineteen PDFY workshops led by 15 two-person group leader teams were conducted. An average of 10 families participated in each group, with an average of 16 individuals per session (25 for the session that included adolescents). Fidelity observations were conducted by trained observers and demonstrated high coverage of key program concepts (Spoth et al., 1998; Spoth et al., 2001). Of the 221 families assigned to the PDFY condition, 124 participated in the program. Although 44% of the PDFY group families declined to participate in the intervention, attendance was high among those who did participate; 94% of attending families was represented by a family member in three or more sessions. Intent-to-treat analyses were conducted, in which all participants assigned to the intervention condition (program attenders and nonattenders) contributed to the analysis sample. Control group families were provided with four fact sheets describing various aspects of adolescent development.

2.5. Procedure

Families actively consenting to participate received information describing the prevention trial. Subsequently, each family received a packet that included an initial questionnaire to be completed individually by the parent(s) and the target child prior to an in-home visit. In the fall of 1993, families were visited in their homes and individually completed additional questionnaires. All participants were assured of the confidentiality of their responses. In-home visits lasted an average of 2.5 hours. Each family member was compensated $10/hour for their participation. Approximately 9 months after pretesting, similar procedures were used to conduct a posttest assessment. Such procedures were used also to conduct follow-up assessments approximately 21, 33, 51, and 75 months after the pretest, when students were in the 7th, 8th, 10th, and 12th grades, respectively. In fall 2004, computer-assisted telephone interviewing procedures were used to collect information from target respondents in early adulthood. All study procedures were approved by the Human Subjects Review committees at Iowa State University and the University of Washington.

2.6. Measures

Alcohol abuse disorder (age 22)—Past-year alcohol abuse disorder at age 22 was measured using a short form of the Diagnostic Interview Schedule (DIS, Robins, Helzer, Cottler, & Goldring, 1989). Reponses to the interview questions were incorporated into a computer algorithm that was used to determine those who met criteria for a DSM-IV alcohol abuse disorder in the past 12 months, which indicates whether or not respondents

experienced clinically significant impairment in the form of either failure to fulfill major role obligations due to drinking, drinking in physically hazardous situations, recurrent alcohol-related legal problems, or persistent drinking despite adverse consequences. The variable was coded 1 for those who met criteria and 0 for those who did not meet criteria for the disorder. The DIS has been shown to be reliable and valid (Leaf, Myers, & McEvoy, 1991; Newman et al., 1996).

Social development model constructs (age 12)—Posttest measures of SDM constructs at age 12 were examined as possible mediators. To assess change in the mediators, analyses included an estimate of the stability of each construct by including a pretest (age 11) measure of the mediator as a covariate. Drawing from a variety of self- and parent-report items, three measures each were constructed as indicators for latent constructs of prosocial opportunities (e.g., perceived opportunities for parent-child interaction), prosocial involvement (e.g., parent-child involvement), prosocial skills (e.g., refusal and problem-solving skills), prosocial rewards (e.g., parent approval), and prosocial bonds (e.g., parent-child affection). A detailed description of these indicators, with sample items and psychometric information, is provided elsewhere (Kosterman, Haggerty, Spoth, & Redmond, 2004). All indicators were coded such that higher scores indicate a higher level of the prosocial variable.

Intervention-targeted family management (age 12)—Several existing family management questionnaire items were formed into a new set of latent variable indicators for the current analyses; therefore, additional psychometric information about these measures is provided here. An intervention-targeted family management latent construct was indicated by three measures of family management practices at age 12. An identical construct was formed at age 11 using pretest measures of family management to control for the stability of the construct over time. Two parent-report items comprised an indicator of anger management within the family (pretest α =.61; posttest α =.62). Five parent-report items were used to create an indicator of the extent to which families held meetings for various purposes, such as to plan family fun (pretest α = .83; posttest α = .84). Finally, 13 parent-report items were used to create a general child management measure that assessed parental monitoring and discipline (pretest α =.81; posttest α =.81).

