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A Meta-Analytic Inquiry Into the Relationship Between Selected Risk Factors and Problem Behavior

Stacy S. Najaka,[1,2] Denise C. Gottfredson,[1] and David B. Wilson[1]

Identifying the predictors of problem behavior is essential both for understanding the causes of such behavior and for preventing it. Although a great deal of research has sought to identify the factors predictive of problem behavior, much of the research to date has been correlational and tells us little about causality. This study attempts to improve on the correlational research by applying meta-analytic techniques to existing experimental and quasi-experimental studies of school-based prevention. The following 3 risk factors were examined: academic performance, bonding to school, and social competency skills. The most convincing evidence of a relationship between risk and problem behavior was found for bonding to school. Positive changes in attachment and commitment to school resulting from the preventive interventions were consistently accompanied by positive changes in problem behavior. Preventive interventions that produced improvements in academic performance produced moderate improvements in problem behavior. With regard to social competence, the association depended in large part on the type of measure used to assess social competency skills. Changes in self-report measures of social competency were unrelated to changes in problem behavior, whereas a strong positive correlation was observed between changes in ratings and observations of social competency by others and improvements in problem behavior.

KEY WORDS: risk factors; problem behavior; delinquency; meta-analysis.

A substantial amount of research in the field of criminology is devoted to understanding the causes of delinquency and related problem behaviors, including drug use, school attendance problems, and conduct problems. Identifying the predictors of problem behavior is essential both for understanding the causes of such behavior and for preventing it. The prevailing model of prevention holds that reducing risk factors associated with adverse outcomes, and increasing protective factors that moderate the effects of exposure to risk, will reduce the likelihood of subsequent problem behavior (Consortium on the School-Based Promotion of Social Competence, 1994; Valente & Dodge, 1997). The effectiveness of this approach to prevention rests, in part, on the extent to which identified risk and protective factors are actually causal.

This paper explores the relationship between selected risk factors and problem behavior by applying meta-analytic techniques to existing experimental and quasi-experimental studies of school-based prevention. Studies of school-based prevention are particularly useful for studying the relationship between risk factors and problem behavior because many of the hypothesized precursors of problem behavior are school-related. In addition to targeting behavioral outcomes, such as drug use and delinquency, school-based prevention programs frequently target school-related risk factors, such as academic achievement and attachment to school. As a result, many evaluations of school-based programs include measures of both problem behavior and risk factors, providing an opportunity to assess whether changes in these factors result in a corresponding change in problem behavior.

The following three risk factors are examined: academic performance, bonding to school, and social

[1]Department of Criminology and Criminal Justice, University of Maryland, Maryland.

[2]Correspondence should be directed to Stacy S. Najaka, Department of Criminology and Criminal Justice, University of Maryland, 2220 LeFrak Hall, College Park, Maryland 20742-8235; e-mail: sskroban@crim.umd.edu.

competency skills.[3] These factors are among the factors most frequently targeted by prevention efforts, and there are theoretical reasons to expect that the factors exert a direct influence on problem behavior (Dodge, 1986; Dodge *et al.*, 1986; Hirschi, 1969). Poor academic performance has been found to predict a number of problem behaviors, including drug use (Jessor, 1976; Smith & Fogg, 1978; Sullivan & Farrell, 1999), drop out (Bachman *et al.*, 1971), and delinquency (Lipton & Smith, 1983; Maguin & Loeber, 1996). Similarly, prior research has repeatedly demonstrated that youths who are more bonded to school are less likely to engage in problem behavior than their weakly bonded peers (Hirschi, 1969; Kelly & Balch, 1971; Thornberry *et al.*, 1991; Wiatrowski *et al.*, 1981). Finally, social competency skill deficits have been linked to a number of problem behaviors, including aggression (Dodge, 1980; Dodge & Newman, 1981; Dodge *et al.*, 1990; Richard & Dodge, 1982), delinquency (Freedman *et al.*, 1978; Gaffney, 1984; Gaffney & McFall, 1981; Walker & Stieber, 1998), and drug use (Pentz, 1985). Previous research provides good reason to expect that gains in academic performance, bonding to school, and social competency skills occurring as a result of intervention efforts are associated with corresponding decreases in problem behavior.

Although a great deal of research has sought to identify the risk factors predictive of problem behavior, much of the research to date has been correlational and tells us little about causality. One of the most rigorous methods of identifying causal factors is through the use of experimental interventions whereby variables are manipulated and resulting behavioral change is measured. Prevention experiments may be the best way to examine the causes of delinquency and crime. According to Tremblay and Craig (1995)

> If an intervention has repeatedly been successful in preventing criminal behavior by modifying a factor that was hypothesized to be a causal factor of criminal behavior, then we have a better test of that theory than a simple correlation between two variables in a longitudinal or cross-sectional study. By contrast, if an intervention has repeatedly been successful in changing a phenomenon hypothesized to be a causal factor of criminality without a consequent reduction in criminal behavior, then one can doubt the validity of the causal hypothesis. (p. 153)

Following this recommendation, the present research attempts to improve on the correlational research by applying meta-analytic techniques to existing experimental and quasi-experimental studies of school-based prevention. This method provides an opportunity to make stronger conclusions regarding the relationships between the risk factors and problem behavior, because variables are manipulated as a consequence of program exposure. It stands to reason that if an intervention results in modifying a factor that is indeed a causal factor of problem behavior, behavioral change should occur for problem behavior as well. Observing change in both a factor and problem behavior following an intervention provides stronger evidence of a causal relationship between the two constructs than a simple correlation between variables where no manipulation has occurred.

