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Early Identification of Children At Risk for Costly Mental Health Service Use

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Abstract

Children and adolescents with serious and persistent conduct problems often require large public expenditures. Successfully diverting one high risk child from unfortunate outcomes may result in a net savings to society of nearly $2 million, not to mention improving the life of that child and his or her family. This figure highlights the potential of prevention, which often rests on the ability to identify these children at a young age. This study examined the ability of a short conduct-problems screening procedure to predict future need for mental health assistance, special education services, and the juvenile justice system during elementary school ages. The screen was based on teacher and parent report of child behavioral habits in kindergarten, and was used to identify children as either at risk or not at risk for behavioral problems. Service outcomes were derived from a service-use assessment administered to parents at the end of the sixth grade, while special education information was gathered through a survey of school records. Study participants (463 kindergarten children; 54% male, 44% African American) were from economically disadvantaged neighborhoods in four diverse communities across the United States. Results indicated that, while controlling for demographic background variables, the risk indicator strongly predicted which children would require services related to conduct disorder or behavioral/emotional problems. Additional analyses revealed that the dichotomous high risk indicator was nearly as strong as the continuous screening variable in predicting the service-use outcomes, and that the screening of both parents and teachers may not be necessary for determining risk status.

Keywords

prevention; behavioral disorders; service utilization

This study determined whether a short conduct-problems screening instrument, administered in kindergarten, could predict children's involvement with the mental health, special education,

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and juvenile justice systems by the time they entered middle school. If high cost children can be identified reliably, early intervention may be cost-effective.

A small minority of children initially display conduct problems as early as preschool, and these problems persist well into adulthood (Moffitt, 1993). This group, called “early starters,” constitutes about 5 or 6% of the population but is responsible for 50–60% of all known crimes (Blumstein *et al.*, 1986). The most reliable and robust predictor of whether a child will display this pattern of serious and persistent conduct problems is extreme and stable oppositional and aggressive behaviors early in life (Achenbach *et al.*, 1998; Lipsey & Derzon, 1998; Loeber, 1982, 1991). Early starters can be contrasted with children who demonstrate problems primarily during adolescence (Moffitt, 1993). These adolescents generally commit only property crimes (Bartusch *et al.*, 1997), and they do so irregularly. Their conduct problems dissipate in early adulthood.

Serious and persistent conduct problems result in great public expense. A life of crime costs society between $1.3 and $1.5 million; a heavy drug user costs society between $370,000 and $970,000; a high school dropout costs society between $243,000 and $388,000 (Cohen, 1998). Most of these costs are related to victim losses, court adjudication, incarceration, medical treatment, rehabilitation, decreased productivity, and foregone earnings. Children showing early conduct problems are at risk for each, and possibly all three, of these outcomes (i.e., criminal activity, substance use, and school dropout). The value to society of successfully diverting one high-risk child from serious conduct problems may be as much as $1.7–$2.3 million (Cohen, 1998). This figure is conservative: it does not capture many inherent benefits for the children and families involved. The potential benefits of preventing conduct disorder are, therefore, quite large.

In spite of the known stability of conduct-problem behaviors, virtually no studies have examined the predictability of service system utilization from early conduct-problem behavior. This study sought to fill that gap by addressing four questions. First, how well does a measure of conduct problems at school entrance predict future involvement with the mental health, special education, and juvenile justice systems? Clearly, the initial step in any successful prevention effort is the accurate identification of high-risk individuals. Second, does the measure's predictive ability vary by child sex, race, or ecological context? If screening efforts are differentially effective for subgroups of children, then the empirical case for prevention may also vary across children. Third, what are the relative advantages of using a more parsimonious dichotomous risk status designation when compared to a continuous measure of conduct problems? And, fourth, is a screening measure more accurate if it combines both parent and teacher reports of behavior? This issue is important because of the added costs of collecting information from two sources. We consider these questions using data from the Fast Track Project (Conduct Problems Prevention Research Group, 1992), a multicohort, multisite longitudinal intervention designed to prevent serious conduct problems in high-risk children.

Method

Participants

This study followed 463 children participating in a longitudinal study being conducted as part of the Fast Track project.[6] Data are available on these children through the end of the sixth grade. The sample includes children who were identified as “high risk” (as described below)

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as well as a representative/normative sample of children who also were recruited from the study schools. It is important to note that no children in these analyses received Fast Track intervention services; children identified as high risk for this study are part of the Fast Track control group (described below).

