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Development of a Brief Parent-report Risk Index for Children Following Parental Divorce

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Abstract

This paper reports on the development of a brief 15-item parent report risk index (Child Risk Index for Divorced or Separated Families; CRI-DS) to predict problem outcomes of children who have experienced parental divorce. A series of analyses using three data sets were conducted that identified and cross-validated a parsimonious set of items representing parent report of child behavior problems and family-level risk and protective factors, each of which contributed to the predictive accuracy of the index. The index predicted child behavior outcomes and substance abuse problems up to six years later. The index has acceptable levels of sensitivity and specificity as a screening measure to predict problem outcomes up to one year later. The use of the index to identify the need for preventive services is discussed, along with limitations of the study.

Keywords

Risk Index; Children and Divorce; Preventive interventions for Divorced Families; Behavior outcomes of Children in Divorced Families

Although children are at increased risk for a wide range of problem outcomes following parental divorce (Amato, 2010), most children adapt well and do not experience serious problem outcomes (Kelly, 2012). Over the past two decades, several preventive interventions that are effective in reducing children's problem outcomes following divorce have been developed (Braver, Griffin, & Cookston, 2005; DeGarmo, Patterson, & Forgatch, 2004; Pedro-Caroll, 2005; Stolberg & Mahler, 1994; Wolchik et al., 2002). Even though all children may potentially benefit from prevention programs following a major family transition such as parental divorce, those who are at higher levels of risk are likely to have more to gain from such programs. A risk index that provides valid information on a child's likelihood of experiencing future problems would be very useful to help professionals assist parents make decisions about seeking services following divorce. This paper describes the development of a brief parent report risk index to predict problem outcomes of children following their parents' divorce. We first review research on the factors that are associated with increased risk for problem outcomes for children following divorce. Identification of such factors provides a foundation for identifying domains to be assessed in a risk measure.

We then discuss issues in moving from the identification of factors that predict problem outcomes to the development and validation of a brief parent-report index to assess their children's risk for later problem outcomes and the strategies used to develop and cross-validate this index. Finally, we discuss the possible utility and limitations of the index and directions for future research.

Factors associated with higher levels of problem outcomes for children after parental divorce.

Two kinds of factors have been shown to predict children's problem outcomes after parental divorce: 1) current level of problems the child is experiencing, and 2) divorce-related risk and protective factors. There is considerable research demonstrating that behavior problems at an earlier stage of development predict elevated problems in subsequent stages. For example, Loeber's (1990) review found that antisocial behavior problems in adolescence were predicted by earlier behavior problems, such as aggression, withdrawal, academic problems, and poor peer relationships. However, in their review of 17 studies, Bennet, Lipman, Racine, and Offord (1998) found that, although childhood behavior problems significantly predicted later persistent conduct problems, few of the measures of behavior problems used provided sufficient evidence that met standard criteria to be useful as a screening measure to identify those who were in need of a preventive intervention. For example, the positive predictive value (percent of cases screened as having a disorder who are found to actually have a disorder) was under 50% in studies when the overall prevalence of the disorder was low. Bennet, et al. (1999) found that predictive accuracy improved when child and family factors were added into the predictive models.

Several risk and protective factors have also been found to be associated with problem outcomes for children following their parents' divorce. Kelly (2012), in a comprehensive review of the research, identified risk and protective factors associated with child and adolescent adjustment following separation and divorce, such as inter-parental conflict, parent mental health problems, and quality of parenting and co-parenting. Similar to the concept of cumulative risk and protection (Rutter, 1979; Sandler et al., 2012; Wilson, Hurtt, Shaw, Dishion, & Gardner, 2009), risk factors are predicted to have an additive effect on the development of problem outcomes. In a prospective longitudinal study of a sample of children (ages nine through twelve) from divorced families, Dawson-McClure, Sandler, Wolchik, & Millsap (2004) found that after accounting for the effects of child behavior problems at baseline, a composite measure of environmental stressors (that included measures of inter-parental conflict, negative life events, contact with non-custodial father, maternal mental health problems, and financial hardship) predicted multiple problem outcomes when children were ages 15 through 18. A risk measure consisting of a composite of the standardized scores of externalizing problems and environmental stressors was significantly related to externalizing problems, internalizing problems, competence, and substance use six years later.

Development of a parent-report assessment of risk index.

The goal of this paper is to develop and validate a brief risk index for children whose parents have divorced. The development of this risk index was guided by the literature on risk and protective factors for children following divorce. A useful risk index would need to accurately identify youth at risk for future problems (i.e., sensitivity) and those not at risk (specificity). False positive predictions can lead to overuse of services and potential stigmatization of children. False negative predictions can lead to families not receiving preventive services that might help them avoid future problems. Conventionally sensitivity and specificity of .70 and above is considered acceptable for a screening measure [see National Research Council/Institute of Medicine (2009) for a full discussion of screening in prevention]. To be maximally useful for this population, such a risk index needs to be brief as well as easy to administer and score.

A risk index could potentially be used both by parents as well as professionals who work in family courts, such as lawyers, mediators, and custody evaluators and those who work with children in other settings, such as social workers, counselors, psychologists and pediatricians. These professionals could use such a measure as a first step in helping parents evaluate whether to participate in services or programs to reduce their children's risk of developing problem outcomes after parental divorce, although as discussed below a risk index cannot specify what specific service is most appropriate for a given family. The measure could also be used by researchers who are evaluating whether services or prevention programs for children from divorced families are differentially effective for children at different levels of risk for problem outcomes.

The paper reports a series of analyses. The first set of analyses (Study I) develops and cross-validates the predictive validity of a brief parent-report measure of child behavior problems with children from divorced families, a key component of a risk index. The second set of analyses (Study II) examines the predictive value of adding items representing post-divorce risk and protective factors to the behavior problem items. Using a different data set, the final set of analyses (Study III) cross-validates the predictive value of a composite risk index which consists of the best set of items assessing child behavior problems and post-divorce risk and protective factors.

