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PROSPER Partnership Delivery System: Effects on Adolescent Conduct Problem Behavior Outcomes Through 6.5 Years Past Baseline

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Abstract

We report long-term effects of the PROSPER delivery system for universal evidence-based preventive interventions on adolescent conduct problem behaviors (CPBs). A cluster randomized trial included 28 school districts assigned to PROSPER or a control condition. Community-based teams in PROSPER condition school districts selected evidence-based interventions—a family-focused intervention in sixth grade and a school-based intervention the next year; follow-up assessments were conducted through 12th grade. CPBs were measured with 12 self-report items derived from the National Youth Survey. Intervention-control differences were tested via a multi-level Zero-Inflated Poisson (ZIP) model. Differences were significant from 9th through 12th grades; Relative Reduction Rates were between 10.1% and 14.5%. The intervention group was delayed in reaching a 10th grade reference level of CPBs by 10.7 months. Moderation analyses indicated stronger effects for early substance initiators. Findings suggest that the PROSPER delivery system has the potential to reduce CPBs in general populations.

Keywords

Preventive intervention; conduct problem behaviors; evidence-based interventions; prevention delivery systems

Epidemiological studies show trends of decreasing rates in conduct-related behaviors since the early-to-mid 90's, with the start points for the trends varying somewhat by the specific behavior (Center for Disease Control and Prevention, 2014; National Center for Juvenile Justice, 2014; Office of Juvenile Justice and Delinquency Prevention, 2013). Unfortunately, although the downward trends have been especially prominent in the past 5 years, the rates

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remain problematically high across home, school, and community settings, with substantial social, health, and economic consequences (Center for Disease Control and Prevention [CDC], 2012). For examples, 31.5% of high school students reported being in a physical fight during the past 12 months and approximately 18% reported carrying a weapon (CDC, 2012); truancy from school for 8th to 12th graders has been estimated between 11% to 27%, albeit prevalence data are difficult to estimate because of differences in reporting procedures across states (Vaughn, Maynard, Salas-Wright, Perron, & Abdon, 2013). In addition, a Substance Abuse and Mental Health Services Administration (SAMHSA) survey recently found that 3.5% of adolescents (ages 12-17) reported having stolen or having tried to steal something worth more than $50 (SAMHSA, 2013).

A number of leading theories addressing adolescent problem behaviors, such as Problem Behavior Theory (Jessor, 1991), focus on the full spectrum of adolescent problem behaviors, including conduct problems and substance misuse. However, conduct-related behaviors frequently are treated separately from substance misuse behaviors, in part because of differing population prevalence rates, varying developmental etiologies, and related differences in assessment and intervention. Further, the literature guiding conduct problem behavior measurement and intervention delineates important subtypes to be considered in intervention outcome studies (Maughan & Rutter, 2001; Patterson & Yoerger, 2002). Frequently, conduct-related behaviors are subdivided into two basic categories: covert behaviors (e.g., stealing, truancy, lying) and overt behaviors, such as aggression and observable destructive types of behaviors (Dishion & Patterson, 2006; Loeber & Schmaling, 1985). This intervention outcome paper focuses on representative covert and overt types of conduct problem behaviors which have appreciable base rates in general population samples. It extends previously reported findings concerning substance misuse, the primary target of the interventions delivered, to examine “cross-over” effects on these other important problem behaviors.

Conduct problem behaviors during childhood and adolescence have been associated with concurrent and subsequent health and adjustment problems, including school dropout, substance misuse (Dodge et al., 2008), later-life antisocial behavior, criminal activity, family instability, and poor health outcomes (Maughan & Rutter, 2001). Both covert and overt types of problem behaviors displayed from ages 10-16 have been shown to increase risk for adult offending (Dishion & Patterson, 2006; Patterson & Yoerger, 2002). More common types of overt conduct problem behaviors (e.g. physical fighting) peak around ages 8-10 and then begin to decline, although total problem behavior rates continue to rise through later adolescence (Maughan, Rowe, Messer, Goodman, & Meltzer, 2004). Covert forms of adolescent conduct problem behaviors often begin to increase around ages 10-12 (e.g., non-aggressive status violations; Maughan et al., 2004). Overall, the health and economic costs of adolescent conduct problem behaviors figure considerably in the total costs of such behaviors in all segments of the population, typically estimated to be many billions of dollars annually (Foster et al., 2005).

Etiological study has demonstrated that key risk factors for adolescent conduct problem behaviors originate in the family, peer, and school settings (Dishion, Patterson, Stoolmiller, & Skinner, 1991; Granic & Patterson, 2006). Consistent with the etiological literature, there

is evidence that universal preventive interventions in family and school settings can reduce problem behaviors, with economic benefits accruing as a result (Greenberg, 2010; Hahn et al., 2007a; Spoth, Redmond, & Shin, 2000; Wilson & Lipsey, 2007).

There is an emerging literature addressing the major gap between what is known about *effective* conduct problem behavior prevention efforts and what is actually employed in practice, particularly through community-based prevention systems (Guerra & Backer, 2011; Saul et al., 2008). To address this problem, further research has been recommended on: (1) effective strategies to better translate proven interventions into practice; (2) technical assistance and other supports for practitioners implementing evidence-based interventions; and (3) delivery systems for evidence-based interventions (Backer & Guerra, 2011; Spoth & Greenberg, 2011).

Fortunately, there has been some progress in mobilizing communities to implement evidence-based interventions for conduct problem behaviors (Backer & Guerra, 2011; Hahn et al., 2007a; Hawkins et al., 2012; Nation, Bess, Voight, Perkins, & Juarez, 2011), supporting an increased investment in proven, community-based evidence-based intervention delivery systems that could yield public health gains (Kuklinski, Briney, Hawkins, & Catalano, 2012; Nation et al., 2011). Yet, there are very limited data from randomized controlled studies on the efficacy of *community partnership systems* designed to deliver universal evidence-based interventions, particularly ones intended to reduce aggression and other conduct problem behaviors (Backer & Guerra, 2011; Hawkins et al., 2012; Spoth & Greenberg, 2011). An earlier study demonstrated that one such system, Communities That Care, was effective in reducing youth problem behaviors (Hawkins et al., 2012).