This research not only represents a novel method of identifying the predictors of problem behavior, but also represents a unique approach to meta-analysis. Meta-analyses of the intervention literature have typically focused on identifying the important features of effective intervention (e.g., Gottfredson *et al.*, in press; Hansen, 1992; Lipsey, 1992; Tobler, 1986; Tobler & Stratton, 1997; Wilson *et al.*, 2001). Previous efforts have examined program characteristics such as intervention content, treatment philosophy, program length, and setting, in an attempt to explain why certain interventions are more effective than others in reducing problem behavior. In other words, intervention features are used to explain the variance in problem behavior effect sizes across studies. In comparison, the approach to meta-analysis utilized in the current research focuses on explaining variance in problem behavior effect sizes as a function of selected risk factor effect sizes. The specific features of the interventions are not of primary concern. Of importance is that each intervention represents an attempt to manipulate behavior, and thus provides an opportunity to assess whether a change in the targeted risk factors is related to a change in problem behavior.

The analytic approach used in the current research to identify the predictors of problem behavior differs in several ways from the traditional mediation

[3] A risk factor is an individual attribute, individual characteristic, situational condition, or environmental context that increases the likelihood of negative behavior (Clayton, 1992; Coie *et al.*, 1993; Masten & Garmezy, 1985; Werner, 1990). Although substantial debate concerning the definition of protective factors exists (Farrington, 1999), a protective factor is often defined as a factor that buffers individuals from adverse outcomes by exerting a moderating effect on risk (Rutter, 1985, 1987). Because prior evidence primarily documents direct effects of the factors to be examined on problem behavior, rather than interactive effects, these factors are considered "risk" rather than "protective" factors in this research.

model approach to estimating mediated effects in prevention studies. The traditional approach involves estimating (1) the effect of the intervention on the mediating variable, (2) the effect of the intervention on the outcome, and (3) the effect of the mediating variable on the outcome, adjusted for the intervention effect (Baron & Kenny, 1986; MacKinnon & Dwyer, 1993). To establish mediation, there must be evidence that the intervention caused the mediator, and the mediator in turn caused the outcome. The meta-analytic approach applied in the current research differs from a traditional mediation model approach in that it addresses the second path in the hypothesized causal chain but not the first. As noted, the focus of the current research is not to identify the characteristics of interventions that produce change in the mediator variables, but rather to identify whether change in the hypothesized mediators is associated with change in the outcome. Accordingly, the analysis examines the path from the hypothesized mediator to the outcome but does not directly address the path from the intervention to the mediator.

METHODS

Study Selection and Inclusion Criteria

The study involves reviewing, combining, and quantitatively summarizing the results of many different studies dealing with the same research question, which in this instance is the impact of school-based prevention activities on selected risk factors and problem behavior. The studies contributing to the current synthesis were selected from a larger set of studies used to inform a recent review and meta-analysis of the features of effective school-based prevention activities (Gottfredson, 1997, 2001; Gottfredson *et al.*, in press; Wilson *et al.*, 2001). The studies were identified through searches of computer bibliographic databases (e.g., PsychLit, ERIC, Sociological Abstracts). As a safeguard, the resulting list of published studies of school-based prevention efforts was cross-referenced with studies cited in recent reviews of prevention programs (Botvin, 1990; Botvin *et al.*, 1995; Dryfoos, 1990; Durlak, 1995; Hansen, 1992; Hawkins *et al.*, 1995; Institute of Medicine, 1994; Tobler, 1986, 1992; Tremblay & Craig, 1995). The search of recent reviews resulted in the identification and inclusion of a few unpublished studies.

In order to be included in the current meta-analysis, each study had to meet several criteria. First, the study must have evaluated an intervention, program, or procedure intended to reduce problem behavior or to affect presumed causal factors of problem behavior. Second, the intervention must have been school-based. In other words, the program must have been implemented primarily in school buildings, or implemented by school staff or under the backing of the school system. Third, the evaluation must have included a no-treatment or minimal-treatment comparison group. Fourth, the evaluation must have reported the effects of the program on one or more problem behaviors. Problem behaviors of interest to the study included indicators of (1) crime and delinquency; (2) alcohol and other drug use, excluding cigarette and smokeless tobacco use; (3) withdrawal from school, school dropout, truancy from school, and tardiness; and (4) rebellious behavior, noncriminal antisocial behavior, aggressive behavior, defiance of authority, disrespect for others, school suspension, and school expulsion.[4] Finally, the evaluation must have reported the effects of the program on at least one of the three risk factors of interest (i.e., academic performance, bonding to school, and social competency skills). It is important to recognize that one cannot assume that all of the studies measuring a particular risk factor actually had a program component designed to change the risk factor. In fact one would hope that not all programs with measures of a risk factor had an intervention component designed to impact the risk factor. If this were the case, and all of the studies actually achieved reductions in risk, there would be little variation in risk factor effect sizes across studies, making it impossible to include the risk factor construct as a predictor of problem behavior in the analysis that follows.

A total of 87 studies representing 114 documents met the above five criteria.[5] The vast majority of the studies (95%) were published documents.

Independent and Dependent Variables

Although the three risk factors are treated as dependent variables in the individual studies providing the data for the meta-analysis, the current research is concerned with whether changes in the factors result

[4]The decision to exclude cigarette and smokeless tobacco use was a practical one. Including these behaviors would have resulted in the inclusion of an unmanageable number of studies. Studies targeting multiple substances were included, but only study measures pertaining to substances other than cigarettes and smokeless tobacco were treated as eligible measures.