Study I: Selection of the Behavior Problem Items

In a previous study on shortening the Behavior Problem Index (BPI; Zill, 1991) that used the general sample of the National Longitudinal Study of Youth (NLSY79; Bureau of Labor Statistics, 2002), Moore, Halle, Vandivere, and Mariner (2002) found that a 6-item shortened version of the BPI provided good predictive validity of child delinquency and cigarette use 2-, 4-, and 6-years later for a subset of 13 and 14 year old children. Our aim was similar to that of Moore et al. (2002), in that we wished to select a small but efficient subset of these items, but distinct in that we wished to predict a broader range of future problem outcomes for children of a broader age range and whose parents had divorced. Two data sets were used. The NLSY79 was used to select the best items for the population of interest, children from divorced families in the age range of four to fourteen, so that the prediction measure

would have broad applicability to the divorced population. The Study of Separating Families data set (Braver & Bay, 1992; Braver et al., 1993) was used to cross-validate the predictive validity of these items. We also included the six items from the Moore et al. (2002) study to select the most parsimonious set of items identified in the two prior analyses of the NLSY sample that would cross-validate in the Study of Separating Families data set.

Methods

Sample.

Initiated by the Department of Labor, Bureau of Labor Statistics, the NLSY79 is a national sample of 12,686 young men and women who were 14–22 years old when they were first surveyed in 1979. The assessment was expanded to include reports on children aged four to 14 born to the NLSY79 women in 1986, including the BPI. Assessments on children have been administered biennially since. We used the sub-sample of the NLSY79 that experienced divorce during the 2-year time period that directly preceded the interview in which the BPI was administered (T1) to identify the most parsimonious set of behavior problem items at T1 that predicted total behavior problems 2-, 4-, and 6-years later (i.e., T2, T3, and T4). The sub-sample included 356 women who had divorced within two years prior to the surveys administered in 1988, 1990, 1992, 1994, 1996, and 1998 and had children ($N = 632$) who were four to 14 years old at the first time point (T1; $M = 8.5$, $SD = 2.9$). The average age of the mothers at T1 was 31.6 ($SD = 3.8$). The children were 52% males, 59% non-black/non-Hispanic, 20% Hispanic, and 21% black.

The Study of Separating Families is a three-wave longitudinal study that collected data on a regionally representative sample (Braver & Bay, 1992) of both non-custodial fathers and custodial mothers who had at least one minor child. The data included randomly selected couples and were collected starting within 2.5 months of the initial filing for divorce but before the divorce was final (T1) and at the 1-year (T2) and 3-year (T3) anniversaries of the first interview. A detailed description of the study can be found in Braver et al. (1993). In addition to assessing children's problem outcomes, this study assessed risk and protective factors and included both mother and father reports. Parents answered questions about one child who was randomly selected from the children who were four to 15 years old. Because the emphasis of the study was on non-custodial fathers, more fathers ($n = 340$) than mothers ($n = 271$) of the 378 families participated in the study. At T1, child age averaged 5.9 ($SD = 4.0$); 55% of the children were males. The average age of mothers and fathers was 30.1 ($SD = 6.2$) and 32.9 ($SD = 6.8$), respectively. For mothers, 89% were nonblack/non-Hispanic, 9% Hispanic, and 2% black; for fathers, 84% were non-black/non-Hispanic, 14% Hispanic, and 2% black. The study was approved by the Arizona State University Institutional Review Board.

Measure.

The 32-item BPI (Zill, 1990) in the NLSY79 data collection obtained mother report of child behavior adjustment for children ages four and above. Items were rated on a 3-point scale (1=never true, 2=somewhat true, 3=very true). Twenty-seven of these items, using the same response format, were administered to both mothers and fathers in the Study of Separating

Families. The BPI taps some of the common behavior problems such as antisocial, distractible-hyperactive, and depressed-withdrawn behaviors. The BPI has been shown to discriminate between children who have received clinical treatment and those who have not (Child Trends, 1999).

Results

Backward and forward stepwise regression analyses were the primary procedures used for selecting items using the NLSY79 divorced sample. We selected the items from the BPI at T1 that best predicted total BPI scores at T2, T3, and T4. Specifically, we selected items that had significant relations with total BPI in at least two out of three follow-ups based on forward stepwise regression and backward stepwise regression, respectively. Using forward stepwise regression, we identified 16 items that were significant predictors of total BPI at two or more time points. Using backward stepwise regression, we identified eight items that satisfied the same criterion. As shown in Table 1, the 8-item scale correlated highly with the 16-item scale ($r = .93$) and both the 8-item and 16-item scales correlated highly with the full 32-item scale ($r = .90$ and $.95$, respectively). Table 1 shows that the correlations of the two shortened scales and full scale with the total BPI at T2 to T4 were all significant and nearly identical. Table 1 also shows that the correlations of Moore et al.'s (2002) 6-item scale with BPI scores at each of the follow-up points were comparable to those of the 8-item and 16-item scales. Therefore, on the basis of parsimony, the eight items from the backward regression were selected and combined with the Moore et al. (2002) items for further cross-validation. Three of the items identified in our analyses and the Moore et al.'s (2002) analysis overlapped. Thus, a total of 11 unique items were potentially eligible for cross-validation. However, one of the items ("Has trouble getting mind off certain thoughts") was omitted from the Study of Separating Families so that 10 items were used in the cross-validation study.