It is especially important to address public health oriented community partnership systems in rural areas. Although approximately one-fifth of the US students reside in rural communities or small towns (e.g., less than 25,000 people; Strange, Johnson, Showalter, & Klein, 2012), few studies of youth conduct problem behaviors focus on rural populations. While some studies comparing rural and urban populations on rates of behaviors such as delinquency and other conduct behavior problems have found that youth in urban settings may have higher rates (Farrell, Sullivan, Esposito, Meyer, & Valois, 2005; Hope & Bierman, 1998), others have shown similar rates in rural and urban settings (Simons, Johnson, Beaman, Conger, & Whitbeck, 1996). Further, many barriers to evidence-based intervention in rural areas have been identified, including challenges to accessibility and limited sustainability over time (Spoth, 2008).

Although it is reasonable to expect that universal, public health-oriented approaches will yield relatively small individual-level effect sizes, a series of meta-analyses and systematic literature reviews (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Ferrer-Wreder, 2014; Hahn et al., 2007b; Sandler et al., 2014) have clearly shown the positive effects of universal interventions in the reduction of conduct problem behaviors, with a likelihood of larger effects among relatively higher-risk populations. Moreover, an increasing number of universal interventions are demonstrating positive effects on associated substance misuse and substance misuse-related problems, depressive symptom

frequencies, and family conflict (Brody et al., 2012; Stormshak et al., 2011; Van Ryzin and Dishion, 2012)

The PROSPER partnership delivery system (PROmoting School-community-university Partnerships to Enhance Resilience) is a universal, public health oriented approach that focuses on community-based collaboration and capacity building. PROSPER is based in the land-grant university outreach system (called the Cooperative Extension System [CES]) linked with the public school system (Spoth, Greenberg, Bierman, & Redmond, 2004). This design positions it to utilize existing and stable resources of these systems to develop and maintain ongoing partnerships; thus, the model has the potential to reach multiple communities in a state. The three-tiered community-university partnership consists of local community teams, state-level university researchers, and a prevention coordinator team in the CES. At the university level, researchers coordinate across sites and conduct process and outcome evaluation. At the community level, local teams of 8-14 members (composed of public school personnel, CES staff, community agency representatives, parents, and youth) select family-focused and school-based evidence-based interventions from a menu, implement the interventions, and are responsible for sustaining quality implementation long-term after research funding ends. In the middle tier, prevention coordinators serve as community teams' coaches, providing training and ongoing technical assistance, as well as serving as liaisons between communities and university-based program leaders. All of the interventions on the PROSPER menu were evidence-based, targeted teen substance misuse as their primary outcome, and addressed well-established risk and protective factors originating in the family and school environments that influence the development of adolescent problem behaviors (Dishion et al. 1991; Sullivan, Farrell, Bettencourt, & Helms, 2008). All were delivered at a developmentally well-timed stage, during early adolescence, before escalation of problematic behaviors, around age 11 in our population (Lahey et al., 2000).

Study Purpose and Hypotheses

This article examines the effects of PROSPER on adolescent conduct problems from 1 to 5 years after both primary intervention components were delivered, 6.5 years past the baseline assessment. As noted, the study was designed to address understudied rural populations, implementing universal evidence-based interventions that target substance misuse and related problem behaviors. Earlier articles addressed prevention of a wide range of substance misuse outcomes, the primary objective of the tested interventions (Spoth et al., 2013). Statistically- and practically-significant long-term findings on PROSPER's substance misuse outcomes, along with evidence of economic efficiencies (Crowley, Jones, Greenberg, Feinberg, & Spoth, 2012), support further PROSPER testing addressing additional public health benefits, particularly considering that there are very limited published results from rigorous RCTs up to 6 years beyond baseline for all types of preventive interventions, particularly universal ones (Foxcroft, Ireland, Lister-Sharp, Lowe, & Breen, 2003; National Research Council and Institute of Medicine [NRC-IOM], 2009).

As noted, the conduct problem behaviors measured for this study included both covert and overt behaviors that can occur across home, school, and community settings. We

hypothesized that, relative to adolescents in the control group, those in the intervention group would demonstrate lower levels of conduct problem behaviors. We also hypothesized slower conduct problem behavior growth between 8th and 12th grades for those adolescents.

In addition, risk-related moderation in preventive interventions is important to examine. A key reason is that possible differential effects of interventions across risk-related subgroups might mask or distort effects when analyzing the entire sample (Brookes et al., 2004). Based on earlier studies (Spoth, Randall, Trudeau, Shin, & Redmond, 2008; Spoth et al., 2011), we expected that a higher-risk subsample either would show outcomes comparable to a lower-risk subsample, or would show stronger outcomes.

Methods

Participants

The participating universities' Institutional Review Boards approved the study procedures before recruitment began. Twenty-eight community school districts from Iowa and Pennsylvania were recruited. Eligibility criteria included district enrollment of 1300 to 5200 students with at least 15% of students eligible for free or reduced-cost school lunches. Districts were located in communities having populations ranging from approximately 7,000 to 45,000. Student participants were in the 6th grade at the time of study pretesting. After blocking (matching) on size and location, districts were randomly assigned to either the intervention or the control condition (14 in each condition) and districts were informed of their experimental assignment. Figure 1 summarizes sample participation across waves, along with complete participation requirements. More details regarding recruitment procedures can be found in earlier published reports (Spoth, Clair, Greenberg, Redmond, & Shin, 2007; Spoth et al., 2004; Spoth, Guyll, Lillehoj, Redmond, & Greenberg, 2007).

