The Use of Reading and Behavior Screening Measures to Predict Nonresponse to School-Wide Positive Behavior Support: A Longitudinal Analysis

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Abstract. This study involved a longitudinal analysis of academic skills and problem behavior through elementary school. The purposes of the study were (a) to explore the interactions between reading skills and problem behavior, and (b) to determine the value of regular screening assessments in predicting which students would not respond to school-wide behavior support in fifth grade. The participants were elementary school students who entered kindergarten in 1998 and completed fifth grade in a school district with school-wide reading and behavior support systems. Analyses consisted of logistic regressions to predict the number of discipline contacts in fifth grade. Results indicated that both reading and behavior variables (including kindergarten reading variables) significantly predicted the number of discipline referrals received in fifth grade. Results are discussed in terms of determining pathways to problem behavior and implications for a combined approach to academic and behavior problems.

Recent research related to the prevention of problem behavior in schools has shown that the signs of antisocial behavior emerge as early as school entry in kindergarten (Hamre & Pianta, 2001; Walker et al., 1998). School personnel attempting to avert negative behavioral trajectories for students face a heightened sense of urgency; research indicates that both academic and behavioral interventions in-creasingly lose effectiveness after third grade (Juel, 1988; Kazdin, 1987; Walker & Severson, 1992). Knowing this information highlights the importance of detecting students who need additional support before the third grade and delivering interventions early in elementary school to avert more severe challenges (Good, Simmons, & Kame'enui, 2001; O'Shaughnessy, Lane, Gresham, & Beebe-

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Frankenberger, 2003; Sugai & Horner, 2002). With ever-dwindling resources, increasing caseloads, and increasing public scrutiny on outcomes, school personnel stand to benefit from taking a systems-level approach to improving academics and school safety (Shapiro, 2000; Walker et al., 1996).

A three-tiered model of prevention and intervention, as described by Walker and colleagues (1996), is one example of a school-wide system of effective academic and/or behavioral practices. In the model, universal interventions promote success for most students and serve as a foundation for providing additional support to students with more intense needs (Sugai, Horner, & Gresham, 2002). Three-tiered systems are based on a set of principles: (a) providing all students with universal interventions, (b) screening students to determine needed services, and (c) delivering a continuum of services matched to the level of support indicated by screening and assessment. Such a model has been adapted to school-based programs by a number of researchers focused on behavior change (Horner, Sugai, Todd, & Lewis-Palmer, 2005; Lane & Menzies, 2003; Nelson, Martella, & Marchand-Martella, 2002; Sprick, Sprick, & Garrison, 1992) and academic improvement (Kame'enui & Carnine, 1998; Vaughn, Linan-Thompson, & Hickman, 2003).

Delivering school-wide, universal behavioral interventions to all students is proving to be an efficient and effective method of providing a base level of support for students and reducing overall problem behavior in schools (Lewis & Sugai, 1999; Metzler, Biglan, Rusby, & Sprague, 2001; Scott, 2001; Taylor-Greene et al., 1997). Nevertheless, not all students will respond to universal interventions, and accordingly, key tasks for school psychologists and other personnel include identifying and providing interventions to nonresponders. By the time these students are identified as nonresponsive, they may have experienced a rich history of reinforcement for problem behavior (e.g., social attention or escape from academic demands), making further successful intervention more difficult (though still important and possible). Predicting which students are at risk for nonresponse should enhance the delivery of academic and behavior support, and improve the academic and social outcomes for students.

Research in the past decade points to two possible pathways to severe problem behavior: a social behavior deficit pathway (Kellam, Ling, Merisca, Brown, & Ialongo, 1998; Reid & Patterson, 1991) and an academic skill deficit pathway (Hinshaw, 1992b; Maguin & Loeber, 1995). The social behavior deficit pathway describes students who enter school with skill deficits in social behavior. These students enter school with poor social skills and a routine of practiced problem behavior that, without intervention, is likely to continue throughout school (Kellam et al., 1998; Reid & Patterson, 1991). They may receive discipline referrals early in school for problem behavior, particularly for inappropriate attempts to obtain or escape social interactions. Their behavior may eventually affect academic achievement (Fleming, Harachi, Cortes, Abbott, & Catalano, 2004; Hinshaw, 1992a), but they may not start school with reading deficits, as their behavior may not be influenced primarily by academic variables.

The academic behavior deficit pathway describes students who enter school with academic deficits but without an established routine of problem behavior. If these students do not respond quickly to universal academic instruction, the experience of repeated academic failure may lead to future problem behavior. A pattern of continued academic failure may lead to externalizing problem behaviors, such as aggression, disruption, and other antisocial behavior (Hinshaw, 1992b; Maguin & Loeber, 1995; Morrison, Furlong, & Morrison, 1997), or internalizing problem behaviors, such as negative self-attribution, learned helplessness, or depression (Dweck & Leggett, 1988; Dweck & Wortman, 1982; Sheridan, Hungelmann, & Maughan, 1999).