We cross-validated these 10 items using the sample from the Study of Separating Families to identify the fewest items that best predicted future child behavior problems from both mother and father reports. The 10 items from mother and father reports at T1 were used to predict the total BPI scores at T2 and T3 of their respective reports as well as the average of mother and father reports. The correlations of mother and father reports of total BPI were .34 at T1, .32 at T2, and .29 at T3. Forward and backward stepwise regression analyses were also used for selecting the best predictor items from four sets of regression models (see Table 2). We kept the five items (i.e., half of the 10 items) that were most predictive from each model. We then identified items that were selected in at least one model across all four sets. Six items met that criterion and the number of times that these items were selected by the stepwise regressions was higher than the others (see Table 2 and Items 1–6 in Table 4). Table 3 shows the total R^2 in predicting the T2 or T3 total BPI from the final six BPI items within and across reporters. The R^2 were generally larger for predicting T2 than T3 total BPI (R^2 ranged from 16% to 34% for T2 total BPI; R^2 ranged from 9% to 22% for T3 total BPI).

Study II: Additive Predictive Value of Measures of Post-divorce Stressor and Protective Factors

Dawson-McClure et al. (2004) found that a composite measure consisting of scales assessing multiple post-divorce stressors predicted children's problem outcomes six years following the divorce, over and above the effects of baseline child externalizing problems. In addition to the presence of stressors, it is possible that the presence of protective resources, particularly quality of parenting, would contribute to the prediction of child behavior problems. The purpose of Study II was to select items representing several common post-divorce stressors and high quality parenting that had additive predictive value above and beyond the child behavior problem items identified in the Study of Separating Families cross-validation study.

Methods

Sample.

The sample consisted of the 378 families from the Study of Separating Families described above.

Measures.

Inter-parental Conflict.—This 13-item measure was an adaptation of the O'Leary-Porter Overt Hostility Scale (1987) included items such as arguing about money and rules on raising children. Items were rated on a 5-point scale (1=did not happen, 2=happen rarely, 3=happen somewhat, 4=happen often, 5=happen often). At T1, α was .84 for mother report and .86 for father report.

Parent Psychological Problems.—A 17-item modified version of the Psychiatric Epidemiology Research Interview (Dohrenwand, Shrout, Egri, & Mendelsohn, 1980) was administered, using a 4-point scale (i.e., 1=not at all, 2=a little bit, 3 quite a bit, and 4=extremely). At T1, α was .92 for mother report and .95 for father report.

Missed Scheduled Visits.—Percentage of missed visits by the noncustodial fathers in the previous month was assessed using both mother and father reports.

Parenting.—Parenting was assessed only for mothers using the acceptance (16 items), rejection (16-items), and consistency of discipline (8 items) subscales of the Children's Report of Parenting Behavior Inventory (CRPBI; Schaefer, 1965). Mothers rated the items on a 3-point scale (1=like you, 2=somewhat like you, 3=not like you). At T1, α = .88.

Results

The indicators of environmental stressors and resources were mother and father reports of inter-parental conflict, parent psychological problems, and missed scheduled visits plus mother report of parenting. The following criteria were used for selection. We first examined whether each of these constructs at T1 was a significant predictor of the mother, father, or averaged (mother and father) reports of T2 or T3 total BPI, above and beyond the six items

from the BPI identified by Study I. For the constructs that were significantly related to any of the outcomes, we then selected representative items from the construct using partial correlation and, if necessary, all possible regression selection methods, over and above the BPI items. All possible regressions perform all possible subset regressions to find a subset of independent variables that optimally predicts a dependent variable. Because the parenting construct was administered to mothers only, we selected the parenting items last. Except for father report of missed visits, all of the hypothesized constructs were significantly correlated with either T2 or T3 total BPI across mother, father, or averaged reports. Only two items from the inter-parental conflict measure (Items 7 and 8 in Table 4) and three items from the parent psychological problems measure (Items 9–11 in Table 4) had significant partial correlations with any of the total BPI outcomes. Due to the relatively small number of items meeting the criteria with partial correlations, no further regression selection procedures were conducted for these two measures. We retained missed visits because mother report of this item had a significant partial correlation with some of the total BPI outcomes. Table 3 shows the total R^2 in predicting T2 or T3 total BPI from the 12 items (six BPI items, two inter-parental conflict items, three parent psychological problems items and one missed visit item) within and across mother and father reports. The R^2 ranged from 22% to 39% for T2 and 16% to 25% for T3 total BPI and were consistently larger than the R^2 for the BPI items alone.

To select items from the mother report of the parenting construct, mother and averaged mother and father reports of total BPI at T2 and T3 were used as the outcome variables. Twenty items had significant partial correlations (after controlling for the BPI items) with at least one of the total BPI outcomes. We applied all-possible regression to determine the most parsimonious subset of the items that predicted the T2 and T3 BPI outcomes after accounting for the 12 already selected items. Three parenting items consistently improved the predictions of the outcomes, and so were added to the risk index (see Items 13–15 in Table 4). Table 3 shows the total R^2 in predicting mother, father, and averaged reports of total BPI from the final 15 items by mother report. The R^2 ranged from 34% to 49% for predicting T2 total BPI and 23% to 32% for predicting T3 total BPI and were considerably larger than the R^2 from the 12-item index. We also examined the child age and gender differences. The predictions were comparable across child age and gender except that the total R^2 of predicting mother report of T2 total BPI by mother report of the 15 items was larger for males than females (61% vs. 33%). However, these items were still good predictors of behavior problems for females. Thus, these 15 items comprised the final version of the index, which we term the Child Risk Index for Divorced or Separated Families (CRI-DS). Table 4 provides the CRI-DS items, responses, and scoring instruction.