Briefly, the study employed a cohort sequential design involving two successive cohorts of 6th graders. All 6th grade students enrolled in study school districts were eligible for participation in the study; a total of 10,849 students across the two cohorts (approximately 90% of those eligible) completed baseline assessments. The average age of students at the beginning of the study was 11.8 years, approximately 50% were male, approximately 77.4% were from dual-parent families, and approximately 85% were Caucasian. Average family income in 2002 was $51,439.

Procedures

Following assignment to condition, local teams formed in the intervention condition school districts selected a family-focused intervention from a list of approved evidence-based interventions. Although three program choices were available, all 14 teams chose the Strengthening Families Program: For Parents and Youth 10-14 (SFP 10-14). Teams recruited 6th graders and their families into the SFP 10-14 program, during the first year for Cohort 1, and during the second year for Cohort 2. Also during the second year, teams chose a school-based program to implement with 7th graders (to be delivered during the second and third years to Cohorts 1 and 2, respectively). Teams were given a menu of three evidence-based interventions — All Stars, Life Skills Training, and Project ALERT. Six

teams chose All Stars, four teams chose Life Skills Training, and four chose Project ALERT.

Data were collected via machine-scored, written self-report questionnaires administered during class periods by trained university staff. A passive consent procedure for parents and an active assent procedure for students allowed participants to opt out of assessments. Following baseline data collection conducted during the fall of 6th grade, community teams in the intervention condition implemented the interventions. Follow-up assessments were conducted approximately six months following the pretest, 18 months past the pretest (after completion of 7th grade school-based programming) and yearly thereafter, through the 12th grade. Incentives were provided to schools for supporting student participation in study assessments.The PROSPER delivery system and procedures are described in more detail in previous publications (Spoth, Clair, et al., 2007; Spoth et al., 2004; Spoth, Guyll, et al., 2007).

Interventions

Family program—SFP 10-14 is based on empirically-supported family risk and protective factors (Molgaard, Kumpfer, & Fleming, 1997). Goals include enhancement of parenting skills (e.g., nurturing, limit-setting, communication) and youth social and peer-resistance skills. Facilitators received a 2-day training. SFP 10-14 includes 7 sessions consisting of 1-hour, separate parent and youth skill-building segments conducted concurrently, followed by 1-hour family segments wherein parents and youth together practice the skills they had learned. Detailed description of content can be accessed at www.extension.iastate.edu/sfp/. Group size averaged 7.5 families (range 3-15) and 20 individuals per session. A total of 1064 families (approximately 2650 family members) attended at least one session in 142 groups in the 14 school districts assigned to the intervention condition (17% of all eligible families); 90% of those attended at least 4 of the 7 sessions. Trained observers found an average adherence to curricular tasks and topics of 92% for family segments, 88% for parent segments, and 91% for youth segments.

School-based programs—Each of the programs was implemented by trained instructors (usually a regular classroom teacher) during class periods, using interactive techniques (e.g., role plays). All Stars is based on social learning theory (Bandura, 1977) and problem behavior theory (Jessor & Jessor, 1977). The 13-session program addresses: (1) perceptions about substance misuse and violence, including the accuracy of peer norms; (2) encouraging a commitment by students to avoid substance misuse and violent behavior; and (3) encouraging school bonding. Life Skills Training, also based on social learning and problem behavior theories, is a 15-session program designed to promote skill development (e.g., peer resistance, self-management, general social skills) and to provide a knowledge base about substance misuse to encourage avoidance. Project ALERT is an 11-session program based on social influence theory. Objectives are to: (1) change beliefs about substance misuse norms and the social, emotional, and physical consequences of substance misuse; (2) teach students to identify and resist pressure to use substances from peers, media, parents, and others; and (3) build students' resistance self-efficacy.

Across both cohorts, the implementation adherence rates (percentage of core components covered in the classroom sessions) for Life Skills Training, Project Alert, and All Stars were 89%, 89%, and 91%, respectively (Spoth et al., 2011). More detail about school-based program theory, objectives, and implementation can be found in previous publications (Spoth, Clair, et al., 2007; Spoth et al., 2004; Spoth, Guyll, et al., 2007).

Measures

Conduct problem behaviors—This construct was assessed with items derived from the National Youth Survey (NYS; Elliott, Huizinga, & Ageton, 1985), concerning the frequency with which the respondent reported engagement in each of 12 behaviors during the past year; behaviors included both covert and overt types of conduct problem behaviors. In general, earlier reviews of the literature have found self-reports of delinquency and crime to be valid and reliable (e.g., Thornberry & Krohn, 2000). Concurrent and predictive validity of the full NYS measure has been well-documented (Farrington, Loeber, Stouthamer-Loeber, Van Kammen, & Schmidt, 1996), and a study with a similar measure, using 14 items (dichotomized and summed) from the NYS (e.g. items related to fighting, stealing, being truant or suspended from school), supported its validity (Brody et al., 2012).

Students responded to: four items about stealing or not paying for something; two items about truancy (run away from home, skipped school or classes without an excuse); two items measuring aggression directed toward other people (beating up or physically fighting with someone and throwing rocks or bottles at someone to cause injury); two items measuring destructive behavior directed toward invading or damaging property (purposely damaging property belonging to others and breaking into a building); and two additional items concerning representative and potentially serious conduct problems in general adolescent populations (CDC, 2012), carrying a concealed weapon and being picked up by police.