[5]A list of the studies is available from the authors.

in a change in problem behavior. Because this test involves an assessment of whether the risk factors predict problem behavior, the factors are treated as independent variables. For the purposes of this research, academic performance is operationally defined by school grades and grade-based measures, such as the number of courses failed and grade retention. School bonding is defined as attachment or commitment to school. It includes measures of the extent to which an individual likes school, as well as measures of educational aspirations and expectations. Social competency skills are defined as problem-solving, decision-making, and coping skills. These skills assist individuals in competent behavioral responding, a process that involves interpreting a social cue, deciding how to respond to that cue, and executing a response (Dodge, 1986; Dodge *et al.*, 1986).

The dependent variable in this research is problem behavior. Following the conceptualization of deviance offered by Jessor and Jessor (1977), problem behavior is defined as "behavior that is socially defined as a problem, a source of concern, or as undesirable by the norms of conventional society and the institutions of adult authority, and its occurrence usually elicits some kind of social control response" (p. 33). Various adolescent problem behaviors, including crime and delinquency, alcohol and other drug use, attendance problems, and conduct problems, are treated as representing a single behavioral syndrome. Research has repeatedly demonstrated positive correlations among these problem behaviors (Bachman *et al.*, 1978; Dryfoos, 1990, 1997; Elliott *et al.*, 1989; Huizinga & Jacob-Chien, 1998; Jessor & Jessor, 1977; Johnston *et al.*, 1978; Smith & Fogg, 1978; White, 1992), and factor analyses focusing on their covariance have generally concluded that a single-factor model is able to account for their correlations (Donovan & Jessor, 1985; Donovan *et al.*, 1988; Farrell *et al.*, 1992; McGee & Newcomb, 1992). The specific measures used to operationalize problem behavior and the risk factors varied from study to study.

Coding Unit: Treatment–Comparison Contrasts

Many of the studies report on multiple treatment–comparison contrasts. Studies with multiple treatment–comparison contrasts sharing some or all of the same students are problematic in meta-analysis, because statistical dependencies are introduced in the data when two or more contrasts share subjects. Multiple contrasts with shared subjects generally take two forms: (1) a single intervention group compared with two distinct control groups, and (2) two distinct intervention groups compared with a single control group.

In instances with multiple treatment–comparison contrasts representing the first form, a decision was made as to which control group most resembled the intervention group. This decision was based on the description of the groups provided by the study's authors and consideration of differences on pretest data when provided. Only contrasts including the control group most similar to the intervention group were identified for inclusion in the analysis.

Multiple treatment–comparison contrasts representing the second form (i.e., two distinct interventions compared with a single control group) were handled on a case-by-case basis. In some instances, the multiple contrasts are defined on the basis of varying levels of program implementation. In other words, the multiple intervention groups are distinct to the extent that they receive the prevention program at different doses. Because there is reason to expect that change occurring as the result of an intervention is most likely when the intervention is implemented at its fullest, only the contrast containing the students receiving the program at the strongest level was selected for inclusion in the meta-analysis. In other instances, the multiple contrasts represent distinct individuals receiving entirely different interventions but sharing the same comparison group. Because the interventions are completely distinct in content and not simply variations of the same program, there is no clear-cut decision rule to warrant maintaining one group of intervention subjects for analysis while excluding the other. Thus in situations such as this, both contrasts were maintained. Although dependencies are introduced by two groups of intervention subjects sharing a comparison group, this situation occurred in only 5 of the 87 studies and thus is not likely to produce substantial error. A total of 98 treatment–comparison contrasts were identified in the 87 studies. Each of the 98 contrasts contained at least one measure of problem behavior; 37 contained at least one measure of academic performance; 24 contained at least one measure of bonding to school; and 55 contained at least one measure of social competency skills.

Coding the Studies and Computing Effect Sizes

A code book was developed to capture information regarding the characteristics of the student population, the nature of the intervention, the research

methodology, the measures of problem behavior, the measures of risk factors, and the observed effects on these measures.[6] Each study was coded by two trained graduate students. Any discrepancies in coding were discussed and resolved.

Whenever possible, the effects of the intervention on the risk factors and the problem behaviors were expressed as standardized mean difference effect sizes. A positive effect size reflects an effect favoring the treatment group on the outcome examined, whereas a negative effect size reflects an effect favoring the comparison group. The standardized mean difference effect size is a measure of the difference between treatment and comparison groups relative to the standard deviation of the measure.[7] Standardizing the difference between the treatment group mean and the control group mean allows for the comparison of effects across studies (see Wilson *et al.*, 2001, for more details). When baseline means were reported by the primary studies, the posttreatment difference was adjusted for any pretreatment difference on that measure.

In some of the primary studies, the effects of the intervention on the constructs of interest were examined at multiple measurement points following the completion of the intervention (e.g., immediate posttest, 1-year follow-up, 2-year follow-up). Meta-analysis assumes that each sample contributes only one effect size. Thus, only effect sizes based on the first available postintervention measurement point were considered. It is reasonable to assume that if the intervention produces a change in behavior, such change is likely to be most pronounced immediately following program completion. In addition, many of the primary studies included multiple measures of the same construct (e.g., three measures of problem behavior). In such an instance, effect sizes based on multiple measures of the same construct were averaged.

Finally, each dependent variable effect size was weighted by the inverse of the sampling error variance. Doing so permits effects based on larger samples to contribute more than effects based on smaller samples. Effect sizes based on larger samples contain less sampling error, and thus were allowed to make a greater contribution to the results.