Because the numbers of items differed across the domains (constructs) and the domain of child behavior problems, as assessed by the BPI, included several more items than the other domains. One limitation of this approach is that the total score differentially weights items in each domain. Although the items were selected to be predictive controlling for other problem items, it is possible that a high score for any individual reflects many items in only one or two domains rather than problems in multiple domains. An alternative approach is to develop the risk index in a way to equally weight the domains of problems, so that a high score represents cumulative risk across domains. In order to develop a risk index using this

cumulative risk across domains approach, we created a composite score for each domain (mean of the standardized scores of the items in that domain) and recomputed the R^2 in Table 3 using the composite scores. As shown in the second half of Table 3, the R^2 of the 12- or 15-items was greater than the R^2 when the 4- or 5-composite score predictors were used. Nevertheless, the R^2 -changes when adding the constructs reflecting family-level risk and protective factors were mostly significant or marginally significant (i.e., R^2 -change > 2%). R^2 ranged from 12% to 29% for predicting T2 total BPI and 11% to 13% for predicting T3 total BPI using father report measures, which does not include parenting. R^2 ranged from 24% to 40% for predicting T2 total BPI and 16% to 27% for predicting T3 total BPI using mother report measures, which includes parenting. Because the predictive power of the 15-item risk index was stronger than the index which used equally weighted scores across the 5 domains we focused on the 15-item index in the following analyses.

As mentioned earlier, the index should be brief and easily administered. In order to put all items in the index in a simple and common response format, we suggest rescaling the items to indicate the presence vs. absence of a problem for each item. CRI-DS would be the sum of the 0 and 1 scores (i.e., minimum=0 and maximum=15). To evaluate the ability of CRI-DS to predict behavior problems, we rescaled each of the 15 items to 0 or 1 for mother report (not father report because parenting items were not administered) and conducted Receiver Operating Characteristic (ROC) curve analyses. ROC curve analysis is a statistical technique incorporated in logistic regression to identify the optimal cut-point and investigate the predictive accuracy to discriminate between positive and negative cases associated with the cut-point, using six criteria: area under the ROC curve (AUC), sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy (Bennet et al., 1998). Sensitivity is the proportion of individuals with clinical levels of problems who are predicted to have clinical levels of problems (i.e., true positive); specificity is the proportion of individuals without clinical levels of problems who are predicted to *not* have clinical levels of problems (i.e., true negative). Specifically, using T1 scores, we first rescaled each of the items to a binary scale in the same direction (e.g., 0 = 0%/never true/not at all/not like you and 1=the remainder of the responses, except for the two inter-parental conflict items where 0 = did not happen or rarely happens and 1=happens sometimes/often/very often). We then created the sum scores for mother report of the 15-item CRI-DS ($m = 6.23$, $sd = 3.00$, $range = 0-15$). The criterion variables were the binary scores of the averaged mother and father reports of T2, T3, or T3 BPI total scores, using the 70th percentile as the cutoff for having high levels of behavior problems. This percentile was selected because Hetherington et al. (1992) found that 35% of adolescent girls and 20% of adolescent boys whose parents divorced in childhood scored in the clinical range on behavior problems. Because we did not have a priori judgment about the importance of sensitivity vs. specificity of the prediction, we selected the optimal cut-point based on the “closest to (0, 1) criteria” as the selection method. This criteria selects the cut-point as the point on the curve closest to (0, 1) in the ROC curve (Perkins & Schisterman, 2006).

As shown in Figure 1, mother report CRI-DS was a fair predictor of the T1 and T2 BPI binary scores [i.e., area under curve (AUC), sensitivity, and specificity > .70]. However, it was a weak predictor of the T3 BPI binary scores. Because the 70th percentile was used as the cut-off for creating the BPI binary scores, the prevalence rates were close to 30%.

Because the chosen prevalence rate was lower than 50%, the positive predictive values were lower than the negative predictive values. PPV ranged from 42% to 50%, NPV from 76% to 89%, and accuracy of prediction from 63% to 75%. The optimal cut-point of the risk measure for each ROC analyses was around 7.

Study III. Cross-validating the Predictive Value of the CRI-DS

Cross-validation of the predictive validity of the 15-item mother report CRI-DS was conducted using the control group sample from a five-wave, six-year longitudinal study of a randomized trial of a preventive intervention for children of divorce, the New Beginnings Program (NBP; Wolchik, et al., 2000, 2002). The NBP trial is an experimental evaluation of two post-divorce preventive interventions for custodial mothers and their children. One limitation of this data set is that it did not include non-custodial father report, so that it could only be used to assess the predictive properties of the mother reports on the CRI-DS. The longitudinal data set, which included measures of functioning in multiple domains, allowed us to test how well the CRI-DS predicted a wide range of outcomes including measures of short-term and long-term behavior problems, substance use, competence and grade point average. Dawson-McClure et al. (2004) also used the control group from the NBP data set to develop a composite risk measure that was highly predictive of outcomes over a six-year period. As noted in the Measures section below, the risk index used by Dawson-McClure et al. (2004) included 181 items. The current study examined the predictive accuracy of the 15-item CRI-DS and evaluated whether the CRI-DS had similar predictivity over four periods (pretest and 3 months, 9 months and 6 years after pretest) for behavior outcomes as the much longer risk measure developed by Dawson-McClure et al. (2004).

Methods

Sample.

The NBP data set included 240 families randomly assigned to one of three conditions: Mother-focused program ($n = 81$), a dual component program – mother-focused program plus child-focused program ($n = 83$), or literature control condition ($n = 76$). Families in the control condition received books on divorce adjustment and syllabi to guide their reading. Only the control group was used for the cross-validation of the CRI-DS. At the pretest, the average age of the children was 10.3 ($SD = 1.1$); the average age of the mothers was 36.5 ($SD = 4.6$). The children were 49% males, 88% non-black/non-Hispanic, 11% Hispanic, and 1% black. The study was approved by the Arizona State University Institutional Review Board.

Measures.