Additional variables—Intervention condition was coded 1 for PDFY group and 0 for control group. Gender was coded 1 for males and 0 for females. Analyses also included child age (M = 11.35, SD = .50) and a risk covariate, which served as a measure of early (age 11) propensity for alcohol abuse. Specifically, a cumulative risk index was computed from five questions that indexed the presence (coded 1) or absence (coded 0) of any parental service use for drug and alcohol problems within the past year, any target child substance use within the past year, any target child drug or alcohol problems within the past year, any target child delinquency within the past year, and having the target child report that most of his or her friends use alcohol. Descriptive analyses showed that 29% of the target participants reported at least one risk at age 11; 6% report two or more risks. Other demographic variables, such as family structure, were considered in preliminary analyses but were not related to the outcomes and did not influence associations among the study measures; therefore, they were excluded from the primary analyses.

2.7. Data Analyses

Moderation and mediation tests were conducted using regression analysis and structural equation modeling (SEM) with Mplus 4.2 (Muthén & Muthén, 1998–2006). Alcohol abuse disorder was specified as a binary variable in the Mplus syntax, and parameter estimates were based on the Weighted Least Squares Mean-Variance adjusted (WLSMV) estimator

with missing data estimation. Delta method standard errors were generated using the Mplus Model Indirect command to calculate the statistical significance of the indirect effects in the mediation models. These analyses included an adjustment for clustering within schools. Model fit for the SEMs was examined using the chi-square statistic, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA). With moderate to large sample sizes, the chi-square statistic often is statistically significant (indicating a degree of model misfit); therefore, statisticians have recommended that a CFI and TLI of close to .95 or greater and an RMSEA of close to .06 or less indicate acceptable model fit (Hu & Bentler, 1999). A caveat to these recommendations is that statistical simulations typically have been based on maximum likelihood estimation, and the applicability of current model fit guidelines for other estimators is less well understood. Thus, it can be advantageous to consult a variety of fit indices to construct a picture of overall model fit.

3. Results

3.1. Alcohol Abuse Disorder Prevalence

Sixteen percent and 21% of PDFY group participants and control group participants, respectively, met criteria for alcohol abuse disorder in the past year. This overall difference was in the expected direction, but was not statistically significant, $\chi2$ (1; n = 313) = .85, p = .36. Alcohol abuse was more common among men (27%) than young women (11%), χ^2 (1; n = 313) = 12.53, $p < .01$. The rate of alcohol abuse for PDFY group men (29%) was slightly higher but not significantly different from the rate for control group men (25%), χ^2 (1; n = 313) = .19, p = .66. The rate of alcohol abuse for PDFY group women (6%) was significantly lower than the rate for control group women (16%), χ^2 (1; n = 313) = 4.34, p = .04.

3.2. Gender Moderation

To formally test for gender moderation, regression analyses using Mplus were conducted. First, the alcohol use disorder variable was regressed on PDFY, gender, PDFY x gender, age, and alcohol risk using the WLSMV estimator. Analyses adjusted for clustering within schools. The effect of the PDFY x gender product term was statistically significant (B = .67, $s.e.$ = .31, $p < .05$; β = .27), and the form of this interaction was consistent with gender differences described above. More importantly, the effect of PDFY on the outcome was statistically significant (B = −.57, $s.e.$ = .28, $p < .05$; β = −.27). With the product term in the model, this parameter represents the simple effect of PDFY on alcohol abuse disorder for women, who comprised the reference group on the gender variable; thus, there was a significant reduction in disorder among PDFY compared to control group women.