In this pathway, it is assumed that the academic and behavior challenges are closely linked, because academic difficulties occasion the problem behavior. As academic task demands increase, academic deficits prevent access to reinforcement for appropriate aca-

demic response, and the student becomes more and more averse to the academic tasks. If student problem behavior is reinforced through removal of the aversive work, the student may increasingly use problem behavior to escape tasks. The result may be an inadvertent cycle, in which (a) the teacher provides an academic task demand, (b) the student engages in problem behavior, and (c) the teacher removes the task from the student or the student from the task (e.g., time-out or sent to office). Within this scenario, the student's problem behavior is reinforced by escaping academic tasks (Lee, Sugai, & Horner, 1999; Roberts, Marshall, Nelson, & Albers, 2001), and the teacher's behavior, excluding the student from instruction, is reinforced by escaping from the student's aversive problem behavior (Wehby, Lane, & Falk, 2003). While other students' skills improve and the work becomes more advanced, the academic deficits of such at-risk students persist and problem behavior increases. This interaction is much like a coercive cycle of parent–child behavior (Patterson, 1982; Patterson, Reid, & Dishion, 1992). This pathway may be more insidious because students prevent themselves from accessing the instruction they need to learn effectively. Further, they may fail to benefit from school-wide systems with demonstrated effectiveness.

This study was designed to test parts of this dual pathway model to see how well it fits patterns that emerge in elementary school. The purpose of the study was to assess the extent to which early academic and behavior deficits contribute to continued behavior problems in the future. Although there is some evidence for the social behavior deficit pathway in the research literature, there is less evidence for the academic deficit pathway. Testing this aspect of the model would increase our understanding of the etiology of antisocial behavior and possibly guide efforts in creating more effective targeted interventions.

On a practical level, we set out to identify school risk factors (especially academic skills variables) that may lead to nonresponsiveness to school-wide behavioral interventions at the end of elementary school. Identi-fying these risk factors as early as kindergarten would help to identify students who need more support, allowing interventions to be delivered earlier, when the chances of effectiveness are greatest. In the interest of efficiency and availability to schools, we chose existing screening measures that many schools already use, rather than measures that would require additional resources.

To address these issues, we conducted three analyses. The analyses evaluated the progress of all students who were enrolled in the district from kindergarten through fifth grade, and assessed the extent to which elementary reading and behavior screening measures at three time points predicted at-risk levels of problem behavior in fifth grade. The study was designed to address the following research question: Within the context of a school district with school-wide reading and behavior support systems in place, to what extent do elementary school reading and behavior screening measures, administered in kindergarten, second grade, and fourth grade, predict multiple office discipline referrals in fifth grade?

Methods

Setting

The setting was a small but fast-growing school district located in a midsized city in the Pacific Northwest. The district is comprised of five schools serving children between kindergarten and Grade 5 and two schools for students in kindergarten through Grade 8 (one kindergarten to Grade 8 school was added in the 2002–2003 school year). During the final year of data collection (2003–2004) total district K–12 enrollment was 5,542 students. The district's ethnic composition was 2.5% African American, 2.4% Asian American or Pacific Islander, 83.6% Euro-American, 9.2% Hispanic or Latino, and 2.3% Native American or Native Alaskan. Six of the seven elementary schools in the district qualified for Title I services, and the mean percentage of children receiving free or reduced fare lunch in the district was 53%, (range 32 to 73%).

The district is characterized as having high rates of student mobility.

All schools in this study had implemented school-wide, three-tier reading (School-wide Reading Improvement Model; Simmons et al., 2002) and behavior (School-Wide Positive Behavior Support [SWPBS]; Horner et al., 2005) programs. Both programs had been in place for 10 years (Colvin & Fernandez, 2000; McIntosh, Chard, Boland, & Horner, 2006; Simmons et al., 2002). The school district has demonstrated a clear commitment to systems-level prevention and intervention by providing scheduled assessment, evaluation, and training to schools in both areas. As a regular part of evaluating the school-wide systems, researchers from the University of Oregon measured the fidelity of implementation for both programs at each school.

For the reading support program, researchers used the Planning and Evaluation Tool for Effective School-wide Reading Programs—Revised (Kame'enui & Simmons, 2002). This tool measures the extent to which school personnel have implemented aspects of an effective school-wide reading improvement model. Though research to determine specific criterion scores for implementation is underway, the criteria provided by these researchers based on the theoretical model are as follows: Schools that meet an 85% assessment score and an 85% overall score are assumed to have implemented an effective school-wide reading program. From 2002 to 2004, all schools met the assessment criteria (mean score = 96%, range 90–99%) and overall criteria (mean score = 92%, range 89–95%).

For the behavior support program, researchers used the School-Wide Evaluation Tool (SET; Horner et al., 2004). The SET utilizes interviews, observations, and permanent product reviews to determine percentage implementation of the critical features of a SWPBS program. Reliability indices are well within acceptable levels for internal consistency (Cronbach's α = 0.96 overall), test–retest reliability (0.97), and interobserver agreement (99%). Further, the scale has been demonstrated to be reasonably sensitive to the effects of SWPBS implementation (Horner et al., 2004). Data used to validate the SET suggest that meeting criteria of 80% on the teaching subscale and 80% on the overall scale indicate adequate implementation of the critical features of SWPBS. From 2001 to 2004, average implementation across schools on the teaching subscale was 88% (range 50–100%) and average overall implementation was 93% (range 79–100%). Out of 20 measurement periods during this time span, 75% of SET scores met both criteria.