Study participants were drawn from four study sites: Durham, NC; Nashville, TN; rural central Pennsylvania; and Seattle, WA. Approximately 54% of the children were boys; about 52% were European American, 44% were African American, and 4% were of other ethnic backgrounds. The mean socioeconomic status (SES) of their families was 25 on the Hollingshead SES scale (Hollingshead, 1979) [between lower and lower-middle class] with a standard deviation of 13; 24% of the families did not include a parent who was employed full-time; and 41% of the families included only one parent.

Schools were selected for the study using a procedure described in more detail elsewhere (Conduct Problems Prevention Research Group, 1992; Lochman & Conduct Problems Prevention Research Group, 1995). Using crime records, poverty statistics, and high school dropout rates, each site identified between 10 and 17 high risk schools in its community. Half of the schools were randomly assigned to receive intervention; the other half (n = 27) were assigned as controls, and it was the students in these control schools that were the participants in this study.

Within the intervention and control schools, children were identified as high risk using information from both teachers and parents. Each kindergarten teacher in these schools completed a brief 10-item screening instrument on each child. The instrument was adapted from the Teacher Observation of Classroom Adaptation-Revised[7] (TOCA-R; Werthamer-Larsson *et al.*, 1991). The teacher rated each child as to whether they displayed behaviors such as “trouble accepting authority; disobedient” and “harms others.” The internal reliability for this measure was high (Cronbach's α = .87). If a child received a score in the top 40th percentile (within site) on this teacher-report measure, aproject staff member contacted and interviewed the child's parent. The parent completed a 24-item measure, based on questions from the Child Behavior Checklist (Achenbach, 1991) and the Revised Problem Behavior Checklist (Quay & Peterson, 1987), which assessed children's conduct problems at home. The internal reliability for this measure also was high (Cronbach's α = .87).

Scores on the teacher-report and parent-report measures were standardized within site and summed. The 10% of the population with the highest combined scores (n = 155, not including Fast Track intervention group children) were designated as “high risk.” The remaining 90% of children were stratified within site according to child's sex, race, and decile scores on the teacher-report measure. From these stratified blocks, 308 children were chosen randomly to represent the rest of the populations in these schools and were assigned to the non-high risk, normative group.[8] When combined, the resulting sample included 463 children.

Of the original sample, 391 were still participating by the seventh year of the project (84% of total) and were able to provide data for this study. When the key outcome data were collected, the children had a mean age of 12.0 years. Because of the intentional overrepresentation of high risk children as well as the possible selectivity in participation (attrition) by the seventh year, alternative weighted analyses were performed that accounted for having a nonrepresentative sample. Details are given below.

[7]These items were taken from the Authority Acceptance subscale of the TOCA-R.

[8]The official Normative sample for the Fast Track project actually includes an appropriate proportion of high risk individuals. Thus, the comparison sample in this paper will be referred to as the non-high risk sample as opposed to the normative sample.

Outcome Measures

Once children were part of Fast Track, their teachers and parents were interviewed on an annual basis. Child school records were also reviewed annually by a member of the Fast Track staff. Two of the outcome measures in this study were derived from school records: whether a child had ever had an individual education plan (IEP) or received special education services; and whether a child had ever repeated a grade in school. A third outcome was taken from the annual survey of parents: whether a child had ever taken medications, such as methylphenidate, because of behavior or emotional problems.

The remaining outcomes for this study were derived from an assessment of service use in the sample. During the summer of the seventh year of the study (after the end of sixth grade for most of the children in the sample), mothers were interviewed using a modified, 30-minute version of the Service Assessment for Children and Adolescents (SACA; Stiffman *et al.*, 2000). Developed for epidemiological research, the SACA assessed children's use of a variety of mental health services and their contact with the juvenile justice system during their lifetime. For this study, the SACA provided dichotomous (yes/no) scores on each of the following six variables:

- Has the child ever received treatment from a provider who specialized in mental health services, such as an outpatient therapist or an in-home family preservation worker, or received treatment in a mental health facility, such as a psychiatric hospital, a drug and alcohol treatment unit, a residential treatment center, a day treatment program, or a group home?
- Has the child ever used any general medical service for emotional or behavioral problems, including talking to a family doctor, going to an emergency room, or staying in a medical hospital?
- Has the child ever stayed overnight in a mental health treatment facility, including a psychiatric hospital, general hospital, drug and alcohol treatment unit, residential treatment center, emergency shelter, group home, foster home, detention center, or jail?
- Has the child ever used any inpatient or outpatient medical/professional service for emotional or behavioral problems, excluding talking to a school counselor or having police contact?
- Has the child ever talked to a school counselor as a result of emotional or behavioral problems?
- Has the child ever been picked up, arrested, or given a warning by the police?