3.3. Mediation

Five structural equation models were conducted to examine, in turn, each SDM construct of prosocial opportunities, involvement, skills, rewards, and bonds as possible mediators of the PDFY intervention effect on alcohol abuse for young women. A sixth model examined possible mediation through intervention-targeted family management. In each model, PDFY, gender, PDFY x gender, age, and alcohol risk were specified as predictors of both the mediator at posttest (age 12) and alcohol abuse disorder at the young adult follow-up (age 22), along with an estimate of the effect of the mediator on the outcome. Moreover, the pretest (age11) measure of the mediator was included as an additional predictor of the

---

[2]Where consistent measures of constructs were available over time, further analyses were conducted with mediators measured at later time points. Substantive conclusions from these analyses were the same as those reported herein.

intervening variable to control for the stability of the construct over time. By accounting for the stability of the constructs, we were able to examine the extent to which PDFY was associated with change in the mediators from pretest to posttest[2] (Windle, 1997). One of the three indicators of each latent variable was selected as a reference indicator and the factor loading for that measure was constrained to 1.0. Freely estimated factor loadings of the same indicator measured at pretest and posttest were constrained to equality over time to ensure a common measurement model at the two time points. Correlations among the measurement errors of the same latent variable indicators measured over time were freely estimated in each model.

Note that the effect of PDFY on alcohol abuse disorder in all of the models represented the simple effect of the intervention on the outcome for women, since the interaction was included as a predictor and women represented the reference group on the dummy coded gender variable. Thus, to test mediation of the significant intervention effect for women, our primary interest was in the statistical significance of the indirect effect of PDFY on alcohol abuse disorder through the mediator. We also were interested in the extent to which the effect of the PDFY x gender product term on the outcome was mediated by the intervening variables, which would help explain the significant gender difference in response to the intervention.

Fit statistics are reported in Table 1. Overall model fit ranged from moderate to excellent, and was generally acceptable for each analysis when viewed across the fit indices. Although the degrees of freedom varied across models, due to the way in which degrees of freedom are obtained under WLSMV estimation (Muthén & Muthén, 1998–2006), each model was parameterized identically. A summary of the primary path coefficients involving the PDFY variable and the mediators, including the estimated indirect effect of PDFY on alcohol abuse, is provided in Table 2. Additional parameters are not reported due to space constraints.

The PDFY variable (i.e., the simple effect of the intervention for young women) had statistically significant associations with the posttest measures of prosocial skills and prosocial bonds, indicating improvements from pretest to posttest in these outcomes among PDFY compared to control group girls. In turn, the negative effect of prosocial skills at posttest on alcohol abuse disorder in early adulthood was statistically significant, and results showed that the overall indirect effect of PDFY on alcohol abuse disorder through prosocial skills was negative and statistically significant. As further evidence for mediation through skills, the unmediated direct effect of PDFY on alcohol abuse disorder was nonsignificant in this model; 21% of the total effect of the intervention on alcohol abuse disorder for young women was mediated through prosocial skills. None of the remaining proposed mediators was significantly associated with the outcome, and no other indirect effects were observed. Also, none of the models provided evidence for mediation of the effect of the PDFY x gender product term on the outcome. Standardized stability estimates ranged from .56 to .80. Estimated R^2 values for alcohol abuse disorder across the models were as follows: Opportunities = .15, Involvement = .15, Skills = .20, Rewards = .15, Bonds = .16, and Family Management = .16.

As a final analysis, a multivariate alcohol abuse disorder model that simultaneously included all of the hypothesized mediators was conducted. Results from these analyses are presented in brief to conserve space. The fit between the data and the multivariate model was acceptable, $\chi2$ (12, $N = 429$) = 31.89, $p = .001$; CFI = .93, TLI = .96, RMSEA = .06. Examination of the parameter estimates revealed a pattern of results similar to that revealed by the individual mediation analyses reported above. PDFY had statistically significant associations with the posttest measures of prosocial skills ($B = .23$, $s.e. = .09$, $p < .05$; $\beta = .$

27) and prosocial bonds ($B = .14$, *s.e.* $= .05$, $p < .05$; $\beta = .12$). Moreover, there was a significant link between skills and alcohol abuse disorder ($B = -1.75$, *s.e.* $= .47$, $p < .05$; $\beta = -.72$), and the specific indirect effect of the intervention on the outcome through skills was statistically significant ($B = -.41$, *s.e.* $= .17$, $p < .05$; $\beta = -.19$), providing evidence for mediation among young women. The estimated R^2 for alcohol abuse disorder in the model was .34.