Participants

Participants included students in fifth grade during the 2003–2004 academic year from all schools in the school district. The sample for the first analysis (from a total of 584 fifth-grade students in the district) was comprised of all students enrolled in the district from fourth and fifth grade ($n = 425$, 73% of all fifth-grade students). The sample for the second analysis used all students enrolled in the district in second and fifth grade ($n = 279$, 48% of all fifth-grade students). The sample for the third analysis used all students enrolled in the district in kindergarten and fifth grade ($n = 194$, 33% of all fifth-grade students).

Measures

Level of problem behavior. Student problem behavior was measured by using office discipline referrals (ODRs). This index is often used to document patterns of problem behavior among groups of students, schools, and specific areas of the schools (Sugai, Sprague, Horner, & Walker, 2000). School staff issue ODRs to students for serious behavioral violations, such as fighting, vandalism, harassment, or noncompliance, as opposed to minor warning slips for less serious violations. Each ODR documents a chain of school staff behaviors, including: (a) observing a behavioral violation, (b) writing a referral to document the incident, (c) sending the student to the office for administrative action, and (d) determination of actions taken. In the district studied, as well as more than 2,500 schools across the continent, ODRs are entered into the School-Wide Information Sys-

tem (May et al., 2002), a Web-based ODR data system, to monitor discipline contacts and tally total ODRs per year. This system includes specific definitions of problem behaviors and decision rules for determining which specific behaviors warrant a referral. These definitions and decision rules, combined with the district's yearly trainings to discriminate between behaviors that do and do not warrant an ODR, are designed to increase their consistency of use and address a possible threat to reliability of ODR data.

ODRs are not a perfect measure of behavior, as not all behaviors are observed or documented. However, ODRs possess sufficient construct validity as a behavioral measure (Irvin, Tobin, Sprague, Sugai, & Vincent, 2004), and they have been correlated with other indicators of academic achievement (Bryant, Schulenberg, Bachman, O'Malley, & Johnston, 2000) and conduct problems (Gottfredson & Gottfredson, 1999). In addition, the number and type of ODRs received significantly predict a range of future outcomes, including continued ODRs, violent events in school, and dropout (Bryant et al., 2000; Tobin & Sugai, 1999). Test–retest reliability from one year to the next for middle and high school students has been documented at 0.54 (Gottfredson & Gottfredson, 1999), higher than for behavior rating scales such as the Behavior Problem Checklist (Quay & Peterson, 1988).

The metric used to determine individual students' levels of problem behavior was the total number of major ODRs each year. Elementary school students receiving 0 or 1 ODRs per year have levels of problem behavior that are considered to demonstrate sufficient response to the school-wide universal behavior interventions, with little need for additional support. Students receiving 2 or more ODRs have levels of problem behavior that indicate both (a) an insufficient response to the school-wide interventions and (b) a need for additional behavior support, including targeted or intensive individual support. This criterion for responsiveness to intervention has been validated in 176 schools in nine states (Horner et al., 2005), as well as through the

use of behavior rating scales: Students receiving 2 or more ODRs in a year score significantly higher on the Problem Behavior subscale of the Social Skills Rating Scale (Gresham & Elliot, 1990) than students receiving 0 or 1 ODRs (Walker, Cheney, Stage, & Blum, 2005).

We selected ODRs to measure problem behavior because of their usefulness in documenting significant events of problem behavior both throughout the year and across years. Such data are not easily obtained by direct observation, which provides excellent data on high-frequency behaviors but not necessarily low-frequency, high-intensity behaviors (Sprague & Horner, 1999). In addition, school personnel in the district regularly use ODRs in data-based evaluation of both school-wide systems and group and individual interventions.

Reading skill. Student reading skill level was measured through Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002) and Curriculum-Based Measurement of Oral Reading Fluency (Shinn, 1989). DIBELS is a standardized, norm-referenced assessment used by more than 7,500 schools in kindergarten through Grade 6 to indicate need for reading support (Good, 2005). DIBELS assesses the most basic skills, including prereading skills (Kaminski & Good, 1996) and oral reading fluency. DIBELS subtests are administered to all students three times each academic year, in the fall, winter, and spring, as brief measures of progress toward achieving high-stakes reading outcomes. Subtests are brief assessments, and the administration time varies from 4 to 9 min per student depending on the grade level. In kindergarten and first grade, DIBELS Phoneme Segmentation Fluency and DIBELS Nonsense Word Fluency are key subtests for assessing prereading skills. Beginning in winter of first grade, the district uses oral reading fluency passages from the Test of Reading Fluency (Children's Educational Services, 1987) and this subtest becomes the primary measure of reading skill through sixth grade.

The reading measures were administered by school staff as part of the school

district's regular screening process. In each school, Title I reading teachers, aides, special education teachers, and school psychologists administered the subtests to students. The schools received regular technical assistance and training in administration from researchers at the University of Oregon.

Technical adequacy of both reading measures has been studied extensively. DIBELS has been researched extensively as a screening and progress monitoring tool to identify and track student progress toward meeting high-stakes reading outcomes (Good, Gruba, & Kaminski, 2002; Good et al., 2003; Kaminski & Good, 1998). In a recent technical adequacy analysis of reading assessment measures, the National Reading First Assessment Committee (Kame'enui, 2002) deemed all DIBELS subtests to have "sufficient evidence" (the highest rating) as screening, progress monitoring, and outcome measures. The DIBELS technical adequacy report (see Good et al., 2003) provides evidence of acceptable levels of reliability and validity. Oral reading fluency is based on more than 20 years of reading research and is regarded by many as the best screening measure of individual reading skills (Fuchs, 2004; Shinn, 1989; Shinn, Shinn, Hamilton, & Clarke, 2002).