To compute the index of conduct problem behaviors, adolescents received one point for each behavior they reported (see Klein, Forehand, Armistead, & Long, 1997, and Sneed, Morisky, Rotheram-Borus, Lee, & Ebin, 2004, for descriptions of how this type of scoring has been used in prior studies), yielding a measure with potential scores ranging from 0 to 12. It is noteworthy in this context that, because of the longitudinal nature of the study, cutting across developmental stages, alternative scoring strategies such as frequency-based weighting were not considered viable. For example, the degree to which a given behavior (e.g., fighting or skipping school) is relatively more or less normative often changes substantially between the 6^{th} and 12^{th} grades. Test-retest reliabilities have been recommended for the NYS measure, rather than Cronbach's alpha (Huzinga & Elliott, 1986). For our measure these reliabilities ranged from 0.56 to 0.62, with approximately 12 months between all but the first two assessments. In addition, to assess the Relative Reduction Rate (RRR), the scale was dichotomized so that those who reported three or more conduct problems were coded “1” and those who reported less than three were coded “0.” We chose the three-item cut-off to delineate more non-normative and/or serious levels of conduct problems; less than 20% of the sample met this criterion.

Risk status—We chose to focus on risk associated with early substance initiation. Although not a comprehensive indicator of adolescent risk for conduct problems, the reciprocal association of substance misuse with conduct problems has been consistently demonstrated in prior research (Angold & Costello, 2001; Dishion & Patterson, 2006; Patterson & Yoerger, 2002). For the current study, higher-risk was defined as lifetime use of alcohol, cigarettes, or marijuana at the 6th grade pretest (27.7% of the analyzed sample met this criterion). At baseline there was a correlation of .43 between conduct problem behaviors and a summed lifetime misuse measure (dichotomous lifetime use of alcohol, cigarettes, and marijuana—summed to form an index with scores from 0 to 3), suggesting that the two are distinct but related constructs.

Data Analyses

Intervention-control differences in conduct problems were tested via a Zero-Inflated Poisson (ZIP) model using SAS PROC NLMIXED (Tin, 2008). A ZIP model analysis is well-suited for use in this instance due to the large number of zeros in the conduct problem measure. Since the outcome variable showed a curvilinear growth pattern over time, a quadratic term was included in the model. Consistent with a growth curve analysis within the multi-level structure of the study design, our analysis had three levels — Level 1 = time, Level 2 = individual, and Level 3 = school district — to account for the nesting of individuals within school districts. The intercept, slope, and quadratic components of the model were treated as random effects. In addition to time and intervention condition, the analyzed model included risk status and the risk by condition interaction. To improve the validity of the estimated growth patterns, only students who completed the baseline assessment and at least two (of the seven) post-intervention waves of data collection were included in the analysis. Missing data for students providing the requisite three or more waves of data were addressed through multiple imputation (50 imputations, see Schafer, 1999); approximately 29% of the analyzed sample had some missing data. The decision to require at least three waves of data for inclusion was made in order to avoid “over-imputation” by limiting the overall amount of outcome data imputed to less than 30%, as well as to facilitate the stable estimation of a non-linear growth model. Imputation procedures utilized the FCS option in SAS PROC MI without normality assumptions, with range restrictions (matching the valid range of the imputed variables), and employed stratification by treatment condition, state, cohort, and risk classification. All students in the intervention condition providing the requisite data were included in the analysis, regardless of intervention exposure (an intent-to-treat-type approach). These procedures resulted in an analyzed sample size of 9,287 (85.6% of those pretested), an average of 305 students per school district.

There are many challenges to ascertaining definitive interpretations of effects in nonlinear models (Cudeck, du Toit, & Sorbom, 2001). To facilitate interpretation of intervention effects, analyses were conducted to examine the difference between experimental conditions in the time (in months) to reach a criterion level of conduct problem behaviors. It was important to select an appropriate developmental time period when conduct problems rates were still increasing, but before they began to level off substantially; the level selected was the 10th grade mean score for the intervention condition (mean = 1.95). Growth curve parameters from the estimated ZIP model were used to estimate the length of time (from

baseline) to reach this level for the intervention and control groups (and the difference in those times), as a way to describe the intervention main effect (please see appendix for details of the estimated model). The PROC NLMIXED ESTIMATE statement (risk status was centered) was used to generate specific point-in-time conduct problem behavior level estimates (i.e., number of conduct problems for each condition, grades 8 - 12) based on the estimated ZIP model. Additional ESTIMATE statements were used to examine risk-related moderation of intervention effects by including a cross-product interaction term.

Finally, point-in-time analyses were conducted to assess intervention effects in terms of RRRs to better clarify the practical significance of statistically-significant intervention-control differences. As described above, for calculating RRRs, a cut-off point of 3 or more conduct problem behaviors (of the 12 possible behaviors) was utilized. Analyses were conducted using PROC GLIMMIX (appropriate for multilevel analyses with dichotomous outcomes). Risk status, all model design factors (condition, block, cohort, state), and interaction terms were included in the model.

Results

Sample Quality: Representativeness, Equivalence, and Attrition

Prior to conducting the outcome analyses, family sociodemographic characteristics (parent education, biological-parent status, parent marital status, number of children in the home, and school lunch program participation) and the outcome variable were examined. Pretest equivalence across intervention conditions was found for all of the variables examined. In addition, analyses were conducted to examine differential attrition across conditions from baseline to each of the seven subsequent data collection points. As in prior studies (Spoth et al., 2008), two factor analyses of variance were used to assess attrition effects. There were two time points in which a significant experimental condition by attrition interaction was found for the conduct problem behavior variable; at the 7^{th} and 8^{th} grade follow-ups, dropouts in the control condition exhibited higher levels of conduct problems at pretest than did dropouts in the intervention condition, suggesting that our analyses could underestimate intervention effects (individuals with a higher initial level of conduct problems were more likely to be retained in the intervention condition, as compared with the control condition). However, utilizing multiple imputation procedures to address missing data also helps address this issue. Finally, differential attrition across the two study cohorts was examined; no significant differences were found.