Risk measures.—The 15-item CRI-DS was assessed at pretest. The six child behavior problem items were extracted from mother report of the Child Behavioral Checklist (CBCL; Achenbach, 1991); the two interparental conflict items from the Overt Hostility Scale (O’Leary-Porter, 1987); the three parent psychological problem items from the Psychiatric Epidemiology Research Interview (Dohrenwand, Shrout, Egri, & Mendelsohn, 1980); and the three parenting items from mother report of Children’s Report of Parenting Behavior

Inventory (Schaefer, 1965). The wording and response scales for these items were almost identical to those in the Study of Separating Families. Mothers also reported the number of missed visits by the child's father in the previous month.

Dawson-McClure et al. (2004) risk measure is a composite of childhood externalizing problems (see *Youth Behavior Problems* below) and post-divorce environmental stressors. Environmental stressors, a multifaceted construct, included mother and youth reports of the 13-item Children's Perceptions of Interparental Conflict Scale (Grych, Seid, & Fincham, 1992; child report $\alpha = .82$; mother report $\alpha = .89$) and the 33-item Negative Life Event Scale (Sandler, Wolchik, & Braver, 1988) as well as mother report of the 27-item Psychiatric Epidemiology Research Interview (Dohrenwend et al., 1980; $\alpha = .91$), the number of missed scheduled visits with the child's father in the past month, and current per capita annual income.

Criterion variables.

Measures of child competence and child behavior problems were assessed at pretest as well as 3 months, 9 months, and 6 years after the pretest. Substance use, GPA, and mental disorder diagnosis were assessed only at the 6-year follow-up.

Competence.—The measure was a composite of youth report of the 6-item self-worth subscale from the Self Perception Profile for Children (Harter, 1985; $\alpha = .69$) and mother and youth reports of the academic, activities, and peer subscales of the Coatsworth Competence Scale (Program for Prevention Research, 1992; child report $\alpha = .83$; mother report $\alpha = .85$). The measure was only administered at the pretest, and 3 months and 6 years after the pretest.

Youth Behavior Problems.—Internalizing problems were assessed as the composite of the standardized scores of mother report of the 31-item internalizing subscale of the CBCL ($\alpha = .88$) and youth report of the 27-item Children's Depression Inventory (Kovacs, 1981; $\alpha = .76$) and the 28-item Children's Manifest Anxiety Scale—Revised (Reynolds & Richmond, 1978; $\alpha = .88$). Externalizing problems were assessed as the standardized composite of mother report of the 33-item externalizing subscale of the CBCL ($\alpha = .86$) and youth report of the 27-item Divorce Adjustment Project Externalizing Scale (Program for Prevention Research, 1985; $\alpha = .87$). Mother and child report of internalizing and externalizing scores were moderately correlated (i.e., on average .29 for internalizing and .33 for externalizing across assessments). A dichotomous variable using the CBCL total problem T-score of equal to or above 60 as the cut-off was used to represent whether the youth was above the borderline clinical range of behavior problems (Achenbach, 1991).

Substance Use.—Youth completed 15 items from the Monitoring the Future Scale (_S1_Reference17Johnston, O'Malley, & Bachman, 1993) which estimates the frequency of use of alcohol, marijuana, and 13 other illicit drugs (e.g., LSD, cocaine) in the past year.

Disorder Diagnosis.—Diagnosis of mental health and substance use disorders in the past year was assessed with the computer-assisted parent and adolescent versions of the Diagnostic Interview Schedule for Children (DISC; Shaffer, Fisher, Lucas, Dulcan, &

Schwab-Stone, 2000). Mother and youth reports of oppositional defiant disorder, attention deficit/hyperactivity disorder, major depressive disorder, conduct disorder, social phobia, separation anxiety, and drug abuse or dependence were assessed.

Results

We evaluated the predictive validity of the CRI-DS by examining its associations with a broad range of behavior outcomes, including measures of mental health and substance use disorder diagnosis. Correlational (for continuous criterion variables) and logistic regression (for dichotomous criterion variables) analyses were conducted. The CRI-DS index scores were created by first rescaling each of the 15 items to 0 and 1 and then taking the sum of the rescaled items ($M = 4.80$, $SD = 2.59$, $range = 0-11$). The CRI-DS correlated highly with Dawson-McClure et al. (2004) risk measure ($r = .56$). As shown in Table 5, the predictions of the outcomes were largely comparable across the two measures such that the CRI-DS had significant relations with all of the short- and long-term outcomes except for GPA at the 6-year follow-up. The magnitude of the correlations of the CRI-DS with the outcomes was in general moderate to large. The odds ratios in predicting clinical or borderline clinical levels of behavior problems or mental health disorder diagnosis ranged from 1.41 ($p < .05$) to 1.81 ($p < .001$). Because the CRI-DS was the sum of 1's on the CRI-DS items, these odds ratios mean that for any increase of the score by one, the odds of having borderline clinical level of behavior problems/mental or substance use disorders were 41% to 81% higher. The correlations and odds ratios were comparable across child gender and age except that CRI-DS had larger correlations with short-term externalizing problems for males than for females (.67 vs. .36, .63 vs. .34, and .66 vs. .25 for pretest, 3-month follow-up, and 9-month follow-up, respectively; $p < .05$).

Similar to Study II, we also created a sum score that equally weighted across domains of the risk index by adding the standardized scores of each predictive construct (i.e., child baseline behavioral problems, Inter-parental Conflict, Parent Psychological Problems, Missed Scheduled Visits, and Parenting) and re-examined how the 5-domain composite predicted children's problem outcomes (see the third column in Table 5). The magnitudes of the correlations and odds-ratios that used this scoring method were in general moderate, although somewhat smaller than those that used the 15-item scores.