Analyses

Examination of the predictive potential of the high risk screening variable was aided by sensitivity and specificity indices. Sensitivity is the proportion of participants using a given service who had been given a high risk designation in kindergarten (i.e., “true positives” who are correctly identified by the screen). Specificity is the proportion of participants not using a given service who had not been labeled high risk at the screening (i.e., “true negatives” who are correctly identified).[9] Any screening instrument balances sensitivity and specificity by identifying more or fewer children as “at risk.” By raising or lowering that threshold, one can raise sensitivity or specificity while lowering the other. To use an extreme example, one could identify all children as at risk and achieve 100% sensitivity. Of course, specificity would be

[9]Sensitivity = [# for which outcome present and risk indicator present]/[# for which outcome present]; Specificity = [# for which outcome absent and risk indicator absent]/[# for which outcome absent].

zero in that case. The relative desirability of high sensitivity versus high specificity depends on the relative costliness of failing to provide intervention or treatment early to at-risk children versus the costs of misidentifying children as at risk (Glascoe *et al.*, 1997). The latter might involve stigma or the costs of treatment provided unnecessarily.

Prior research provides a context for assessing the figures presented below. In a survey of studies on the prediction of conduct disorder, Bennett *et al.* (1999) found that sensitivity rates based on risk indicators assigned at kindergarten or first-grade were unlikely to exceed 50% for such outcomes, whereas specificity rates were unlikely to exceed 90%. It is discouraging to think that one might only expect to identify and potentially treat 50% of the cases that would otherwise end up achieving a certain unfortunate outcome. An intervention, however, is unlikely to prevent all future behavioral problems; a low sensitivity rate for one outcome does not mean an intervention will not prevent the occurrence of another outcome (for instance, it may prevent a child from future need of overnight mental health assistance, while not preventing future need of an IEP at some point). And as some figures indicate that only 20% of children in need of care typically receive it (Institute of Medicine, 1994; as cited in Bennett *et al.*, 1999, p. 1067), figures close to 50% might actually be relatively respectable. It is also worth pointing out that sensitivity and specificity rates reflect the nature of the outcome. In general, higher specificity rates are more attainable as the likelihood of not achieving the outcomes featured in studies of this nature is rather high. As with any proportion, larger denominators will likely translate into smaller ratios; so the more likely the outcome has occurred at some point in a population of children regardless of risk status, the more likely a sensitivity rate will be lower (helping to explain lower sensitivity numbers for such categories as ever had an IEP/special education services, or “any of the above services”). At the same time, lower specificity rates are often associated with outcomes that have an extremely high likelihood of not occurring in a population (such as inpatient mental health assistance).

To compare the predictive power of these models for each outcome measure, receiver operating characteristics (ROC) curves were generated for some analyses (Agresti, 1990). The ROC curve plots sensitivity against 1 minus the specificity given a varying predicted probability cutoff. The area under this curve indicates the predictive power of the model. Possible values range from 0.5 to 1, with higher values indicating greater predictive power. This value is helpful in summarizing the effectiveness of a screening classification regarding a particular outcome as well as the degree to which a screening indicator has been both sensitive and specific in respect to that outcome.

Because all outcome variables used in this study were dichotomous, logistic regressions were used for statistical analyses. Predictors in these models included dummy variables to denote high risk status (no vs. yes) as well as gender (whether child was female) and minority status (whether child was an ethnic minority).[10] Also included in the models were three dummy variables to denote site (with Durham as the omitted site).[11] In order to address the second research question introduced above, two-way interaction terms between the high risk dummy variable and the other explanatory variables were initially included in the models and retained if statistically significant ($p < .05$).

To improve interpretation of the effect of the explanatory variables, marginal effects are presented in the Results section in place of the conventional logit coefficients. As is well known,

[10]Of the sample involved in this study ($n = 391$), over 92% of those classified as Minority are African American.