Intervention-Control Differences

Table 1 presents the means and the results of testing for intervention vs. control condition differences in the overall number of conduct problems. At each time point from the 9^{th} to 12^{th} grade, the intervention group exhibited significantly lower levels of conduct problems than controls. Although effect sizes were small, indications of the practical significance of intervention impacts were observed. As illustrated in Figure 2, results from the analysis of the time in months to reach the average 10^{th} grade level (1.95) of intervention group conduct problem behaviors indicate that the control group reached that level of problem behaviors significantly sooner (10.7 months earlier; 95% CI [1.9, 19.5]; estimated standard error =

4.5). In addition, results showed that, across the 9th – 10th grades, RRRs for intervention group adolescents reporting three or more conduct problem behaviors were 13.7 and 14.5%, respectively. Following 10th grade, the frequency of conduct problem behaviors begins to level off and diminish, as is normative (Elliott, 1994).

Results from risk-related moderation analyses are presented in Table 2. Risk-related moderation effects were significant for the 9th to 11th grade time points, indicating significantly stronger effects for higher-risk, early substance initiators at those assessment points. Results also favored the higher-risk group at the 8th and 12th grade assessment points, but moderation effects were not statistically significant. Subsequent tests showed significant intervention effects for both higher- and lower-risk subgroups from 9th – 11th grades and for the 12th grade higher-risk subgroup.

Discussion

As summarized in the introduction, both covert and overt conduct problem behaviors are prevalent across home, community, and school settings (CDC, 2012). They are associated with concurrent health and social adjustment problems (e.g., school dropout, substance misuse), as well as subsequent, later-life antisocial behavior, criminal activity, family instability, poor health outcomes (Maughan & Rutter, 2001), and high economic costs (Foster et al., 2005). Earlier reports from this project have indicated positive effects of the PROSPER delivery system on substance misuse, the primary targeted outcome. The current paper analyzed effects on the ancillary conduct problem behavior outcome. Findings from the current study provide evidence of reductions in conduct problem behaviors through implementation of the PROSPER delivery system. Significant effects were detected for students during the 9th through 12th grades, with somewhat stronger effects demonstrated for the higher-risk subsample; that is, among individuals who had initiated substance misuse prior to the interventions in the fall of 6th grade.

More generally, although effect sizes were small in magnitude, RRRs suggest that these results have practical significance. For example, in 10th grade, the RRR was 14.5%, suggesting that for every 100 individuals displaying three conduct problem behaviors in non-intervention school districts, there would be approximately 15 fewer 10th graders displaying such behaviors in districts that offered PROSPER-delivered, evidence-based family-focused and school-based interventions during middle school.

A number of intervention characteristics may have contributed to the positive effects that were observed. To begin, strategies to ensure quality implementation of these evidence-based interventions were employed, such as standardized training and ongoing observations to evaluate adherence to the implementation protocol. In addition, the interventions were designed to delay substance initiation by addressing risk and protective factors associated with substance misuse, many of which also are associated with conduct problem behaviors. The evidence-based interventions on the PROSPER menu address risk and protective factors originating in family and school settings—putative mediators of conduct problem behavior outcomes, such as parent-child communication and affective quality; parental monitoring, rule-setting, and consistent discipline; adolescent assertiveness; and general social skills

(Redmond et al., 2009; Spoth, Trudeau, Guyll, & Shin, 2012). In particular, the school-based interventions focus on key individual risk and protective factors relevant to conduct problem behaviors: interpersonal problem-solving skills involving awareness and management of emotions; consideration of the consequences of one's actions; reducing impulsive responding to stressful situations; effectively handling situations with peers that include risk-taking; and developing healthy peer friendships. In short, the programs focused on the core competencies or skills that have been identified as protective against both substance misuse and conduct problem behaviors, as delineated in earlier reports (see Guerra & Bradshaw, 2008; Sullivan et al., 2008). Further, earlier empirical study found intervention-induced changes in putative mediators, such as parenting behaviors and skills, parent-child interactions, and adolescent life skills evident at the 7th, 8th, and 9th grade follow-up assessments (Redmond et al., 2009).

Collectively, the present findings, as well as those showing effects on substance misuse (Spoth et al., 2011), highlight the potential of evidence-based universal preventive interventions to produce multiple community-level effects, across the domains of positive youth skill development, family functioning, and decreased youth problem behaviors. Other outcome studies evaluating universal programs like those on the PROSPER menu, or examining an evidence-based program delivery system like PROSPER, also have shown positive effects. For example, a study of outcomes of a universal intervention incorporating both family-focused and school-based universal components (LIFT: Linking the Interests of Families and Teachers) showed positive effects on physical aggression among fifth graders one year following intervention implementation, with an effect size (*d*) .14, and greater effects for higher-risk youth (Reid, Eddy, Fetrow, & Stoolmiller, 1999). In addition, The Communities That Care delivery system showed a 25% reduction in initiation of delinquent behavior through the 10th grade (Hawkins, Oesterle, Brown, Abbott, & Catalano, 2014).

Key study limitations concern issues of generalizability of the findings and the assessment of conduct problem behaviors. First, although our sample was comparable to the targeted study population, a broad community sample of rural town and small city youth, we recommend that research be undertaken with other populations, such as high minority rural and more urban populations. Second, although our assessment of conduct problem behaviors included the types of behaviors most frequently occurring during the developmental stage of study participants, the measure was necessarily brief. A more comprehensive measure could be expected to exhibit higher reliability that could enhance statistical power, in addition to providing more complete conduct problem behavior coverage. Related to this point, the degree to which intervention effects would be found for more severe conduct problems is unknown. In addition, our assessment of conduct problem behaviors was based on self-reports; self-reports of anti-social and/or illegal behaviors may be subject to social desirability biases. It has been reported, however, that youth self-reports of conduct problem behaviors tended to identify more behaviors than did their parents (Offord, Boyle, & Racine, 1991). Nonetheless, the possibility that exposure to intervention may generate self-reporting biases is a potential limitation of the study.