Odds ratios do not quantify the predictive accuracy of a predictor variable. A strong odds ratio does not necessary imply strong discrimination between individuals likely to have the outcome (Pepe, Janes, Longton, Leisenring & Newcomb, 2004). Similar to Study II, we conducted ROC curve analyses to evaluate the predictive accuracy of the CRI-DS at pretest and 3 month, 9 months, and 6 years after the pretest using the CBCL total problem cut-off score (i.e., $T \geq 60$) as the criterion variable. Using this approach, 35% of the youth were classified as having borderline clinical levels of behavior problems at the pretest, 26% at 3 months after the pretest, 23% at 9 months after the pretest and 24% at 6 years after the pretest. The ROC curves and the predictive accuracy (sensitivity, specificity, positive predictive value, negative predictive value, prevalence, and overall predictive value) at the optimal cut-point for each assessment time are shown in Figure 2. The CRI-DS was a fair predictor of clinical levels of behavior problems at pretest and 3 months and 9 months after

the pretest with AUC's being .82, .83, and .83, respectively, and with sensitivity and specificity above 70%. The PPVs ranged from 47% to 61%; the NPVs ranged from 84% to 91%; and the accuracy of predictions ranged from 72% to 75%. Similar to the finding with the Study of Separating Family, the predictive values of the long-term clinical levels of behavior problems was not as good as those of the short-term. At the 6-year follow-up the specificity were a little below 70%; PPV was 42%; NPV was 91%, and the accuracy of prediction was 68%. The optimal cut-point was 6 for each assessment time.

Discussion

The purpose of this paper was to develop a brief, psychometrically adequate measure to predict behavior outcomes of youth who have experienced parental divorce. The 15-item Child Risk Index for Divorced or Separated Families as completed by mothers was highly predictive of a wide range of children's problem outcomes over time, including competence and internalizing and externalizing problems. Also, the odds ratios for predicting multiple, serious problem outcomes were substantial for shorter follow-up periods and still adequate over a six-year time period. An important strength of the study is that the risk index was cross-validated using a prospective longitudinal analysis in a separate sample. Below, we discuss potential uses of this index and summarize the most important strengths and limitations of it. Then, limitations of the study and directions for future research are discussed.

Brief measures of children's risk for developing serious behavior problems could be used by professionals working with divorced parents to help them decide whether to seek services after divorce. Because it is a brief index it does not provide sufficient data on problems or concerns in any domain so that it cannot be used to advise parents as to what service might best fit their needs and concerns. Rather it could be used as an initial screen to be followed by a more in-depth interview about parental concerns in each area of post-divorce family functioning to assess what types of services might be most appropriate. Such measures could also be used to evaluate who benefits most from participation in prevention programs that have demonstrated the capacity to significantly improve children's problems following divorce (Braver, Griffin, & Cookston, 2005; Pedro-Carroll, 2005; DeGarmo, Patterson, & Forgatch, 2004; Wolchik et al. 2002).

It is notable that the six items assessing behavior problems that were selected had comparable validity to that of the full 32-item BPI in predicting child behavior problems several years later. It is also notable that the predictive validity of the risk measure was substantially improved by adding items assessing divorce-related stressors and parenting quality. Further, the short index had a comparable level of accuracy as Dawson-McClure et al. (2004) assessment of the same constructs, which included 181 items, for predicting multiple outcomes up to six years following the assessment. In future uses, we recommend 'Never', 'Sometimes', and 'Always' as the response scale for all 15 items, scoring Never=0 and the other responses = 1 to denote absence vs. presence of the problem. Such response format gives respondents a wider choice of options to indicate 'presence' of the problem and at the same time provides the person who administers CRI-DS an easy method of calculating the total score (see Table 4 for the instruction of calculating the total score). In addition, the

sum of 0/1 scores provides a clear indication of the number of problems across the 15 questions that occurred in the family and whether it is above or below the cut-point of 6 or 7 problems (as the ROC analyses indicated). The brevity of the current measure and the simple scoring increases its potential practical utility as a way for professionals working with divorced families to identify who may be particularly appropriate for services or programs that lower their children's risk of problem outcomes following divorce.

The ROC curve analyses provided important information on the properties of CRI-DS. From a public health perspective, measures of sensitivity and specificity are often used to strike a balance between detecting problem outcomes that are likely to occur (and might be avoided by participating in a preventive intervention or treatment) and correctly predicting that a negative outcome will not occur (so that the individual need not incur the costs of such services). Sensitivity and specificity above .70 are often used as evidence that a screening measure is striking a reasonable balance of predictive accuracy (Wood, Flowers, Meyers, & Hill, 2002). The mother report screening measure had acceptable predictive accuracy in two samples up to one year following the assessment. The most important question for practical utilization of this measure concerns the increased information obtained from knowing whether a score is above or below the cut-point, as compared to simply knowing the base rate of a problem outcome following divorce. As seen in Figures 1–2, there appears to be a substantial increase in information gained by knowing whether the score is above or below the cut-point. The positive predictive values were relatively low (e.g., 40%–60%) for all models predicting future problem outcomes, which is not surprising given the relatively low prevalence. However, this represents better than a 10% increase in prediction of likelihood of a problem outcome as compared to only knowing the prevalence rate. The practical implication is that although being above the cut-point indicates that a child has a higher likelihood of developing problem outcomes than is generally true for children from divorced families, more than 50% of these children will not develop behavior problems. Thus, although enrollment in an evidence-based preventive intervention would be particularly appropriate for these families, they should not be stigmatized or overly alarmed that problem outcomes are inevitable. Although the measure provides an indicator of the level of risk and does not indicate the specific type of problem outcome, this does not diminish the usefulness of the measure because parents are most likely to be interested in preventing any of a wide range of problems that might occur. The current measure could be used as the first step in a multiple gating approach in which those above the cut-point on the CRI-DS are administered additional, more in-depth measures to assess the areas of risk, current problems and need for services. It is important to emphasize that a risk measure, such as the current one, is most useful when there are evidence-based programs that reduce risk factors and enhance protective factors. Several programs have been found to reduce problem outcomes for children following divorce (Braver, Griffin, & Cookston, 2005; DeGarmo et al., 2004; Pedro-Carroll, 2005; Wolchik et al. 2002) so that optimally, the risk measure would be used by professionals working with divorced families to help them identify their need for such programs.