The metric used to determine student reading skill level was the raw score of each subtest administered. Each subtest yields a continuous raw score, which can be compared to local norms or, more commonly in practice, against benchmark criteria that mark sufficient progress towards meeting early literacy goals. Students scoring above the benchmarks are considered on track toward positive literacy outcomes, and students below the benchmarks are viewed as not responding to the schoolwide universal reading intervention and likely to need additional reading support. Raw scores, rather than standard scores, were used for a number of reasons. First, both measures use a raw score based, rather than a standard score based, metric in determining whether students meet a raw score criterion. Second, using local percentile scores would have reduced the generalizability of the results to students on a national level. Third, school personnel using DIBELS and ORF are familiar with the raw scores and decision rules based on these scores. For these reasons, it was most logical to use the raw scores instead of converting them into standard scores.

Procedures

A member of our research team collected data from two archival databases used regularly by the school district. These data included three variables: number of major ODRs received each year, as derived from the district School-Wide Information System database, and DIBELS and ORF scores, as derived from the district reading project database. We then merged these data sets into one longitudinal database using Microsoft Access, Microsoft Excel, and SPSS 11 for Mac OS X, with cases representing individual students and variables representing repeated measurements of ODRs and reading scores.

Design

The design used was a longitudinal analysis of a grade cohort from kindergarten through fifth grade, with measurement of reading and behavior screening measures at least yearly. Multiple predictor (independent) variables during the course of elementary school were used to determine their relation to outcomes in fifth grade.

Dependent variable. The dependent variable selected for these analyses was a dichotomous variable, that is, whether students received 2 or more major ODRs during fifth grade. As described in the previous section, this criterion distinguishes between students who are likely to be successful in school with universal behavior support and those who need further support. This criterion is considered an index of the severity of problem behavior for the individual and the effectiveness of the universal behavior support program.

Predictor variables. The predictor variables used in these analyses included the number of major ODRs received each academic year in kindergarten and Grades 2 and 4, DIBELS subtest scores obtained in kindergarten, and ORF scores obtained in

Table 1
Codes and Operational Definitions of Elementary Variables

Code	Operational Definition
DIBELS ISF	DIBELS Initial Sound Fluency subtest raw score (Grade K only)
DIBELS LNF	DIBELS Letter Naming Fluency subtest raw score (Grades K–1)
DIBELS NWF	DIBELS Nonsense Word Fluency subtest raw score (Grades K–1)
DIBELS PSF	DIBELS Phoneme Segmentation Fluency subtest raw score (Grades K–1)
ORF	Oral Reading Fluency subtest raw score (Grades 1–5)
ODRs	Number of ODRs received during year (Grades K–5)

Note. DIBELS = Dynamic Indicators of Basic Early Literacy Skills; ODRs = office discipline referrals.

Grades 2 and 4. All of these variables were used to determine what measures predict multiple referrals in fifth grade. Table 1 describes the variables used in the study.

Analysis. To explore the research questions, we performed a series of binary logistic regression analyses. Logistic regression analyses are similar to multiple regression analyses, but the dependent variable is dichotomous and represents one of two possible outcomes (in this case, receiving 0–1 or multiple ODRs). Though there is a loss of variability in specifying a dichotomous dependent variable, we used logistic regression analyses for three important reasons. First, logistic regression analyses are robust to violations of normality and can be used when multiple regressions cannot. ODRs nearly always violate assumptions of normality, because a large majority of students receive very few ODRs, but some students receive as many as 20 or more, leading to a marked, positive skew. Second, logistic regression analyses are useful when a dichotomous distinction is useful to the field. In this case, we consider it important for school personnel to know which students did not respond to the school-wide intervention because they will need to be identified for additional support. Third, the results of logistic regression analyses are useful because they provide both tests of significance for predictor variables and odds ratios indicating the functional relationship between predictor and outcome (Wright, 1995).

Odds ratios (ORs) represent the change in the odds of the outcome for each 1-point increase in the predictor variable. An OR = 1 indicates no relationship between the predictor and the outcome. An OR < 1 indicates a negative association, and an OR > 1 indicates a positive association. The strength of the prediction is represented by how much the OR deviates from 1. These ORs can be converted into simple conditional probabilities, indicating the percentage likelihood of the outcome given a particular value of a predictor variable.

In accordance with previous studies using logistic regression analyses (Tobin & Sugai, 1999), we used a backward stepwise likelihood ratio method, in which all variables were entered initially and then removed if they did not contribute to the model. For each analysis, we selected the typical criteria for inclusion in the model (p value for significance = 0.05; p value cutoff for inclusion in the model = 0.10).