4. Discussion

PDFY had a long-term effect on young adult alcohol abuse disorder that was moderated by gender. Young women who participated in PDFY with their families in early adolescence reported a lower rate of alcohol abuse in early adulthood compared to their control group counterparts. Although men are more likely to abuse alcohol than women, the rate of alcohol abuse among young women is not trivial (Grant et al., 2004), and many adverse health-related consequences of alcohol abuse are more severe for females than males (Nolen-Hoeksema, 2004). Because far less research has focused on alcohol abuse among women compared to men, this study contributes to an important gap in the literature (National Center on Addiction and Substance Abuse, 2006) and illustrates that brief preventive interventions can have effects on targeted outcomes that persist over an extended period of time (Skara & Sussman, 2003).

It is possible that gender moderation of the intervention effect was due to gender differences in the etiology of alcohol abuse disorder. If psychological and social characteristics play a more prominent role in the alcohol abuse of young women (Guo et al., 2001; Yeh et al., 2006), then psychosocial interventions might have a greater impact on pathways leading toward alcohol abuse among females compared to males. However, with a systematic examination of theoretically specified constructs as a starting point, the current analyses failed to identify significant SDM mediators of the PDFY x gender interaction effect, which would have helped explain the gender moderation finding. There may be other relevant mediators that were overlooked and went unmeasured in this study. For example, though they are not formal components of the intervention, PDFY may have prompted differential changes across gender groups in alcohol-specific processes, such as reduced reliance on coping motives for drinking or increased negative alcohol expectancies.

Another aim of this study was to examine mechanisms in the long-term intervention effect on alcohol abuse for young women. Results provided some evidence for mediation through prosocial skills. The PDFY variable, which represented the intervention effect for young women in our moderation models, had a positive effect on prosocial skills in early adolescence, indicating that target girls in PDFY group families increased their skills compared to target girls in control group families. In turn, adolescent prosocial skills were negatively related to young adult alcohol abuse disorder. The indirect effect of PDFY on alcohol abuse disorder was negative and statistically significant. Thus, among girls, PDFY appeared to improve prosocial skills in adolescence, and this improvement was associated, in turn, with a lower rate of young adult alcohol abuse disorder. This finding provides further support for the importance of interactive prosocial skills development as a key ingredient in preventive interventions (Tobler & Stratton, 1997).

None of the other constructs showed evidence of significant mediation. Overall, there was not strong empirical evidence that program effects were obtained through the broad array of hypothesized social developmental and family management mechanisms considered here, with the exception of prosocial skills. These findings are similar to those from a few existing studies, which also have revealed limited support for hypothesized mediating mechanisms involved in program effects on targeted outcomes (Ennett et al., 2001). Of course, it can be

difficult to demonstrate indirect effects in long-term prevention trials due to the increasing influence of competing causes and random factors over time (Shrout & Bolger, 2002). For instance, there are a host of individual, family, school, and peer processes that operate over the course of adolescent and young adult development that may progressively weaken the causal influence of brief family interventions. Again, there may be other relevant mediators, such as coping motives for drinking and alcohol expectancies, that further explain the total effect of the intervention on alcohol abuse disorder for young women. It is important to conduct hypothesis-driven mediation tests and to clearly document the degree of support for hypothesized mechanisms in long-term prevention trials. Doing so may not only provide hints as to what the active ingredients of effective prevention programs might be, but also may highlight the need for theory revisions and program modifications.