Several limitations of this study need to be recognized. First, the measure was developed specifically to be used with divorced families. Although many of the items are not unique to divorce and predict outcomes in other populations, the findings from this study should not be

generalized beyond this population. Several of the risk factors that were included in the measure are particularly salient following divorce (e.g., interparental conflict, parent visitation) and other factors may be important to include for other populations. Second, high scores on the risk index can be obtained in many different ways. For example they may reflect multiple problems in a single domain (e.g., child behavior problems, or parenting) or moderate levels of problems in several domains. Thus, they do not necessarily reflect cumulative risk across multiple domains such as would be reflected in a measure such as the Adverse Child Experience study (Felitti et al., 1998). The alternative scoring of the risk measure that equally weighted problems in each of the separate domains had somewhat weaker predictive validity than the 15-item index. Thus, as a screening measure we prefer to score each of the 15 items separately. Third, for the ROC curve analyses with the Study of Separating Families data set, the cut-points of problem outcomes on the continuous measures were selected using estimates of problem outcomes based on other studies of divorced families (i.e., Hetherington et al., 1992). The use of different cut-points might have yielded different findings. Fourth, only the NBP data set included children's reports of problem outcomes (i.e., internalizing and externalizing problems, diagnosed disorder) or archival data (GPA). Other than these measures, problem outcomes were assessed using parent report so that the prediction values may be inflated by reporter bias given that parents also completed the risk measure. Fifth, we did not have the data to conduct and cross-validate the predictive validity of the CRI-DS as reported by non-custodial fathers. Finally, the analyses indicated that the CRI-DS were in general comparable in predicting child behavior outcomes across child age and gender, except being stronger predictors of boys' than girls' short term behavioral problems. However, the samples did not include wide diversity on a number of important dimensions including ethnicity, length of time since separation, and different custody arrangements.

There are several directions for future research. One of these involves ways in which the predictive validity of the CRI-DS could be improved. The predictive value might be improved by combining information across multiple reporters and methods, such as by using mother, father and child reports and direct observation of parent-child interactions. The predictive value of the father report measure might be improved by adding measures of the aspects of the father-child relationship that predict children's well-being following divorce, such as quality of parenting (Sandler, et al., 2012). Another approach to improving the predictive validity of the measure might be to include items on other risk and protective factors following parental divorce, such as divorce related-stressful events and co-parenting, and use a different set of behavior problem items, such as items from the Strengths and Difficulties Questionnaire (Goodman, 2001) that have been found to predict child behavior problems in other populations. Researchers should also examine the invariance of the measure across sub-groups that differ on ethnicity, time since separation, and custody arrangements.

Another focus of future research is to assess whether the CRI-DS differentiates those who are more or less likely to benefit from prevention programs. Dawson-McClure et al. (2004) found a program by risk interaction in which families with higher scores on a lengthy risk measure benefitted most from participating in a prevention program. The current study has provided a brief measure that could be used to replicate these findings, and potentially

advance our ability to identify families that are most likely to benefit from participating in preventive interventions for divorced families.

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Figure 1:
Predictive accuracy of the 15-item mother report CRI-DS using the Relative Operating Characteristic (ROC) curve analyses and the Study of Separation Family dataset

Figure 2:

ROC curve of predicting pretest, 3-month, 9-month, and 6-year borderline child behavior problems by mother report of the 15-item CRI-DS for the New Beginnings Program Study. Note: Some of the cut-points were extrapolated between cut-points to satisfy the “closest to (0,1) criteria”.

Table 1:

Pearson Correlation Coefficients of the Time 1 scores on the 8-item and 16-item shortened BPI scales, Moore et al. 6-item shortened scale, and the total BPI at T2–T4 from the NLSY79 dataset

	1	2	3	4	5	6	7
1. T1 8-item scale	1.00						
2. T1 16-item scale	.93	1.00					
3. T1 32-item scale	.90	.95	1.00				
4. Moore T1 6-item scale	.80	.81	.86	1.00			
5. T2 Total BPI	.32	.33	.38	.42	1.00		
6. T3 Total BPI	.51	.50	.52	.48	.48	1.00	
7. T4 Total BPI	.55	.55	.52	.55	.32	.72	1.00

Note. All of the correlations were significant at $p < .0001$

Selecting the final set of the BPI items from the Study of Separation Family data set using forward stepwise and backward stepwise regression analyses

Table 2:

		BPI Items ^a										R ²
		1	2	3	4	5	6	7	8	9	10	
IV: CP report BPI items	Forward											
	T2	x	x		x		x	x			x	0.350
	T3	x	x				x			x	x	0.089
DV: CP report Total BPI	Backward											
	T2	x			x		x	x			x	0.350
	T3	x				x	x		x			0.092
IV: NCP report BPI items	Forward											
	T2	x			x		x	x				0.295
	T3	x			x		x			x		0.128
DV: NCP report Total BPI	Backward											
	T2	x			x		x	x				0.295
	T3	x			x				x		x	0.128
IV: CP report BPI items	Forward											
	T2	x			x		x	x				0.309
	T3	x					x		x		x	0.157
DV: average CP & NCP reports	Backward											
	T2	x			x		x	x				0.309
	T3	x					x		x		x	0.157
IV: NCP report BPI items	Forward											
	T2	x			x		x			x	x	0.280
	T3	x			x		x			x		0.156
DV: average CP & NCP reports	Backward											
	T2	x			x		x	x				0.283
	T3	x			x		x			x		0.156
Total number of times selected		8	16	0	12	3	14	6	3	11	7	

Note:

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1_p Cheats or tells lies", 2: "Has difficulty concentrating/paying attention", 3: "Is easily confused, seems in a fog", 4: "Bullies or is cruel/mean to others", 5: "Has trouble getting along with other children", 6: "Feels worthless or inferior", 7: "Is restless, overly active, cannot sit still", 8: "Has strong temper and loses it easily", 9: "Is disobedient at school", and 10: "Feels others are out to get him/her". Items 2, 5, and 9 were items from the Moore et al. (2002) 6-item scale but not the 8-item scale. The best 5 items were chosen for each analysis. IV: independent variables; DV: dependent variable; CP: custodial parent-Mother; NCP: non-custodial parent-Father; R^2 : variance account for the dependent variables by the 5 selected items.