Hypotheses. We predicted that a number of variables would significantly predict behavior (ODRs) in fifth grade (with $\alpha = 0.05$). For Grade 4 and Grade 2 analyses, we hypothesized that number of ODRs and oral reading fluency scores would be significant predictors. We assumed that the predictive validity and stability of ODRs would be high, and expected a strong association, especially when considering that the predictor and outcome variables were based on the same measure. The predictive power of reading flu-

Table 2
Logistic Regression Analysis for Predicting Grade 5 Referrals from Grade 4 Reading and Behavior Variables ($n = 425$)

Variable	β	SE	OR	R	p
DIBELS ORF Grade 4 winter	−.01***	.00	0.99***	.56	<.0005
ODRs Grade 4	.49***	.08	1.63***	.30	<.0005

Note. β = Standardized β; *SE* = standard error; OR = e^B (odds ratio). See Table 1 for operational definitions of variables. −2 Log likelihood = 393.63; model χ^2 = 195.54***; *df* = 2; Nagelkerke R^2 = .49.
*p < .05. **p < .01. ***p < .001.

ency was of particular interest in this study, as it provides information about the link between reading and behavior. Because the relationship has been shown to increase in strength through elementary school, we expected the strongest prediction in fourth grade. For the kindergarten analysis, we hypothesized that DIBELS Letter Naming Fluency would explain the most variance in behavior in fifth grade, because the measure is an indicator of school readiness, and students who are less prepared for schooling may fall behind other students in reading skill throughout elementary school. We did not hypothesize that kindergarten ODRs would significantly predict ODRs in fifth grade because of the extremely low occurrence of kindergarten ODRs in the sample.

Results

Initial Analyses

Missing cases. Before the primary analyses could be completed, the issue of missing data and effects of attrition needed to be addressed. The data sets used for the analyses included 26 to 73% of students in fifth grade at the end of 2003–2004. The missing cases were due to students transferring in and out of the district over their 6 years of elementary school. Because of the potential error associated with extrapolating and interpolating values, missing data were excluded from the analysis using listwise deletion. To determine whether participants with missing data had different outcome scores than those included in the analyses, we used four statistical tests.

First, we completed two *t* tests to determine whether participants with missing data and participants with complete data had significantly different numbers of ODRs or oral reading fluency scores at the end of fifth grade. Second, we used two analysis of variance tests to determine if the number of years missed because of mobility produced differences in scores. None of the four tests produced statistically significant differences, suggesting that participants excluded from the analyses did not differ greatly from participants included in the analyses. This provided evidence that the students used in the analyses were representative of the population of students in the district as a whole.

Prediction Analyses

Prediction based on Grade 4 variables. Table 2 shows results from the logistic regression analysis used to determine the ability of fourth-grade oral reading fluency scores and number of ODRs to predict ODRs received in fifth grade ($n = 425$). In accordance with the backward stepwise method employed to build the model, all predictor variables not contributing greatly to the model ($p > .10$) were removed for final tests of significance. The final model was statistically significant ($\chi^2 = 195.54$, $p < .0005$). This model explained 49% of the variance in whether students received multiple ODRs during fifth grade. In this analysis, two variables were significant predictors: ODRs in Grade 4 ($R = 0.56$, OR = 0.99, $p < .0005$), and ORF

Table 3
Logistic Regression Analysis for Predicting Grade 5 Referrals from Grade 2 Reading and Behavior Variables ($n = 279$)

Variable	β	SE	OR	R	p
DIBELS ORF Grade 2 Spring	$-.02$***	.00	0.98***	.54	<.0005
ODRs Grade 2	.19*	.07	1.20*	.13	.01

Note. β = standardized β; SE = standard error; OR = e^B (odds ratio). See Table 1 for operational definitions of variables. -2 Log likelihood = 269.14; model χ^2 = 117.64***; df = 2; Nagelkerke R^2 = .46.
*$p < .05$. **$p < .01$. ***$p < .001$.

in the winter of Grade 4 ($R = 0.30$, OR = 1.63, $p < .0005$). These indicate positive relationships between ODRs in Grades 4 and 5, and negative relationships between ORF in the winter of Grade 4 and ODRs in Grade 4. For each 10-point increase in ORF, the probability of receiving multiple ODRs in Grade 5 decreased by 10%. For each additional ODR, the probability of receiving multiple ODRs in Grade 5 increased by 13%.

Prediction based on Grade 2 variables. Table 3 shows results from the logistic regression used to determine the ability of second-grade variables to predict problem behavior in fifth grade ($n = 279$). The final model was statistically significant ($\chi^2 = 117.64$, $p < .0005$). This model explained 46% of the variance in whether students received multiple ODRs during fifth grade. Similar to the first analysis, the following variables were significant predictors: ORF in the spring of Grade 2 ($R = 0.54$, OR = 0.98, $p < .0005$) and ODRs in Grade 2 ($R = 0.13$, OR = 1.20, $p = .01$). For each 10-point increase in ORF, the probability of receiving multiple ODRs in Grade 5 decreased by 20%. For each ODR, the probability of receiving multiple ODRs in Grade 5 increased by 6%. The results were different from the first analysis in that both variables were significant predictors, but reading fluency explained more variance.

Prediction based on kindergarten variables. Table 4 includes results from the third analysis, to determine kindergarten pre-

dictors of problem behavior in fifth grade ($n = 194$). The final model was also statistically significant ($\chi^2 = 74.66$, $p < .0005$) and explained 43% of the variance in whether students received 2 or more ODRs. In this analysis, there was only one variable that was a significant predictor of ODRs in fifth grade, DIBELS Phoneme Segmentation Fluency (DIBELS PSF), obtained in the spring of kindergarten ($R = 0.52$, OR = 0.97, $p < .001$). For each 10-point increase in DIBELS PSF, the probability of receiving multiple ODRs in Grade 5 decreased by 29%. Kindergarten ODRs were not significant predictors.