4.1. Limitations

Findings should be considered in light of some limitations. Although participants were representative of the region in which the study was conducted, the extent to which findings might generalize to a more diverse sample of participants in suburban and urban settings is unknown. Also, analyses have revealed some selective attrition from the study due to parent educational attainment and adolescent alcohol use. Intervention effects might be specific to the more select sample of target young women who were from more highly educated families and who were less heavily involved in alcohol use as teens. Importantly, there has been little evidence of differential attrition from the longitudinal trial, which mitigates against an important threat to the internal validity of the study. Effect sizes were not large in this study. However, we would not expect to observe large effect sizes in an 11-year longitudinal trial of a brief, family-focused preventive intervention taking place over 5 weeks for a total of 10 hours. Moreover, even relatively small effect sizes can translate into important public health benefits (White & Pitts, 1998). Note also that we conducted conservative intent-to-treat analyses, which preserve the integrity of the experimental design, but also provide an underestimate of the true efficacy of the program among those who participated.

4.2. Implications

These analyses illustrate the importance of examining moderation and mediation in longitudinal prevention trials, that is, of seeking to understand how and for whom prevention programs have their effects. Further research is needed. For instance, in addition to gender, other potential moderators might include baseline risk status or family history of disorder; these considerations were beyond the scope of this analysis. Still, the current findings hold promise for reducing the public health burden of alcohol abuse among young women (National Center on Addiction and Substance Abuse, 2006).

Acknowledgments

References

Barnes, GM.; Farrell, MP.; Banerjee, S. Family influences on alcohol abuse and other problem behaviors among black and white adolescents in a general population sample. In: Boyd, GM.; Howard, J.; Zucker, RA., editors. Alcohol problems among adolescents: Current Directions in prevention research. Hillsdale, NJ: Lawrence Earlbaum Associates; 1995. p. 13-31.

Brook, JS.; Cohen, P.; Whiteman, M.; Gordon, AS. Psychosocial risk factors in the transition from moderate to heavy use or abuse of drugs. In: Glantz, MD.; Pickens, R., editors. Vulnerability to drug abuse. Washington, DC: American Psychological Association; 1992. p. 359-388.

Catalano, RF.; Hawkins, JD. The social development model: A theory of antisocial behavior. In: Hawkins, JD., editor. Delinquency and crime: Current theories. Cambridge, UK: Cambridge University Press; 1996. p. 149-197.

Ennett ST, Bauman KE, Pemberton M, Foshee VA, Chuang Y-C, King TS, et al. Mediation in a family-directed program for prevention of adolescent tobacco and alcohol use. Preventive Medicine. 2001; 33:333–346. [PubMed: 11570838]

Grant BF, Dawson DA, Stinson FS, Chou SP, Dufour MC, Pickering RP. The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991–1992 and 2001–2002. Drug and Alcohol Dependence. 2004; 74:223–234. [PubMed: 15194200]

Guo J, Hawkins JD, Hill KG, Abbott RD. Childhood and adolescent predictors of alcohol abuse and dependence in young adulthood. Journal of Studies on Alcohol. 2001; 62:754–762. [PubMed: 11838912]

Hawkins, JD.; Catalano, RF. Preparing for the Drug Free Years: Family guide. South Deerfield, MA: Channing Bete; 1988.

Hawkins JD, Weis JG. The social development model: An integrated approach to delinquency prevention. Journal of Primary Prevention. 1985; 6:73–97.

Hu, L-t; Bentler, PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling. 1999; 6

Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future national results on adolescent drug use: Overview of key findings, 2004. (NIH Publication No. 05-5726). Bethesda, MD: National Institute on Drug Abuse; 2005.

Kosterman R, Haggerty KP, Spoth R, Redmond C. Unique influence of mothers and fathers on their children's antisocial behavior. Journal of Marriage and the Family. 2004; 66:762–778.

Kosterman R, Hawkins JD, Haggerty KP, Spoth R, Redmond C. Preparing for the drug free years: Session-specific effects of a universal parent-training intervention with rural families. Journal of Drug Education. 2001; 31:47–68. [PubMed: 11338965]

Kosterman R, Hawkins JD, Spoth R, Haggerty KP, Zhu K. Effects of a preventive parent-training intervention on observed family interactions: Proximal outcomes from preparing for the Drug Free Years. Journal of Community Psychology. 1997; 25:337–352.