Despite being able to compute effect sizes from a range of statistical data, in many cases the studies did not report any of the information needed to compute effect sizes for the factors and behaviors of interest. In such instances, an attempt was made to at least record the direction of the effect (i.e., favored the treatment group, favored the comparison group, or no difference) and whether it was statistically significant. Effect sizes could be computed for (a) 22 of 37 intervention–comparison contrasts containing measures of both academic performance and problem behavior, (b) 20 of 24 intervention–comparison contrasts containing measures of both bonding to school and problem behavior, and (c) 31 of 55 intervention–comparison contrasts containing measures of both social competency skills and problem behavior.

Statistical Analysis

In order to determine whether improvements in the selected risk factors were associated with improvements in problem behavior, we first estimated three random effects bivariate regression equations (one for each risk factor), where the dependent variable was the weighted effect size for problem behavior following the intervention and the independent variable was the effect size for the risk factor following the intervention. The random effects approach to analyzing effect sizes assumes that the effect size distribution is heterogeneous, and that effect sizes differ from the population mean as a function of variance due to sampling error and variance due to random unmeasured differences among studies (Lipsey & Wilson, 2001; Raudenbush, 1994). If in fact the risk factor is a cause of problem behavior, one would expect to observe a positive correlation between their respective effect sizes. In contrast, if the two variables are unrelated and the factor is not predictive of problem behavior, one should observe a zero or near-zero correlation.

The second step in the analysis examined the robustness of the relationship between the risk factor and problem behavior effect sizes. Extreme effect sizes judged to be unrepresentative of study findings were removed from the effect size distribution, and the bivariate relationship between the risk factor effect sizes and the problem behavior effect sizes was reestimated using the trimmed distribution. In addition, various study variables were added to the regression equations to determine if the association between the key constructs changed once variability in the dependent variable due to potentially important method and sample features was controlled. Two independent variables capturing sample characteristics (i.e., grade level, risk status) and three independent

[6] A copy of the code book is available from the authors.

[7] The standardized mean difference effect size can be approximated from a wide range of summary statistics. For a full list of effect size formulas see Lipsey and Wilson (2001).

variables capturing features of the study methodology (i.e., random assignment, initial group similarity, overall method rating) were individually added to each of the three regression equations. Including these sample and method variables in the regression equations allows one to determine if the relationship between each risk factor and problem behavior is attenuated by differences in samples and differences in methodologies across studies. The Appendix describes the measures in greater detail.

Finally, the relationship between each risk factor and problem behavior was assessed using measures based solely on direction of effect rather than actual effect size. This step of the analysis was not limited to the cases where effect sizes could be computed for both the risk factor and problem behavior but instead included any case where a simple determination could be made regarding the direction of the effect ($1 =$ *favored the treatment group*, $-1 =$ *favored the comparison group*, $0 =$ *no difference*). If the effects that lack sufficient information to compute actual effect size statistics do not systematically differ from those effects where actual effect sizes could be computed, the bivariate correlation based on direction only should be similar to the bivariate correlation based on effect sizes.

RESULTS

Description of the Interventions

Each intervention program was assessed for the presence or absence of 17 intervention components (e.g., instruction, counseling, interventions to change norms) using a classification scheme developed for use in the National Study of Delinquency Prevention in Schools (Gottfredson *et al.*, 2000). These codes were used to group programs into 11 mutually exclusive program categories. The 11 intervention categories were further grouped as being either environmentally or individually focused. The distribution of program types is shown in Table 1. Three fourths of the interventions were categorized as individually focused interventions, concerned with changing knowledge, attitudes, beliefs, behaviors, or skills of individual students (Gottfredson *et al.*, in press). A much smaller percentage of the interventions (24%) were categorized as environmentally focused interventions, concerned with changing the school or classroom environment in order to reduce problem behavior and increase prosocial behavior (Gottfredson *et al.*, in press).

Methodology and Sample Descriptors

The characteristics of the sample and methodology for the 98 treatment–comparison contrasts are summarized in Table 2. The majority of the contrasts (82%) used nonrandom assignment of students to conditions. Despite this, more than half of the treatment–comparison contrasts were placed in the top three categories of initial group similarity, and 61% of the treatment–comparison contrasts were placed in the top two categories of overall evaluation methodology. With regard to sample characteristics,

Table 1. Major Intervention Categories for the 98 Intervention–Comparison Contrasts

Intervention category	Frequency	Percentage
Environmentally focused interventions	23	23.5
School and discipline management interventions	5	5.1
Establishing norms or expectations for behavior	4	4.1
Classroom or instructional management	9	9.2
Reorganization of grades or classrooms	5	5.1
Individually focused interventions	75	76.5
Self-control or social-competency instruction		
With cognitive–behavioral or behavioral instructional methods	33	33.7
Without cognitive–behavioral or behavioral instructional methods	11	11.2
Other instructional programs	5	5.1
Cognitive–behavioral, behavioral modeling, or behavior modification	12	12.2
Counseling, social work, and other therapeutic interventions	5	5.1
Mentoring, tutoring, and work study	6	6.1
Recreation, community service, enrichment, and leisure activities	3	3.1

Table 2. Methodology and Sample Descriptors for the 98 Intervention–Comparison Contrasts

Variable	Frequency	Percentage
Assignment to conditions		
Nonrandom	80	81.6
Random	18	18.4
Rating of initial group similarity (1 = *highly dissimilar*, 7 = *highly similar*)		
1	0	0.0
2	5	5.1
3	21	21.4
4	21	21.4
5	24	24.5
6	21	21.4
7	6	6.1
Overall evaluation methodology		
Serious weaknesses	1	1.0
Moderate weaknesses	11	11.2
Some weaknesses/some strengths	26	26.5
Moderate strengths	50	51.0
Rigorous	10	10.2
School grades included		
Preschool	1	1.0
Early elementary	21	21.4
Late elementary	24	24.5
Middle/junior high school	48	49.0
Senior high school	24	24.5
Level of criminal involvement		
General school population	64	65.3
High-risk population	34	34.7

the most common grade level targeted in the studies was middle/junior high school students. Roughly equal numbers of interventions were aimed at early elementary, late elementary, and senior high school students. Studies targeting preschool students were extremely uncommon. Most of the interventions were delivered to a general student population. Approximately one third of the interventions were restricted to a high-risk student population. Gender and race variables were missing for many of the treatment–comparison contrasts. Of the 68 contrasts for which gender was reported, the mean proportion of females was 40%. Of the 59 contrasts for which racial makeup was reported, the mean proportion of Caucasians was 51%.