Because the significant predictor variable was an index derived in the spring rather than the fall of kindergarten, we conducted a set of follow-up analyses to compare the predictive power of fall versus spring DIBELS variables. We computed correlations between the most powerful fall DIBELS predictor (DIBELS Letter Naming Fluency), the most powerful spring DIBELS predictor (DIBELS PSF), and the outcome measure (receiving multiple ODRs in Grade 5), then used a Hotelling t test (for dependent observations; Glass & Hopkins, 1996) to test the significance of the difference between these correlations. The difference between the correlations ($t = 0.15$) was not significant.

Conditional probabilities. We used the ORs from the previous regression analysis to compute conditional probabilities of receiving multiple future ODRs based on reading scores and ODRs assessed in kindergarten.

Table 4
Logistic Regression Analysis for Predicting Grade 5 Referrals from Kindergarten Reading and Behavior Variables ($n = 194$)

Variable	β	SE	OR	R	p
DIBELS PSF Kindergarten spring	$-.03$***	.00	0.97***	.52	.00

Note. β = standardized β; SE = standard error; OR = e^B (odds ratio). See Table 1 for operational definitions of variables. -2 Log likelihood = 194.28; model χ^2 = 74.66***; df = 1; Nagelkerke R^2 = .43.
*$p < .05$. **$p < .01$. ***$p < .001$.

Results are presented in Table 5. First we computed probabilities for students who received a kindergarten ODR. Students without an ODR in kindergarten had a 20% likelihood of receiving 2 or more ODRs in Grade 5, and students with an ODR in kindergarten had a 33% likelihood. Then we computed conditional probabilities given scores on the DIBELS PSF measure. As described in the measures section, students meeting DIBELS benchmark criteria are on a trajectory for positive reading outcomes. The benchmark criterion in spring of kindergarten for this measure is a score of 35. Participants who scored 35 or higher, indicating sufficient progress with school-wide reading support, had an 18% likelihood of receiving 2 or more ODRs in fifth grade. Participants whose DIBELS PSF scores were between 10 and 34, indicating the need for targeted reading support, had a 25% likelihood of multiple ODRs in fifth grade. Participants whose scores were below 10, indicating the need for intensive reading support, had a 33% likelihood of multiple ODRs by Grade 5. These findings indicate that students reading below benchmark are at a greater risk for behavioral challenges in fifth grade. Of note, all students with an ODR in kindergarten met the PSF benchmark, and no students who missed the benchmark had an ODR that year. Essentially, students may have had either a behavior problem or a reading problem, but none had both.

To better understand the predictive relationship between DIBELS PSF scores and ODRs, we graphed the mean yearly ODRs for two groups, as seen in Figure 1 ($n = 194$). The first group represents students whose DIBELS PSF scores in the spring of kindergarten were below the benchmark (< 35), and the second group represents students whose scores were above the benchmark (≥ 35). The mean ODRs

Table 5
Conditional Probabilities for Multiple Discipline Referrals in Grade 5

Kindergarten Predictor Variable	Value	Conditional Probability (%)
ODRs	0	20
	1 or more	33
Spring DIBELS PSF	≥ 35 (above benchmark)	18
	10–34 (targeted support)	25
	<10 (intensive support)	33

Note. Conditional probabilities were computed from logistic regression analyses. See Table 1 for operational definitions of variables.
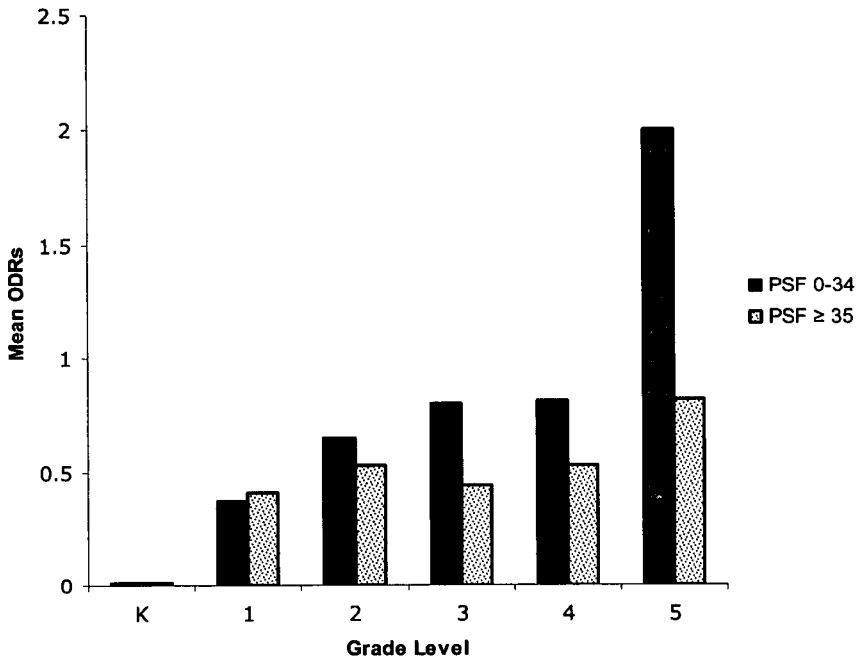
Figure 1. **Differences in mean ODRs per year for students scoring above (** *n* **= 152) and below (** *n* **= 68) the DIBELS PSF benchmark, as assessed in spring of kindergarten.**

were similar in kindergarten and first grade, but the difference increased steadily in Grades 2 and 3 and increased sharply in Grade 5.