Finally, due to the analytical complexity of the tested ZIP model and associated estimation challenges, cohort effects on the outcome were not evaluated in that model (cohort effects

were estimated in the RRR analyses). Although it is possible that effects could have differed across the two cohorts (e.g., due to increased experience by teachers and facilitators delivering programming to the second cohort of intervention participants), or that power to detect effects could have been affected due to the inclusion of cohort effects (e.g., statistical power could be enhanced through reductions in standard errors by controlling for cohort effects), analyses conducted with the data combining the two cohorts should provide a valid test of intervention effects for the sample overall.

The high rates and costs of conduct problem behaviors among adolescents underscore the possible public health benefits of cost-effective interventions for general populations that reduce those behaviors, such as those implemented in the PROSPER study. As noted, the PROSPER interventions usually are characterized as preventive interventions for substance misuse, yet as illustrated in the present findings, these interventions also may affect conduct problem behaviors.

Most importantly, an emerging literature reviewed in the introduction emphasizes that effective solutions to the public health problem of conduct problem behaviors will require the development and testing of systems for the broad-based delivery of evidence-based interventions (Hawkins et al., 2012). The PROSPER dissemination model is similar to that contemplated for a nationwide Primary Care CES, consistent with healthcare reform legislation (Grumbach & Mold, 2009). That is, the PROSPER delivery system is based in the national land grant university CES infrastructure and conforms with a public health, primary prevention approach to the reduction of adolescent problem behaviors. In this connection, Knox and Aspy (2011) have recommended that a national extension service for youth violence prevention be established to support translation of evidence-based interventions. The PROSPER delivery system demonstrates a potentially national Extension model that shows positive effects on the reduction of conduct problem behavior that could serve this purpose. A similar type of model could also operate under the community-based prevention structure of the Affordable Care Act.

To summarize, findings from this study suggest the PROSPER delivery system as tested with general populations in rural areas has the potential to reduce conduct problem behaviors. These results, along with previously-established findings indicating reductions in substance misuse, have public health implications. Community-based models such as PROSPER that have linkages to national infrastructures could have a substantial impact by effectively delivering evidence-base programs to broad segments of the US population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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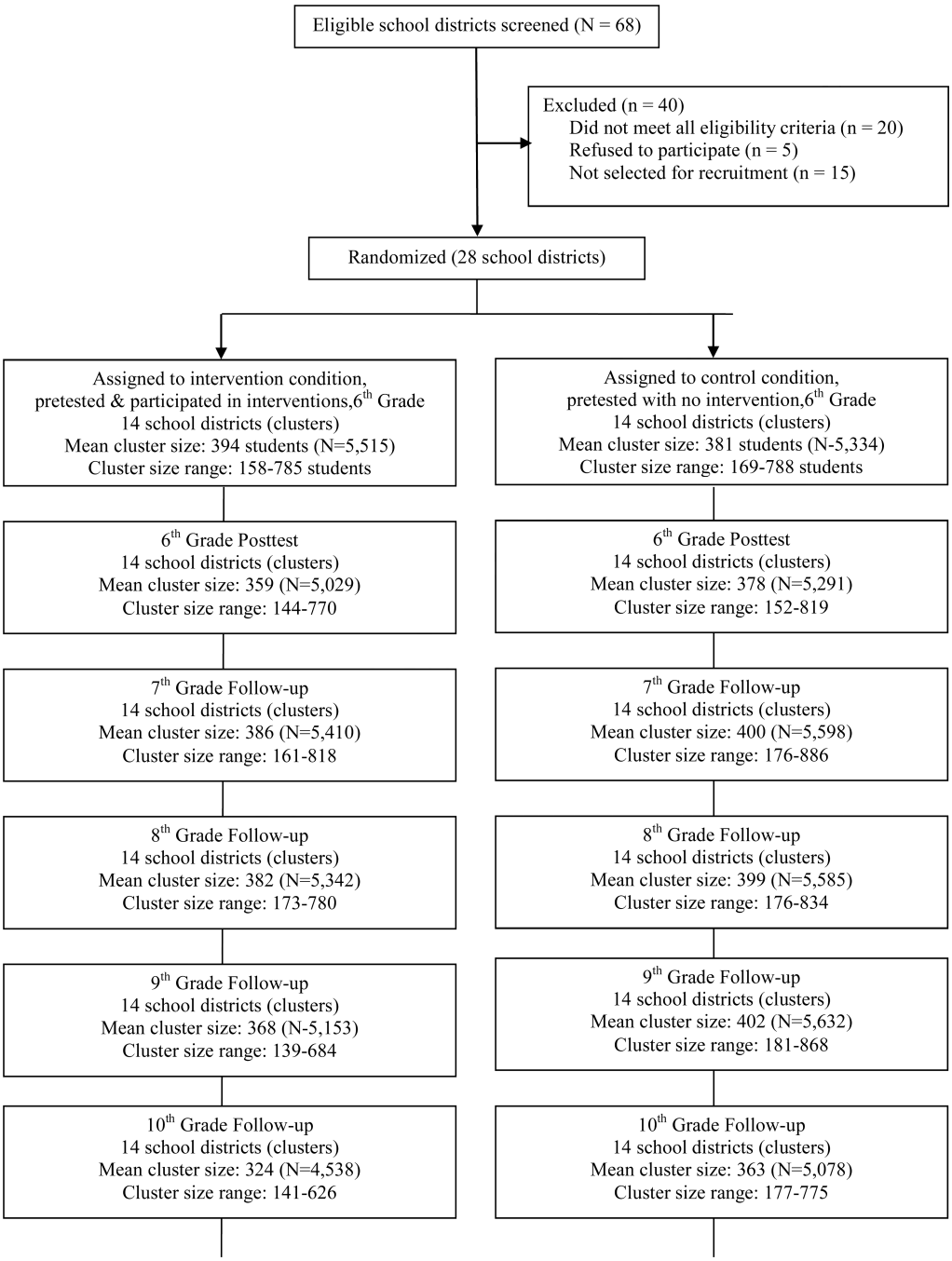