Effect Size Analyses

Mean Effect Sizes

The random effects mean effect size for each of the three risk factors and problem behavior is shown in Table 3. Overall, the interventions had a small positive effect on problem behavior, with mean effect sizes ranging from 0.05 to 0.11. Consistent with the notion of mediating effects, program effects were slightly larger for the risk factors, with mean effect sizes ranging from 0.11 for bonding to school to 0.28 for social competency.

Table 3. Random Effects Mean Effect Size

Variable	Mean ES	Min ES	Max ES	Q^a	k^b
Problem behavior	0.11	−0.18	0.68	84.6	22
Academic performance	0.19	−0.27	0.89	187.0	22
Problem behavior	0.05	−0.23	0.30	60.3	20
Bonding to school	0.11	−0.28	0.68	57.5	20
Problem behavior	0.09	−0.47	1.69	82.7	31
Social competency	0.28	−0.18	2.16	209.6	31

Note. The first two rows of the table pertain to contrasts for which effect sizes for problem behavior and academic performance could be computed; the next two rows pertain to contrasts for which effect sizes for problem behavior and bonding to school could be computed; and, the last two rows pertain to contrasts for which effect sizes for problem behavior and social competency could be computed.

[a]Homogeneity test. All Q values are statistically significant indicating that the distributions are heterogenous.

[b]Number of effect sizes contributing to each analysis.

Table 3 also displays the Q statistic for each distribution of effect sizes. The Q values indicate that the distributions are all heterogenous, and that the variability of effect sizes is larger than would be expected by chance. In other words, there are differences among the effect sizes due to sources other than sampling error. This heterogeneity is not particularly surprising given the data, and it does not necessarily mean that the measures themselves are heterogenous. Although it is possible that there are differences between studies in the way that the constructs are measured, it is also plausible that the heterogeneity is the result of differences between studies in the impact of treatment. The purpose of meta-analysis is to explain variability. When meta-analyzing studies of school-based prevention programs, one would expect variability in effect sizes, because one would assume that not all programs impact behaviors and attitudes the same. If the Q values associated with the effect size distributions indicated homogeneous distributions, we would not have enough dispersion of effects to allow for the analysis presented below.

Academic Performance and Problem Behavior

The correlations between the academic performance effect sizes and problem behavior effect sizes are shown in Table 4. The bivariate regression equation based on the full distribution of effect sizes

Table 4. Random Effects Regression Analysis for Problem Behavior Effect Sizes Regressed on Academic Performance Effect Sizes

	Variable	*r*	*B*	*k*[a]
Bivariate models				
1	Academic performance	.58	0.37**	22[b]
2	Academic performance	.33	0.18	21[c]
Multivariate models				
3	Academic performance	.30[d]	0.17	21
	Random assignment		−0.09	
4	Academic performance	.26[d]	0.16	21
	Initial group similarity		−0.02	
5	Academic performance	.19[d]	0.12	21
	Overall evaluation methodology		−0.05	
6	Academic performance	.33[d]	0.19	21
	Grade level		0.03	
7	Academic performance	.32[d]	0.18	21
	High risk		−0.01	
Direction only				
8	Academic performance	.27		37

[a]Number of effect sizes contributing to each analysis.
[b]Full distribution of effect sizes.
[c]Trimmed distribution of effect sizes.
[d]Semipartial correlation between academic performance and problem behavior.
** $p < .01$.

produced a correlation between the two constructs of .58 (see Table 4, Model 1). As expected, improvements in academic performance were significantly associated with improvements in problem behavior.

One of the 22 treatment–comparison contrasts containing effect sizes for both academic performance and problem behavior was found to contain effect sizes that were notably discrepant from the mean of the distribution.[8] When this contrast was removed from the effect size distribution, the bivariate correlation between academic performance and problem behavior was reduced to .33 (see Table 4, Model 2). Although this correlation is noticeably smaller than the correlation based on the full distribution of effect sizes, it is nonetheless indicative of a moderate positive relationship.

Models 3 through 5 in Table 4 show the correlation between academic performance and problem behavior remaining after taking into account features of the methodology. Of primary interest is the semipartial correlation between the risk factor and problem behavior effect sizes. The semipartial correlation represents the correlation that remains after controlling for the added independent variables. If the relationship between academic performance and problem behavior is robust, one would expect little change in the correlation after controlling for the methodological characteristics of the studies. The findings generally support the earlier conclusion of a moderate relationship, with semipartial correlations ranging from .19 to .30. Models 6 and 7 show the correlation between academic performance and problem behavior remaining after taking into account features of the sample, namely grade level and risk status. Including these variables had essentially no effect on the correlation, indicating that the relationship between the two constructs was not conditioned by either grade level or high-risk status.