Discussion

This study was designed to explore interactions between reading skills and problem behavior, with an emphasis on prediction of future behavior problems through the use of school-wide screening measures. Longitudinal analyses were used to determine the extent to which reading screening measures and ODRs, data collected regularly by the district, predicted the number of ODRs in fifth grade. All of the analyses yielded significant models that explained a substantial amount of the variance in problem behavior in fifth grade, and the models at each year tested included a reading skill variable, suggesting a predictive relationship between reading scores and problem behavior, which at times was stronger than the relationship between earlier and later referrals.

As described earlier, the predictive power of ODRs was expected, particularly

because the outcome variable was assessed using the same measure as the predictor variable. This does, however, add to the base of evidence for the predictive validity of ODRs. The other significant contributor to the model at each grade was a reading score. This result is potentially more interesting because it suggests an interaction between academic skills and problem behavior. The finding that reading skill level adds to the predictive power of ODRs (and in earlier grades, exceeds its predictive ability) suggests that academic deficits may place students at considerably greater risk for future problem behavior and nonresponse to school-wide behavior interventions. When considering the analyses, it appears that there were early differences in behavior and academic variables for students on track for multiple ODRs in fifth grade, and that those differences became more pronounced (and therefore more predictive) as the students progressed through elementary school.

In kindergarten, results showed that DIBELS PSF in the spring of kindergarten

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significantly predicted the presence of 2 or more ODRs 5 years later. DIBELS PSF is a measure of phonological awareness, the understanding of and the ability to manipulate the component sounds in words. Phonological awareness is one of the foundational components of beginning reading (Kame'enui & Simmons, 1998) and is considered a true measure of prereading skills rather than knowing the names of letters in the alphabet, which is considered an indicator of exposure to print or parental reading involvement and indicates school readiness. For the students in this sample, an actual skill difference played a stronger role in predicting future problem behavior than a school readiness difference.

Though the follow-up analysis did not show a significant difference between fall and spring scores, it is noteworthy that a measure at the end of kindergarten was the most significant predictor. This finding could suggest that reading skill at the end of kindergarten, which to some extent indicates how a child has responded to kindergarten literacy instruction, is more predictive of later outcomes than reading skill at the beginning of kindergarten. However, because the differences in prediction between fall and spring scores were not statistically significant, this may not necessarily be the case. Though this lack of response did signal an increased risk for future behavior challenges, not all students with durable reading deficits received multiple ODRs in fifth grade.

Even though the number of ODRs places students at significant risk for future problems, as shown through the conditional probability analyses, the number of ODRs received in kindergarten was not a significant predictor because so few students (3) received ODRs in kindergarten. It is possible that the difference in prevalence of ODRs in early grades may be due to differences in the attributions associated with student misbehavior across the grade levels. Students may have been less likely to receive ODRs in kindergarten because of a perception that some behaviors, such as hitting others, should be managed in the classroom, perhaps because such behaviors signal that a student has not been taught

certain basic social skills. However, as students progress to second grade and beyond, school professionals may assume that students should know how to behave in social situations, so the same behavior may result in an ODR.

Limitations

We caution readers not to assume blindly that these differences can be generalized to students in the population as a whole. The setting and sample are unique in that school districts that have successfully implemented school-wide reading and behavior support systems are still small in number, although increasing in frequency (see McIntosh et al., in press). Implementation of this combined approach to reading and behavior is intended to change trajectories of students, and these systems may have contributed to the results. It appears that teachers and staff in the school district are effective in helping a vast majority of students become established readers, regardless of the number of ODRs received, and we hypothesize an even stronger relationship between behavior problems and academic deficits in schools without these preventive systems. Clearly, more research is needed to compare the trajectories of students in schools with and without these systems in place. In addition, the district studied had a high mobility rate. Only 26% of students who started in kindergarten in 1998 were still enrolled in the district in fifth grade in 2004. Our analysis was restricted by the data set, which did not allow us to track students once they moved out of district. The preliminary analyses determined that students transferring into the district did not have significantly different scores than students who were continuously enrolled in the district, but the research community may hypothesize different outcomes for students who are not exposed to early preventive systems and are exposed to the risks associated with increased mobility.

The variables used in the study to determine reading skills and problem behavior were measures regularly completed by district staff. Though this aspect of the study increases

the applicability of the findings to applied school settings, it does present some challenges in interpretation of the results. Because extant data were used, it was not possible to obtain information on fidelity of administration and scoring.

In addition, researchers have raised concerns about school-wide measures of problem behavior, including ODRs (see Kern & Manz, 2004). Some of these concerns include the lack of sensitivity to certain types of problem behavior. ODRs do not measure behaviors that are not observed by school staff, including covert behavior, such as vandalism, theft, or relational aggression (Mayer, 1995). There is also the possibility of inconsistent use of ODRs by school personnel, owing to varying views of what constitutes an ODR, overuse or underuse for various reasons, or different rates for diverse populations of students (Skiba, Peterson, & Williams, 1997). Though we noted earlier that the school district completes regular trainings as a method of improving reliability, we cannot assume that these efforts entirely mitigated this problem.