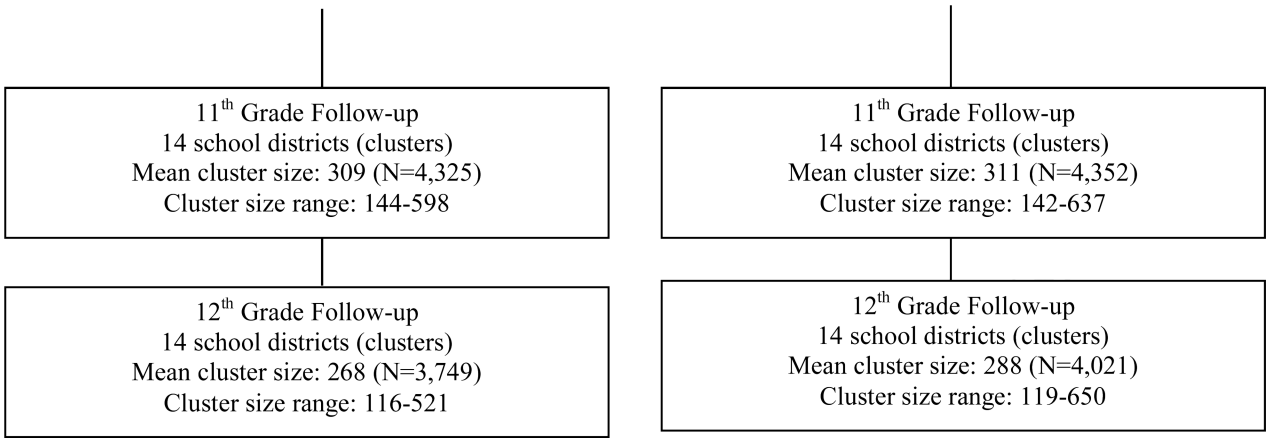

Figure 1.

Profile of participation in randomized preventive intervention trial.

Figure 1 Note: Eligibility criteria included (a) no previous or current involvement in a university-sponsored intervention evaluation study, (b) district size between 1,300 and 5,200 students and located in a nonmetropolitan area (to facilitate building local community-based teams), (c) districts not affiliated with a university (e.g., not located in communities in which 50% or more of the population is comprised of college or university students and staff); and (d) at least 15% of district families eligible for free or reduced cost school lunches. In addition, eligible school districts had a Cooperative Extension staff person available to serve the school district's community, and the school district personnel and key community partners had to be willing to abide by the randomization procedures and to participate fully in the intervention, if assigned to the intervention condition. Once the targeted number of school districts were recruited (28), recruitment ceased and additional potential districts were not recruited. Two school districts (one each in Iowa and Pennsylvania) dropped out during the pretesting period and were replaced with two comparably-sized school districts remaining in the eligible pool. A series of analyses suggested that the replacement schools did not bias results toward positive intervention–control differences. Student participation in the assessments at a given wave was not contingent on participation in prior waves (all enrolled students in the 2 study cohorts were recruited for participation at each wave). Cluster sizes include the students from both cohorts who completed assessments. There was considerable stability in the enrolled samples from year to year; however, we eliminated from the sample those students who changed conditions (i.e., moved from a school district in one condition into one in a different condition) to preserve randomization; there were a total of 144 such students across the eight waves of data collected.