[11]In addition to including variables to control for site, we were also concerned with a likely clustering of error variance due to similar characteristics shared by children attending the same school. In order to control for this type of error structure, a robust estimator of error variance was derived by specifying a clustering at school level within our models (StataCorp, 1999). Because children may have attended more than one school within the 6-year span of this study, the children's school in first grade was specified as the clustering unit. It was deemed most likely to represent school clustering effects.

interpreting the coefficient estimates from logistic regression is somewhat awkward—those estimates represent the effect of the explanatory variable on the log-odds ratio. One option is to present odds ratios, but a more informative alternative is to present the so-called "marginal effects" (Greene, 2000). The marginal effect represents the effect of the explanatory variable in meaningful terms—the likelihood that the individual experiences the outcome of interest. In this case, the marginal effect is the impact of risk status (or any other variable) on the predicted probability that the individual uses the service, holding all other variables in the analyses constant. The marginal effect is analogous to the ordinary regression coefficient but allows for the fact that the dependent variable is dichotomous.

As discussed above, there was some concern regarding the degree to which having a nonrepresentative sample (oversampled on high risk children) might alter the generalizability of the results. In addition, there was some concern about the small yet nonignorable level of attrition (approximately 15% of the initial sample) that had occurred by the time the SACA was administered. As widely discussed in the literature, selection effects and differential attrition in field studies can reduce both internal and external validity (e.g., Cook & Campbell, 1979).

To examine the potential impact of overselection for high risk children and possible differential attrition, we performed alternative weighted analyses (Levy & Lemeshow, 1991). The weight was a function of two probabilities. The first probability involved the likelihood that a child was selected for the study. Because of the oversampling, that probability was about three times as great for high risk children as for the non-high risk children. A second probability was calculated based on an attrition model that predicted participation in the seventh year of the study (when the SACA was administered) based on important individual characteristics. To allow for interactions between high risk status and the predictors of attrition, we estimated the attrition model separately for high risk and non-high risk groups. We used the resulting coefficient estimates to calculate predicted probabilities of participation. The probability weight used in these alternative analyses is the inverse of the product of these two probabilities. These weights were used to provide population estimates of the service-use rates. They were also used in main effects logistic regression models that were computed for all outcome measures. When the results of those analyses were compared to the results of main effects models without weights, they were virtually identical. Therefore, we concluded that selection and participation issues were not noticeably altering our outcomes and proceeded using nonweighted models.

Results

Question 1: Does High Risk Status Predict Future Involvement With the Mental Health, Special Education, and Juvenile Justice Systems?

Table 1 presents rates of service utilization through the end of elementary school. The first column provides weighted service utilization rate estimates. (These figures are representative of children of this age living in poor neighborhoods across the country.) The figures in this column show that, although the rate of children receiving at least one of these service types is above 50%, use is predictably low for other categories such as inpatient mental health use (less than 2%). The next columns present rates by high risk status. For all outcome measures, children identified as high risk in kindergarten had much higher rates of service use across the subsequent 6 years. Over half of children identified as high risk later received some kind of professional service for emotional or behavioral problems, whereas approximately 16% of the non-high risk children received such services. Overall, 82% of high risk children had received assistance in at least one of the defined categories.

Table 1 also presents the sensitivity and specificity indices. Results show that the kindergarten risk indicator was a relatively sensitive predictor of later use of psychotropic medication, later use of mental health services from a school counselor or general medical professional, and future overnight placement for mental health problems. For instance, three out of four children who had received inpatient services for mental health by the seventh year had been identified in kindergarten as at high risk for future behavioral/emotional problems. Specificity was high for all variables, indicating that children not identified as at risk for behavioral problems were very likely not to require services for such problems within the next seven years.

As noted above, logistic regressions were used to examine how high risk status predicted service use while controlling for the key demographic factors of sex, race, and variations due to study site (all of which might be considered to have a strong impact on variation in the outcomes). The results of these analyses are presented in Table 2. High risk children were significantly more likely than non-high risk children to have received mental health assistance in the forms of professional services (specialty mental health or general medical for mental health reasons), medication ($p < .01$), or inpatient mental health services ($p < .05$). The relation between high risk status and the likelihood of receiving any inpatient or outpatient service for mental health was marginally significant ($p = .06$). For school-related services, high risk children were significantly more likely to have received special education services (IEP or special education minutes) or received mental health-related school counseling ($p < .01$). Although to a lesser degree, high risk status also was related to the likelihood of repeating a grade in school ($p = .08$). Finally, high risk children were significantly more likely to have had contact with the police ($p < .05$).