Leaf, PJ.; Myers, JK.; McEvoy, LT. Procedures used in the Epidemiological Catchment Area study. In: Robins, LN.; Reiger, DA., editors. Psychiatric disorders in America. New York: Free Press; 1991. p. 11-32.

MacKinnon DP, Johnson CA, Pentz MA, Dwyer JH, Hansen WB, Flay BR, et al. Mediating mechanisms in a school-based drug prevention program: First-year effects of the Midwestern prevention project. Health Psychology. 1991; 10:164–172. [PubMed: 1879388]

Mason WA, Kosterman R, Hawkins JD, Haggerty KP, Spoth R. Reducing adolescents' growth in substance use and delinquency: Randomized trial effects of a preventive parent-training intervention. Prevention Science. 2003; 4:203–213. [PubMed: 12940470]

Mason WA, Windle M. Family, religious, school and peer influences on adolescent alcohol use: A longitudinal study. Journal of Studies on Alcohol. 2001; 62:44–53. [PubMed: 11271963]

Muthén, LK.; Muthén, BO. Mplus user's guide. 4th ed.. Los Angeles: Muthén and Muthén; 1998–2006.

Naimi TS, Brewer RD, Mokdad A, Denny C, Serdula MK, Marks JS. Binge drinking among U.S. adults. Journal of the American Medical Association. 2003; 289:70–75. [PubMed: 12503979]

National Center on Addiction and Substance Abuse. Women under the influence. Baltimore, MD: Johns Hopkins University Press; 2006.

Newman DL, Moffitt TE, Caspi A, Magdol L, Silva PA, Stanton WR. Psychiatric disorder in a birth cohort of young adults: Prevalence, comorbidity, clinical significance, and new case incidence from ages 11 to 21. Journal of Consulting and Clinical Psychology. 1996; 64:552–562. [PubMed: 8698949]

Nolen-Hoeksema S. Gender differences in risk factors and consequences for alcohol use and problems. Clinical Psychology Review. 2004; 24:981–1010. [PubMed: 15533281]

Orlando M, Ellickson PL, McCaffery DF, Longshore DL. Mediation analysis of a school-based drug prevention program: Effects of Project ALERT. Prevention Science. 2005; 6:35–46. [PubMed: 15766004]

Park J, Kosterman R, Hawkins JD, Haggerty KP, Duncan TE, Duncan SC, et al. Effects of the "Preparing for the Drug Free Years" curriculum on growth in alcohol use and risk for alcohol use in early adolescence. Prevention Science. 2000; 1:125–138. [PubMed: 11525344]

Robins, LN.; Helzer, J.; Cottler, L.; Goldring, E. The Diagnostic Interview Schedule Version III-R. St. Louis, MO: Washington University School of Medicine; 1989.

Shrout PE, Bolger N. Mediation in experimental and nonexperimental studies: New procedures and recommendations. Psychological Methods. 2002; 7:422–445. [PubMed: 12530702]

Skara S, Sussman S. A review of 25 long-term adolescent tobacco and other drug use prevention program evaluations. Preventive Medicine. 2003; 37:451–474. [PubMed: 14572430]

Spoth R, Goldberg C, Redmond C. Engaging families in longitudinal preventive intervention research: Discrete-time survival analysis of socioeconomic and social-emotional risk factors. Journal of Consulting and Clinical Psychology. 1999; 67:157–163. [PubMed: 10028221]

Spoth R, Redmond C, Shin C. Direct and indirect latent-variable parenting outcomes of two universal family-focused preventive interventions: Extending a public health-oriented research base. Journal of Consulting and Clinical Psychology. 1998; 66:385–399. [PubMed: 9583342]

Spoth R, Trudeau L, Guyll M, Shin C, Redmond C. Universal intervention effects on substance use among young adults mediated by reduced adolescent substance initiation. (under review) Manuscript submitted for publication.