Finally, when program effects were coded based on direction only, rather than effect size, the bivariate correlation between academic performance and problem behavior was .27 (see Table 4, Model 8). This finding is consistent with the results based on the effect size distribution. It appears that the program effects that lacked sufficient information to compute actual effect size statistics did not systematically differ from those effects where effect sizes could be computed, at least with regard to the direction of effects. Taken together, these findings indicate a moderate positive relationship, though not statistically significant, between improvements in academic performance and improvements in problem behavior.

Bonding to School and Problem Behavior

The correlations between the bonding to school effect sizes and problem behavior effect sizes are shown in Table 5. The bivariate regression equation based on the full distribution of effect sizes produced a correlation between the two constructs of .82, indicating a strong positive association between improvements in bonding to school and improvements in problem behavior (see Table 5, Model 1).

One of the 20 treatment–comparison contrasts containing effect sizes for both bonding to school and problem behavior was found to contain effect sizes that were notably discrepant from the mean of the distribution. When this contrast was removed from the effect size distribution, the bivariate correlation

[8]Outliers were identified by generating a scatter-plot with the risk factor effect size on one axis and the problem behavior effect size on the other. *Z* scores were computed for suspect study effect sizes by subtracting the study effect size from the mean effect size of the distribution and dividing the resulting difference by the weighted standard deviation of the distribution. If the resulting *z* score was greater than 1.96, the effect size value was considered to be an outlier.

Table 5. Random Effects Regression Analysis for Problem Behavior Effect Sizes Regressed on Bonding to School Effect Sizes

	Variable	*r*	*B*	*k*[a]
Bivariate models				
1	Bonding to school	.82	0.79***	20[b]
2	Bonding to school	.86	0.89***	19[c]
Multivariate models				
3	Bonding to school	.84[d]	0.90***	19
	Random assignment		−0.04	
4	Bonding to school	.86[d]	0.88***	19
	Initial group similarity		−0.01	
5	Bonding to school	.85[d]	0.85***	19
	Overall evaluation methodology		−0.02	
6	Bonding to school	.83[d]	0.88***	19
	Grade level		0.03	
7	Bonding to school	.86[d]	0.89***	19
	High risk		0.02	
Direction only				
8	Bonding to school	.56		24

[a]Number of effect sizes contributing to each analysis.
[b]Full distribution of effect sizes.
[c]Trimmed distribution of effect sizes.
[d]Semipartial correlation between bonding to school and problem behavior.
***$p < .001$.

between school bonding and problem behavior actually increased slightly to .86 (see Table 5, Model 2).

Models 3 through 7 in Table 5 show the correlation between school bonding and problem behavior remaining after taking into account features of the methodology and the characteristics of the sample. The findings are consistent with the above conclusion of a robust relationship, with correlations ranging from .83 to .86. The relationship between bonding to school and problem behavior remained large, positive, and significant, even after controlling for the added independent variables.

Finally, when program effects were coded based on direction only, rather than effect size, the correlation between bonding to school and problem behavior was .56 (see Table 5, Model 8). This finding is consistent with the results based on the effect size distribution and suggests that the program effects that lacked sufficient information to compute actual effect size statistics did not systematically differ from those effects where effect sizes could be computed. Taken together, these findings provide compelling evidence of a robust relationship between school bonding and problem behavior. Positive changes in attachment and commitment to school were consistently accompanied by positive changes in problem behavior.

Social Competency Skills and Problem Behavior

The correlations between the social competency skills effect sizes and problem behavior effect sizes are shown in Table 6. The bivariate regression equation based on the full distribution of effect sizes produced a correlation between the two constructs of .46, indicating a fairly strong and significant association between improvements in social competency skills and improvements in problem behavior (see Table 6, Model 1).

Two of the 31 treatment–comparison contrasts containing effect sizes for both social competency skills and problem behavior were found to contain effect sizes that were notably discrepant from the mean of the distribution. When these contrasts were removed from the effect size distribution, the bivariate correlation between social competency and problem behavior was noticeably reduced to .12 (see Table 6, Model 2). Inconsistent with expectations, it appears that interventions that produced positive changes in social competency skills produced only slight improvements in problem behavior.

Models 3 through 7 in Table 6 show the correlation between social competency skills and problem behavior remaining after taking into account features of the methodology and the characteristics of

Table 6. Random Effects Regression Analysis for Problem Behavior Effect Sizes Regressed on Social Competency Effect Sizes

	Variable	*r*	*B*	*k*[a]
Bivariate models				
1	Social competency	.46	0.39***	31[b]
2	Social competency	.12	0.07	29[c]
Multivariate models				
3	Social competency	.11[d]	0.07	29
	Random assignment		0.12	
4	Social competency	.17[d]	0.11	29
	Initial group similarity		0.02	
5	Social competency	.11[d]	0.06	29
	Overall evaluation methodology		0.07*	
6	Social competency	.09[d]	0.06	29
	Grade level		−0.04	
7	Social competency	.11[d]	0.07	29
	High risk		0.12	
Direction only				
8	Social competency	.31		55

[a]Number of effect sizes contributing to each analysis.
[b]Full distribution of effect sizes.
[c]Trimmed distribution of effect sizes.
[d]Semipartial correlation between social competency and problem behavior.
*$p < .05$. ***$p < .001$.

the students targeted by the interventions. The findings are consistent with the above conclusion of a modest association, with correlations ranging from .09 to .17.

Finally, when program effects were coded based on direction only, rather than effect size, the correlation between social competency skills and problem behavior was .31 (see Table 6, Model 8). This finding suggests that the studies that lacked sufficient information to compute actual effect size statistics systematically differed from those studies where actual effect sizes could be computed, such that the former were more likely to observe positive changes in both social competency skills and problem behavior.