The marginal effects make these results relatively easy to understand. For instance, the significant result for the IEP/special education outcome indicates that high risk children were 20 percentage points more likely (on average) to have received that service by the seventh year of the study than non-high risk children, controlling for gender, minority status, and site. This effect varies among outcomes, with the most substantial difference occurring for the likelihood of using a specialty mental health provider (high risk children were more than 26 percentage points more likely to use such a service) and the smallest effect occurring for the likelihood of staying overnight for mental health services (high risk children were just over 3% more likely to do so). Note that the difference in the effect of high risk status as presented in Table 2 versus Table 1 is mostly due to the inclusion of demographic variables in the logistic regression models.

Question 2: Does the Effect of High Risk Status Vary by Child Sex, Race, or Ecological Context?

As noted, two-way interaction terms between high risk status and the other predictors were included in initial models in order to examine whether the influence of being at risk for behavioral problems on future service use might vary across levels of the child sex, minority classification, or geographic region of the country. The only significant interaction detected across all outcomes involved the interaction between high risk status and study site for the likelihood of having received any inpatient or outpatient service for mental health assistance. The specific interaction terms (given in the footnotes below Table 2) reveal what is behind this significant effect: The high risk children at the Pennsylvania and Washington sites were close to 20 percentage points more likely to have used any inpatient or outpatient service for mental health problems than the high risk children in Durham or Nashville.

Question 3: What are the Relative Advantages of Using a More Parsimonious Dichotomous High Risk Designation When Compared to a Continuous Measure of Conduct Problems?

Designating someone as “high risk” or “not-high risk” provides a practical way to determine who should or should not receive an intervention. However, any categorization of individuals into groups discards potentially important information: Not all children in the high risk group are equally at risk, and not all children in the non-high risk group are equally invulnerable. For that reason, we consider whether the discarded information provides any additional ability to explain the key outcomes. Thus, the next analyses sought to determine whether any information remained in these continuous scores—once accounting for the information captured in the dichotomous high risk designation—that might provide increased accuracy in predicting service use. Main effects logistic regression models were calculated that included high risk status, sex, race, site, plus the two continuous scores from the screening measures described above.[12] The results of these analyses are presented in Table 3. The left column gives the predictive power for models that only included the high risk dichotomous designation (in addition to the other demographic predictors) whereas the right column gives the predictive power for models that also included the teacher and parent continuous scores. By looking at the measure of model fit based on the ROC numbers, one can see that, for almost all of the outcomes, the two continuous indicators add virtually no explanatory power to the model—the possible exception being the model for inpatient mental health service use.

Question 4: Do Parental Reports Improve the Accuracy of the Screening Procedure?

To this point, the results suggest that the high risk indicator is an effective predictor of service use. Because obtaining reports from both parents and teachers can be costly, it is important to know whether information from both sources is needed to predict service use.

To examine the potential effectiveness of the teacher screening score alone as a determinant of high risk status, a teacher-high risk indicator was created from the kindergarten TOCA scores with percentages of high risk children based on the teacher score set to match the percentages of children already designated as high risk at each site.[13] Table 4 shows the degree to which the combined high risk designation (based on both parent and teacher scores) overlaps with the retrospective teacher-high risk designation: Almost 83% of the time these designations agree.

In order to compare the predictive power of the high risk designation based on teacher report only to high risk designation based on teacher and parent report, main effects logistic regression models for the outcome measures were calculated, and ROC curves were generated. The numbers showing the predictive power of the logistic regressions for the two sets of models are presented in Table 5. In most cases the effect of the combined-source high risk designation is equal to or slightly higher than that of the teacher-only high risk designation. The difference is minimal, however. In fact, all values are within 0.03. For two of the outcomes, inpatient mental health service use and police contact, the predictive power is slightly higher when using the teacher report only.

Discussion

This study has shown that costly social service utilization through early adolescence can be predicted to a considerable degree by the time a child finishes kindergarten. By evaluating children's conduct problems with a brief screening measure, kindergarten teachers and, to a

[12]Two subjects who received the SACA were missing data for the parent screening measure, and thus there is a slightly lower *N* for models including the continuous predictors.