Implications

Implications for theory. This study adds to the literature documenting the link between academics and behavior, especially regarding the pathways involved in the development of problem behavior. There is already some evidence supporting a pathway in which students enter school with social behavior deficits or excesses that persist through school (Hinshaw, 1992b; Reid & Patterson, 1991; Walker, Stieber, Ramsey, & O'Neill, 1991). In this study the students with ODRs in kindergarten represented these students. Though few in number, students receiving an ODR in kindergarten were at a heightened risk of receiving multiple ODRs in Grade 5.

This study also identified an entirely different group of students who enter school with reading skill deficits and are at a greater risk for developing future problem behavior. The results suggest that, for these students, academic difficulties preceded behavior difficulties. As shown in Figure 1, differences in

problem behavior did not emerge until Grade 2, and were not clearly evident until Grade 5. There are at least two explanations for this phenomenon. First, the low reading scores may serve as markers for other variables that place students at risk for problem behavior. But an explanation of why these other variables would occasion a sharp increase in behavior problems in Grade 5 is difficult to discern. A second explanation is that low scores affect the student's environment and behavior, resulting in increasingly aversive tasks in the classroom that lead to increasingly severe behavior. Because the more predictive scores were shown to be deficits in important prereading skills, rather than school readiness skills, that were still present after a year of explicit instruction, it is likely that these skill deficits themselves profoundly changed these students' school experiences. Students with low skills expend more effort for reading behaviors and experience reduced access to typical schedules of reinforcement for correct academic behavior. Over time, low skill levels may persist and typical academic tasks become more demanding, and students may increasingly engage in problem behavior when it is reinforced with removal of academic tasks. As students successfully escape tasks, their skill deficits persist and future academic tasks become more aversive. By Grade 5, academic tasks in other subjects are more likely to involve reading and may also become aversive. As we did not test teacher–student interactions in this study, we raise these only as potential explanations that bear further research.

That the two kindergarten risk factors (DIBELS PSF and ODRs) identified mutually exclusive groups of students (i.e., no students had low academic skills *and* discipline referrals) provides initial evidence that the pathways described in the introduction may be relatively independent, yet operate concurrently. In this sample, both groups of students at risk for conduct problems, those with academic deficits or social behavior deficits, had the same probability, 1 in 3, of developing conduct problems in later grades, but the

mechanisms for each pathway are likely to be different. Any students identified as at risk in both areas may be at an exponentially greater risk for future problems.

Implications for practice. If reading and behavior are as closely linked as has been shown in this and other studies, there is great promise for preventing future problems in both reading and behavior. Much of the promise lies in preventive and early intervention efforts in each area, which may lead to prevention of problems in both areas. Early identification and remediation of academic deficits may prevent future behavioral challenges and vice versa. Often in school settings, academic and behavior problems are viewed separately, involving separate teams, processes, and interventions. An integrated approach, with teams providing both academic and behavior support through the same systems may lead to better academic and behavioral outcomes for more students (McIntosh et al., in press; O'Shaughnessy et al., 2003). As noted, previous studies found much stronger associations between academic and behavioral variables. It is possible that the implementation of comprehensive school-wide support in both areas served to weaken the associations between academic deficits and behavior problems.

The results also support an expanded role for school psychologists, especially given the new regulations provided in the recent reauthorization of the Individuals with Disabilities Education Improvement Act (2004). The revisions to the 1997 act emphasize both prevention of academic and behavior challenges and response to intervention as essential components bridging general and special education. Responsibilities that may be new to some school psychologists include (a) implementing school-wide academic and behavioral systems designed to prevent school problems, (b) monitoring their fidelity of implementation and academic and behavioral outcomes, (c) detecting students who are not responding to the interventions, and (d) providing additional support to these students.

Future research. This set of analyses represents a growing movement of research examining behavioral principles in academics and behavior in school settings. This research is important, and more questions abound. For example, what are the differences in schools with and without school-wide reading and behavior support systems? Studies using large samples of students will be necessary to answer these questions on a meaningful scale, and the advent of large reading databases from the Reading First Initiative and large behavioral databases from state SWPBS initiatives may make answering these questions more possible.

Much of the effort in exploring the link between academics and behavior has focused on reading skills. In our minds, this emphasis is justified, given the keystone nature of reading skills in most subject areas and the wide availability of research-validated reading measures. Yet reading is one skill in the broad area of academics, and future directions of this research are likely to explore other subjects, including mathematics, spelling, and writing.

Conclusions

With the advent of the No Child Left Behind Act (Elementary and Secondary Education Act, 2001), researchers and practitioners alike are increasingly asking important questions about how to improve both academic achievement and school safety. Research-based core curricula have been promoted as key instruments in academic success; likewise, SWPBS has been identified as an efficient and effective system to promote prosocial behavior and decrease violent behavior in schools. Yet simply providing a research-based curriculum may not provide all students access, particularly if the learning environment is chaotic and unsafe. And implementing SWPBS may not reduce problem behavior if students have such low skills that classroom instruction is aversive. Academic and behavioral success may be symbiotic, as an effective behavior system allows effective academic instruction to take place. Likewise, early academic instruction is an important

method of preventing significant behavior problems later in school. To achieve complete success in one area, it may be necessary to concentrate efforts in the other area as well.

Supplementary Material

For a further discussion of implications for policy and practice, go to www.nasponline .org/publications/sprsupplemental.html

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