In an attempt to better understand the unexpected weak association between the social competency effect sizes and the problem behavior effect sizes, differences in the measurement of social competency were explored. A substantial amount of research has been devoted to the assessment of social competency skills in children and adolescents (Butler & Meichenbaum, 1981; Hops & Greenwood, 1981; Kendall *et al.*, 1981; Michelson *et al.*, 1981). A number of different assessment modalities have been used to measure competency, including self-reports, ratings by significant others, and naturalistic observation, and not all assessment procedures have been found to predict social competency equally well (see, for example, Schneider & Byrne, 1989; Waas & French, 1989). The lack of concordance between measures, particularly the disagreement between self-ratings of competence and ratings of competence by others, has led some to suggest that the evaluation of one's own behavior and skills may lack objectivity and that self-evaluations may be affected by social desirability considerations. For example, a child may provide a very competent response when asked what he or she would do if placed in a hypothetical interpersonal problem-solving situation. However, in real-life problem situations, the child might behave in a much less rational and less competent manner. Although the child is able to recognize a competent response, the ability to formulate an appropriate solution does not necessarily translate to actual behavior. In such an instance, it is plausible to expect that judgements of competence by outsiders, such as teachers, parents, and observers, would provide a more accurate assessment of social competence.

If self-report measures of social competence are less valid than reports of competence by others, and social competence is in fact a predictor of problem behavior, one should observe a stronger correlation between social competency skills and problem behavior when the measurement of competence is based on evaluations by others rather than self-reports. To explore this possibility, the bivariate relationship between social competency and problem behavior was estimated separately for treatment–comparison contrasts with self-report measures of social competency ($N = 24$) and treatment–comparison contrasts with measures of social competency based on other sources ($N = 12$). After removing outliers from each effect size distribution, the weighted effect sizes for problem behavior were regressed on each set of social competency effect sizes. The two regression equations produced markedly different findings. The bivariate correlation between self-reported social competency and problem behavior was nearly zero ($r = .03$). In contrast, the bivariate correlation between judgements of social competency by others and problem behavior was .60. This discrepancy suggests that the two sets of competency indicators are measuring quite different things. To the extent that measures based on observations by researchers, ratings by parents, and reports by teachers represent more valid indicators of social competence, these results are encouraging and consistent with expectations.

Taken together, the findings bearing on the association between social competency skills and problem behavior are mixed, but suggest a positive relationship. When all measures of competence were analyzed together, only a weak association between the two constructs was observed. However, when measures of competency skills based on sources other than self-reports were examined separately, there were indications of a strong and positive relationship between improvements in social competency skills and improvements in problem behavior.

Perhaps the most notable contribution of the above findings is that they point to the importance of measurement and raise questions concerning how to best measure social competency. The current research suggests a lack of concordance between self-report measures of social competency and measures of social competency based on ratings and observations by others. As noted, one plausible explanation for this finding is that the evaluation of one's own behavior and skills tends to reflect inflated perceptions of competence as opposed to actual skills. However, one could also make the argument that the correlation between ratings of competence by others and problem behavior may be exaggerated to the extent that the same adult rater is rating both the problem behavior and social competency skills. Similarly, adult

ratings and observations of social competency may be confounded with measures of problem behavior, as social competency skill deficits may closely mirror indicators of problem behavior (e.g., defiance of authority, disrespect of others). Clearly, there are many issues to be considered, and it would be premature to make the blanket statement that adult judgements of social competency are superior to self-report measures. Hops (1983) has suggested that measures based on different sources capture independent dimensions of social competence. To the extent that this is true, the best approach to measuring social competency may be to utilize multiple measures of competence based on different sources.

DISCUSSION

In an effort to better understand the relationship between problem behavior and academic performance, bonding to school, and social competency skills, the present research applied meta-analytic techniques to existing experimental and quasi-experimental studies of school-based prevention. The most convincing evidence of a relationship between risk and problem behavior was found for bonding to school. Positive changes in attachment and commitment to school were consistently accompanied by positive changes in problem behavior. Academic performance effect sizes were found to have a moderate positive association with problem behavior effect sizes. These findings, when compared with the results bearing on the relationship between school bonding and problem behavior, suggest that attachment to school and commitment to education are more predictive of problem behavior than achievement in school. In his discussion of attachment to school, Hirschi (1969) posits a causal chain that runs from academic incompetence to poor academic performance to disliking of school to the rejection of the school's authority to involvement in deviant behavior. He also predicts that the variables that are further removed in the causal chain from the dependent variable will have a weaker relationship with the dependent variable than the hypothesized proximate variables. Although this hypothesis was not directly addressed in the current research, it is consistent with the finding of a larger correlation between school bonding and problem behavior than between academic performance and problem behavior. With regard to social competence, the association depended in large part on the type of measure used to assess social competency skills. Self-report measures of social competency were unrelated to problem behavior, whereas a strong positive correlation was observed between ratings and observations of social competency by others and improvements in problem behavior.

Limitations

Inferring Causality

The findings noted above contribute to our understanding of the relationship between selected risk factors and problem behavior. The most distinctive feature of this research is its application of meta-analytic techniques to experimental and quasi-experimental studies of school-based prevention. Observing change in both a risk factor and problem behavior following an intervention provides a better indication of whether the risk factor is a cause of problem behavior than a simple correlation between the two variables in a longitudinal or cross-sectional study, because variables are manipulated as a consequence of program exposure.