[13]We set the threshold in this way to make sure the percentage of children deemed at risk did not vary across screening alternatives. Doing so makes comparisons of sensitivity and specificity of the measures more straightforward.

lesser extent, parents are able to discern which children will become involved in the mental health, special education, and the juvenile justice systems up to six years later. This study has shown that an early designation of high risk status can effectively predict service use (and thus predict emotional and behavioral problems serious enough to require services), and that the predictability of this high risk status does not appear to vary substantially by child sex, child race, or geography as represented by the four Fast Track sites. Although service utilization patterns varied by child sex and race and across project sites, kindergarten ratings of conduct problems remained a robust predictor of later service utilization in all groups of children. The broad generalizability of this pattern suggests that early conduct problems represent an obvious risk factor among most populations of children. We also found that a dichotomous classification of risk status can be as effective a predictor for service-use likelihood as a continuous predictor of risk, and that a high risk classification derived from teacher reports alone might be as effective in predicting service-use likelihood as a classification based on both teacher and parent reports.

If we know which young children are most likely to become involved with the mental health, special education, and juvenile justice systems, the rationale for developing effective prevention and intervention services is made stronger. There is evidence suggesting that the overall effectiveness of mental health treatment is greater for young children than adolescents (Weisz *et al.*, 1987). Comprehensive reviews have found that conduct problems can be prevented when high risk children and their families receive early education and support services (Yoshikawa, 1994). Targeted prevention and intervention studies have demonstrated that the savings to society from reducing the incidence of serious and persistent conduct problems exceed the costs of high quality and effective programs (Barnett, 1996).

It is important to note that the high risk designation used in this study was moderately sensitive but highly specific. The relative advantages of high sensitivity versus high specificity depend on a variety of factors, including the likelihood that a child identified as high risk is subsequently treated, and the costs of that treatment (Glascoe *et al.*, 1997). When screening measures are not specific enough, too many children are falsely designated as high risk. One consequence of this is that certain children will receive evaluation and treatment that is unnecessary. However, because of the extremely high costs to society of children and adults with serious and persistent conduct problems and the relatively moderate costs of targeted prevention programs, such a screening procedure may be warranted and still yield cost-effective outcomes. In other words, the combination of a high exclusion rate for children not in need of services (high specificity) with the potential reduction in service-use costs of the correctly identified children (despite moderate levels of sensitivity) likely translates into a cost-effective prevention program. Another consequence of a less specific high risk designation is that certain children may be subject to undeserved labeling. However, as long as the negative consequences of inclusion in a prevention program are avoided, children who are mistakenly labeled as high risk might still benefit from intervention. To be successful in any population, a prevention program must deliver services in a manner that minimizes stigmatization and maximizes participant receptiveness to treatment. Services such as tutoring, social skills training, and parent training might enhance positive outcomes even among children with subclinical levels of conduct problems. Thus, even a loose criterion for screening may be cost-effective.

This study does not address whether receiving treatment at the time of screening would have prevented the need for or substantially reduced the use of costly social services. This study also does not address the critical importance of a well-formulated and effective intervention irrespective of when it is provided. Clearly, the accurate designation of children as high risk is only the first step in the process of getting them the help they need. To that end, however, this study has demonstrated that an inexpensive screening in kindergarten can identify those

children at risk for emotional and behavioral problems as manifested in their use of mental health, special education, and/or juvenile justice services within the following six years.

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Table 1

Rates of Lifetime Service Use (Whether Ever Used) 7 Years After Risk Status Designation (N = 391)

	Population estimate[a]	High risk	Non-high risk	Sensitivity[b]	Specificity[b]
Had an IEP/special education services	36.3%	56.3%	33.2%	36%	83%
Medications[c]	9.0	30.6	5.3	62	80
Repeated a grade	23.4	31.9	22.7	33	79
Specialized mental health[c]	18.1	46.5	13.0	52	83
General medical[c]	6.5	18.1	4.5	59	79
Overnight mental health[c]	1.8	7.6	0.8	75	77
Any service for mental health (SACA)[c]	21.3	52.1	15.8	50	84
School counselor[c]	9.0	26.4	5.7	61	80
Police contact	6.9	16.7	5.3	52	78
Any of above services	57.7	82.6	53.9	33	90

[a] Population estimate weighted to account for overrepresentation of high-risk subjects in the sample and higher rate of dropout for non-high risk subjects by the seventh year of the study. The represented population reflects the Fast Track sample (i.e., children living in poor neighborhoods).

[b] Sensitivity and specificity figures based on normative sample (N = 326).