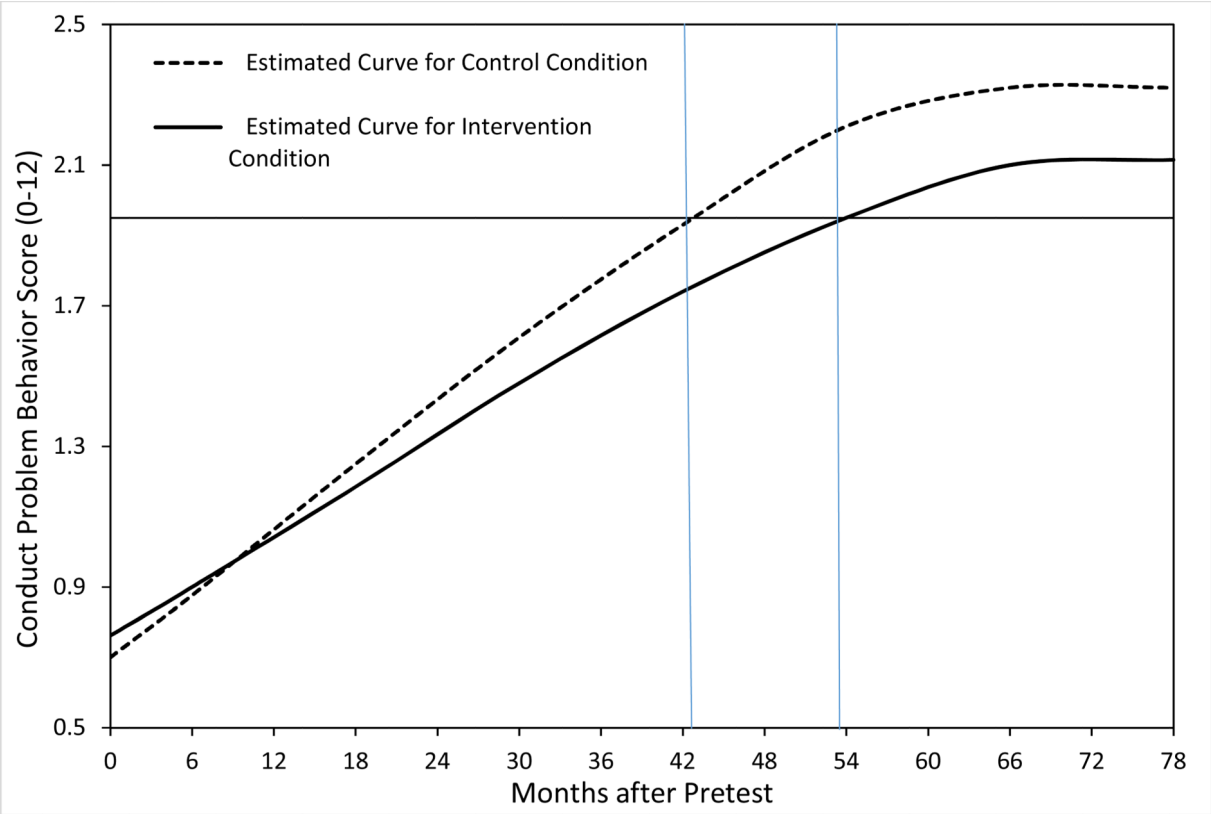

Figure 2.

Growth in conduct problem behaviors through the 12th grade and intervention group delay in reaching reference time point.

Figure 2 Note: The rationale for the selected level of the Conduct Problem Behaviors score at which to compare relative growth in problem behaviors between conditions (1.95, which is approximately the estimated level of the behaviors at 10th grade in the intervention condition) is provided in the methods section. This model includes random effects (for school district and risk level) for the intercept, slope, and quadratic terms. Experimental Condition and Risk were included in the model as fixed effects. The difference in time for the Intervention and Control Conditions to reach the specified Conduct Problem Behavior reference level was 10.7 months (SE=4.5; 95% CI = 1.9, 19.5, *t*-value = 2.35, *p* = 0.02).

Table 1

Point-in-time intervention-control differences: Full sample

Grade	Main Effects							
	Intervention Mean (SE)	Control Mean (SE)	Difference	*t*-value (*p*)	95% Confidence Interval Lower (Effect Size)	95% Confidence Interval Upper (Effect Size)	Effect Size (SD)	RRR[§]
8th	1.400	1.466	0.066	1.36	−0.029	0.161	0.03	ns
	(0.034)	(0.033)	(0.048)	(0.176)	(−0.01)	(0.07)	(2.31)	
9th	1.695	1.832	0.137	2.27	0.018	0.257	0.05	13.7%
	(0.042)	(0.039)	(0.061)	(0.025)	(0.01)	(0.09)	(2.93)	
10th	1.916	2.117	0.201	2.66	0.005	0.352	0.06	14.5%
	(0.052)	(0.053)	(0.076)	(0.009)	(0.01)	(0.10)	(3.66)	
11th	2.007	2.271	0.264	2.41	0.04	0.485	0.05	10.1%
	(0.068)	(0.068)	(0.110)	(0.020)	(0.01)	(0.09)	(5.30)	
12th	1.980	2.245	0.265	2.60	0.06	0.469	0.05	11.1%
	(0.073)	(0.084)	(0.102)	(0.012)	(0.01)	(0.10)	(4.86)	

Note: Intervention *N* = 4,729; Control *N* = 4,558. Means are model-based, from multi-level ZIP model analyses (as described in the text).

The nominal model-based degrees of freedom for all tests is 53; however, unique estimates of degrees of freedom for each model parameter estimated are generated by MI that vary according to between and within variances from the MI analysis. Number of imputations is 50.

Effect Sizes are calculated based on Cohen's *d* for the difference in means and for the lower and upper confidence levels of that difference.

[§]RRRs are from point-in-time multi-level ANCOVA analyses conducted using PROC GLIMMIX; cut-off was 3 or more conduct problem behaviors.

Table 2

Point-in-time intervention-control differences: Risk moderation

Grade	Risk-Moderation Effects						
	Intervention Higher Risk (SE)	**Control Higher Risk (SE)**	**Difference at Higher Risk (SE)**	**Intervention Lower Risk (SE)**	**Control Lower Risk (SE)**	**Difference at Lower Risk (SE)**	***t*-value for Risk-Moderation (*p*)**
8th	2.377	2.499	0.122	1.107	1.157	0.050	1.63
	(0.065)	(0.064)	(0.079)	(0.030)	(0.031)	(0.050)	(0.103)
9th	2.603	2.802	0.199	1.402	1.516	0.114	2.22
	(0.074)	(0.066)	(0.089)	(0.037)	(0.037)	(0.051)	(0.028)
10th	2.739	3.018	0.279	1.634	1.815	0.181	2.03
	(0.095)	(0.086)	(0.111)	(0.042)	(0.045)	(0.067)	(0.048)
11th	2.751	3.088	0.337	1.770	1.980	0.210	2.07
	(0.103)	(0.091)	(0.133)	(0.059)	(0.062)	(0.097)	(0.043)
12th	2.696	3.005	0.309	1.768	1.982	0.214	1.63
	(0.104)	(0.109)	(0.138)	(0.074)	(0.076)	(0.113)	(0.106)

Note: Intervention N = 4,729; Control N = 4,558. Means are model-based, from multi-level ZIP analyses (as described in the text).

The nominal model-based degrees of freedom for all tests is 53; however, unique estimates of degrees of freedom for each model parameter estimated are generated by MI that vary according to between and within variances from the MI analysis. Number of imputations is 50.

All 9^{th} – 12^{th} grade higher- and lower-risk subgroup intervention effects are significant at $p < .05$ or .01 except for the 12^{th} grade lower-risk subgroup.