Nonetheless, it is important to recognize that observing a strong association between change in one variable and change in another, such as the correlation observed in the current research between effects on bonding to school and effects on problem behavior, does not absolutely imply causality. Because the research is based on groupwise data, it is possible that the risk factor effect size reflects the behaviors or attitudes of one group whereas the problem behavior effect size reflects the behaviors of another group. In such an instance, the correlation between change in the risk factor and change in problem behavior is not the result of the mediating effect of the risk factor but is instead the result of the intervention producing change in the risk factor among one set of subjects and change in problem behavior among another set of subjects.

An additional limitation of the data is that it is not possible to determine (1) whether the intervention altered the risk factor, which subsequently reduced problem behavior, (2) whether the intervention directly affected problem behavior and the risk factor, (3) whether the intervention directly affected problem behavior, which subsequently reduced the risk factor, or (4) whether the intervention directly affected a third unmeasured variable, which subsequently reduced the risk factor and problem behavior.

Although experimental and quasi-experimental studies afford higher internal validity related to the causal effect of the manipulation on both the risk factor and problem behavior, one can only infer that the change in the risk factor caused the change in problem behavior. More definitive conclusions regarding causal order would require a theory about the time lag involved in altering the risk factor, the time lag involved in the risk factor affecting the behavior, and corresponding measures to capture these lags. Nonetheless, two factors support the conclusion that change in the risk factors preceded change in problem behavior. First, the theoretical rationales underlying many of the interventions suggest that the programs directly targeted the risk factors more often than the problem behaviors. Second, a comparison of program effects on the risk factors and program effects on problem behavior suggests that change in the risk factors preceded change in problem behavior. In each of the effect size analyses, the mean effect size for the risk factor was larger than the mean effect size for problem behavior. This pattern is consistent with the notion of the risk factors as mediating variables and the idea that program effects will be largest for proximal outcomes.

Heterogeneity of the Measures

Another limitation of the current study is that it combines disparate measures of both the independent variables and the dependent variable. With regard to the dependent variable, there is empirical evidence that the behaviors subsumed in the definition of "problem behavior" (i.e., crime and delinquency, alcohol and other drug use, school attendance problems, and conduct problems) are manifestations of a single general tendency, and that deviance is a unified phenomenon (Donovan & Jessor, 1985; Donovan *et al.*, 1988; Farrell *et al.*, 1992; McGee & Newcomb, 1992). Nonetheless, it is possible that the evidence of causality would be different for different dimensions of problem behavior. For example, improvements in academic achievement may decrease the likelihood of dropout but have little impact on drug use. Similarly, it is possible that the evidence for causality would be different for different ways of measuring the risk factors. This was in fact found to be the case for social competency skills. Evidence of causality was stronger for judgements of competence by others, as opposed to self-evaluations. Similar discrepancies may exist among the other risk factors as well. Unfortunately, because of the already limited number of studies available for analysis, dividing the studies into subsets on the basis of type of risk factor measure or problem behavior measure was not possible.

Recommendations

The clearest implication of this research is that prevention programs that increase bonding to school have the potential to significantly reduce problem behavior. Interventions that increase academic performance are also likely to reduce problem behavior, but to a lesser extent than programs that produce positive changes in bonding to school. Assuming that measures of social competency skills based on reports by others are more valid indicators of the construct than those based on self-reports, programs that achieve improvements in social competency skills should also observe a corresponding decrease in problem behavior.

The purpose of this research was to examine the association between selected risk factors and problem behavior. Accordingly, the analysis examined the path from the hypothesized mediator to the outcome but did not address the path from the intervention to the mediator. Future research should consider the characteristics of interventions that predict change in the risk factors. As illustrated in Table 3, the average effect sizes for the risk factors and problem behavior are small, indicating that on average, prevention programs are not producing noticeable reductions in risk factors and problem behavior. This may be the result of schools implementing programs with a scattered focus and too little attention paid to the quality of implementation. The typical school operates fourteen different prevention activities concurrently, and the typical activity is implemented with poor quality (Gottfredson *et al.*, 2000). Nonetheless, the minimum and maximum effect sizes presented in Table 3 cover a broad range, indicating that some programs are achieving large reductions in risk and problem behavior. Researchers should consider the processes of mediation and should try to connect program elements with the mediators. Identifying the specific characteristics of programs that produce the largest reductions in risk will assist schools in selecting prevention activities known to produce positive outcomes.

APPENDIX: SAMPLE AND METHOD VARIABLES

Grade level. This is an ordinal variable measuring the grade level of the subjects at the time of the intervention and ranges in value from 1 to 5 (1 = *mostly*

preschool, 2 = *mostly early elementary*, 3 = *mostly upper elementary*, 4 = *mostly middle school*, 5 = *mostly high school*).

Risk status. This is a dichotomous variable where a value of 0 indicates that the subjects targeted by the intervention were representative of the general population, and a value of 1 indicates that the study subjects were characterized as being at high risk for problem behavior.

Random assignment to conditions. This is a dichotomous variable where a value of 0 indicates nonrandom assignment to conditions, and a value of 1 indicates random assignment of students to conditions.

Initial group similarity. This is an ordinal variable measuring the similarity of the intervention and comparison groups at baseline and ranges in value from 1 to 7 (1 = *highly dissimilar*, 7 = *highly similar*).

Method rating. This is an ordinal variable measuring the overall evaluation methodology and ranges in value from 1 to 5 (1 = *serious weaknesses*, 2 = *moderate weaknesses*, 3 = *some weaknesses/some strengths*, 4 = *moderate strengths*, 5 = *rigorous*). This 5-point evaluation was informed by a series of items addressing assignment to conditions, unit-of-assignment, unit-of-analysis, use of control variables in the analyses to adjust for initial group differences, rating of initial group similarity, variable measurement, and attrition.

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