Table 3:

R-square from regression of mother, father and averaged father and mother reports of total BPI at T2 and T3 on the risk items and risk domains from Time 1 using the Study of Separation Family data set

	T2 BPI-Mother Report	T3 BPI-Mother Report	T2 BPI-Father Report	T3BPI-Father Report	T2 BPI-Average Report	T3 BPI-Average Report
I. Prediction using individual items						
<i>6 items (from BPI)</i>						
Mother items	.34	.09	.20	.22	.30	.13
Father items	.16	.21	.30	.13	.27	.10
<i>12 items (from BPI, Inter-parental Conflict, Parent Psychological Problems, & Missed Scheduled Visits)</i>						
Mother items	.39	.16	.24	.25	.36	.22
Father items	.22	.24	.30	.17	.28	.13
<i>15 items (from BPI, Inter-parental Conflict, Parent Psychological Problems, Missed Scheduled Visits, and Parenting)</i>						
Mother items ^a	.49	.23	.34	.29	.44	.33
II. Prediction using individual constructs						
<i>1 construct (by BPI)</i>						
Mother construct	.26	.08	.15	.17	.26	.13
Father construct	.10	.06	.27	.09	.22	.09
<i>4 constructs (by BPI, Inter-parental Conflict, Parent Psychological Problems, & Missed Scheduled Visits)</i>						
Mother constructs	.31	.12	.18	.20	.32	.20
Father constructs	.12	.12	.29	.11	.24	.13
<i>5 constructs (by BPI, Inter-parental Conflict, Parent Psychological Problems, Missed Scheduled Visits, and Parenting)</i>						
Mother constructs ^a	.36	.16	.24	.22	.40	.27

Note:

^a Only the Mother report scale was used here because the added parenting items were available only on CP report.

Table 4:

Child's Risk Index for Divorced or Separated Families (CRI-DS).

Please answer each of the following questions by checking one box.				
	Never	Sometimes	Always	
	1	2	3	
1. Your child has difficulty concentrating.	☐	☐	☐	
2. Your child bullies or is cruel or mean to others.	☐	☐	☐	
3. Your child is disobedient at school.	☐	☐	☐	
4. Your child feels that others are out to get him/her.	☐	☐	☐	
5. Your child feels worthless or inferior.	☐	☐	☐	
6. Your child lies or cheats.	☐	☐	☐	
7. You and your Ex argued about child discipline practices	☐	☐	☐	
8. You and your Ex argued about visitation	☐	☐	☐	
9. You have poor appetite	☐	☐	☐	
10. You feel lonely	☐	☐	☐	
11. You worry too much	☐	☐	☐	
12. The parent who does not live with the child misses many scheduled visits.	☐	☐	☐	
13. You seem to see your child's faults more than his/her good points.	☐	☐	☐	
14. You don't seem to know what your child needs or wants.	☐	☐	☐	
15. You don't have a good time at home with you child.	☐	☐	☐	

Total score = Sum of number of checks of the shaded boxes. The cut-point for predicting behavior problems is a total score of 6 or greater.

Table 5:

The association of the 15-item CRI-DS and Dawson-McClure's risk measure with the short term and long term child outcomes, using the control group from the New Beginning data set

	CRI-DS (15-item index score)	CRI-DS (5-construct composite score)	Dawson-McClure et al. Risk Measure
<i>Correlation</i>			
Pretest Internalizing	.45 **	.39 **	.59 **
3-month Internalizing	.45 **	.41 **	.43 **
9-month Internalizing	.41 **	.34 **	.38 **
6-year follow-up Internalizing	.35 **	.27 **	.53 **
Pretest Externalizing	.57 **	.41 **	.73 **
3-month Externalizing	.49 **	.37 **	.58 **
9-month Externalizing	.42 **	.30 **	.43 **
6-year follow-up Externalizing	.43 **	.33 **	.60 **
Pretest Competence	-.25 *	-.23 *	-.23 *
3-month Competence	-.39 **	-.28 *	-.26 *
6-year follow-up Competence	-.38 **	-.33 **	-.54 **
6-year follow-up GPA	-.18 ^{ns}	-.13 ^{ns}	-.42 **
6-year follow-up Substance Use	.26 *	.18 ^{ns}	.43 **
<i>Odds Ratio</i>			
Pretest CBCL above borderline clinical level	1.81 ** (4.67 **) ^a	3.73 **	4.00 **
3-month CBCL above borderline clinical level	1.80 ** (4.59 **) ^a	3.22 **	3.49 **
9-month CBCL above borderline clinical level	1.71 ** (3.99 **) ^a	2.85 **	2.61 **
6-year follow-up CBCL above borderline clinical level	1.57 ** (3.24 **) ^a	3.20 **	3.22 **
6-year follow-up DISC Mental health or substance disorder diagnosis	1.41 * (2.42 *) ^a	1.66 [†]	4.18 **

Note.

[†] p < .10;

* p < .05;

** p < .01.

(BLOCKED FOR REVIEW's Risk Measure was a z-score based measure and CRI-DS was a measure of counts.

^a The number in the parenthesis reflects the odds ratio from the standardized CRI-DS for prediction, so that the unit is comparable to that of Dawson-McClure et al. Risk Measure and that of CRI-DS 5-construct composite scores.