Spoth R, Trudeau L, Shin C, Redmond C. Long-term effects of universal preventive interventions on prescription drug misuse. Addiction. 2008; 103:1160–1168. [PubMed: 18557842]

Spoth RL, Guyll M, Day SX. Universal family-focused interventions in alcohol-use disorder prevention: Cost-effectiveness and cost-benefit analyses of two interventions. Journal of Studies on Alcohol. 2002; 63:219–228. [PubMed: 12033699]

Spoth RL, Redmond C. Project Family prevention trials based in community-university partnerships: Toward scaled-up preventive interventions. Prevention Science. 2002; 3:203–221. [PubMed: 12387555]

Spoth RL, Redmond C, Kahn JH, Shin C. A prospective validation study of inclination, belief, and context predictors of family-focused prevention involvement. Family Process. 1997; 36:403–429. [PubMed: 9543661]

Spoth RL, Redmond C, Shin C. Randomized trial of brief family interventions for general populations: Adolescent substance use outcomes 4 years following baseline. Journal of Consulting and Clinical Psychology. 2001; 69:627–642. [PubMed: 11550729]

Tobler NS, Stratton HH. Effectiveness of school-based drug prevention programs: A meta-analysis of the research. The Journal of Primary Prevention. 1997; 18:71–128.

White D, Pitts M. Educating young people about drugs: A systematic review. Addiction. 1998; 93:1475–1487. [PubMed: 9926552]

Windle, M. Alternative latent-variable approaches to modeling change in adolescent alcohol involvement. In: Bryant, KJ.; Windle, M.; West, SG., editors. The science of prevention: Methodological advances from alcohol and substance abuse research. Washington, DC: American Psychological Association; 1997. p. 43-78.

Yeh M-Y, Chiang I-C, Huang S-Y. Gender differences in predictors of drinking behavior in adolescents. Addictive Behaviors. 2006; 31:1929–1938. [PubMed: 16446046]

Table 1

Model fit statistics for the structural equation modeling analyses of alcohol abuse disorder

SDM Mediation Model	χ^2	df	p	CFI	TLI	RMSEA
Opportunities	16.25	8	.04	.93	.91	.05
Involvement	8.81	6	.18	.99	.99	.03
Skills	18.47	9	.03	.91	.91	.05
Rewards	20.92	7	.01	.96	.96	.07
Bonds	10.12	7	.18	.99	.99	.03
Family Management	13.22	8	.10	.98	.98	.04

Note. Estimated degrees of freedom values vary across models due to the nature of the WLSMV estimator, but each model was parameterized in exactly the same way. CFI = comparative fit index, TLI = Tucker-Lewis Index, and RMSEA = root mean square error of approximation. $N = 429$.

Table 2

Mediation of the simple effect for young women of Preparing for the Drug Free Years (PDFY) on alcohol abuse disorder

Mediator	PDFY → Mediator			Mediator → Alcohol Abuse			PDFY → Alcohol Abuse			Indirect Effect		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Opportunities	.05	.09	.04	−.06	.12	−.03	−.56*	.28	−.26	−.01	.01	−.01
Involvement	.01	.05	.01	−.07	.14	−.03	−.57*	.28	−.26	.00	.01	.00
Skills	.24*	.10	.23	−.49**	.16	−.24	−.45	.28	−.21	−.12*	.05	−.05
Rewards	.09	.08	.08	−.04	.12	−.02	−.56*	.28	−.26	−.01	.01	−.01
Bonds	.14**	.05	.12	−.19	.11	−.11	−.54	.28	−.25	−.03	.02	−.01
Family Management	.04	.04	.06	−.33	.19	−.09	−.55*	.28	−.26	−.01	.02	−.01

Note.

*
$p < .05$

**
$p < .001$.