[c] Service provided for emotional, behavioral, drug, or alcohol problems.

Table 2

Logistic Regressions of Mental Health (MH) Service Use Outcomes (Columns) on Predictors (Rows)—Marginal Effects Presented

	IEP/special education		Medications for MH		Repeated grade		Specialty MH		General medical for MH		Overnight for MH		Inpatient/outpatient for MH		School services for MH		Police contact	
Outcome predictor	**Effect**	**Z**	**Effect**	**Z**	**Effect**	**Z**	**Effect**	**Z**	**Effect**	**Z**	**Effect**	**Z**	**Effect**	**Z**	**Effect**	**Z**	**Effect**	**Z**
Nashville	−0.167†	1.70	−0.002	0.05	0.221**	2.85	0.054	0.64	0.076**	2.83	0.004	0.33	0.100	0.99	0.148**	4.83	0.096**	3.32
Pennsylvania	−0.280**	2.72	−0.020	0.43	−0.009	0.09	−0.033	0.35	0.055†	1.75	−0.013	0.72	−0.089	0.76	0.041	0.86	0.043	1.18
Washington	−0.195*	2.43	−0.038	0.78	−0.260**	3.85	0.026	0.33	0.058*	2.26	−0.006	0.43	−0.087	0.69	0.106**	3.21	−0.016	0.46
Site effect	8.52*		1.10		30.62**		3.74		8.97*		1.40		11.74** ‡		37.92**		22.36**	
Female	−0.145**	2.63	−0.068*	2.19	0.013	0.31	−0.103†	1.95	−0.077**	3.33	−0.017	1.53	−0.127*	2.47	−0.040†	1.90	−0.080**	3.60
Minority	−0.046	0.61	−0.037	1.18	0.214**	3.20	−0.096†	1.77	−0.018	0.77	−0.002	0.17	−0.098†	1.70	−0.026	0.89	0.020	0.92
High risk	0.205**	4.25	0.168**	5.38	0.076†	1.73	0.269**	5.82	0.068**	3.44	0.031*	2.22	0.217†	1.86	0.128**	5.52	0.035*	2.13
Constant	0.079	0.83	−0.197**	4.41	−0.353**	4.90	−0.234**	2.88	−0.179**	3.93	−0.063*	2.20	−0.190*	2.00	−0.270**	7.34	−0.151**	3.27

Note. Z = Absolute value of z-statistic; degrees of freedom for all models = 390; joint site effects are chi-square statistics,

* significant at 5%;

** significant at 1%;

† significant at 10%.

‡ significant HR × site interaction for "inpatient/outpatient for MH" outcome, $\chi^2 = 8.10$ (marginal effects: HR × Nashville = −0.036, HR × Pennsylvania = 0.184, HR × Washington = 0.221).

Table 3

Comparison of Logistic Regressions for Models With HR Status Only Versus Models With HR Status Plus Continuous Screening Variables—Predictive Power (Area Under ROC Curve)[a]

	Dichotomous HR variable	HR variable + screening variables
IEP/special education	.68	.69
Medication for MH	.78	.80
Repeated grade	.78	.79
Specialty mental health	.75	.77
General medical for MH	.78	.79
Overnight for MH	.81	.88
Inpatient/outpatient for MH	.75	.77
School services for MH	.79	.80
Police contact	.83	.85

[a]Entire output for logistic models used to generate these numbers are available by request from the first author.

Table 4

Numbers of Subjects With Teacher + Parent High Risk (HR) Designation Versus Teacher Only High Risk Designation

	Parent + Teacher HR designation		
Teacher HR designation	**Non-high risk**	**High risk**	**Total**
Non-high risk	215	35	250
High risk	32	109	141
Total	247	144	391

Table 5

Comparison of Logistic Regressions for Models With HR Status as Derived From Parent and Teacher Scores Versus HR Status Derived Only From Teacher Scores—Predictive Power (Area Under ROC Curve)[a]

	Combined HR variable	Teacher HR variable
IEP/special education	.68	.68
Medication for MH	.78	.77
Repeated grade	.78	.78
Specialty mental health	.75	.73
General medical for MH	.78	.78
Overnight for MH	.81	.84
Inpatient/outpatient for MH	.75	.72
School services for MH	.79	.76
Police contact	.83	.84

[a]Entire output for logistic models used to generate these numbers is available by request from the first author.