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Mental Disorders in Five Year Old Children With or Without Developmental Delay: Focus on ADHD

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Abstract

Epidemiological studies of children and adolescents with intellectual disability have found 30–50% exhibiting clinically significant behavior problems. Few studies, however, have assessed young children, included a cognitively typical comparison group, assessed for specific disorders, and/or studied family correlates of diagnosis. We assessed 236 5-year old children, 95 with developmental delay (DD) and 141 with typical development (TD), for clinical diagnoses using a structured interview. Every disorder assessed was more prevalent in the developmental delay group. The percent of children meeting criteria for Attention Deficit Hyperactivity Disorder (ADHD) most highly differentiated the two groups (ratio 3.21 to 1). There was high stability from externalizing behavior problems at age 3 to ADHD diagnoses at age 5 in both groups. In regression analyses, parenting stress at child age 3 related to later ADHD diagnosis in both groups and maternal scaffolding (sensitive teaching) also predicted ADHD in the DD group.

Children and adolescents with developmental delays are at high risk for emotional and behavioral problems. Epidemiological studies of youth with intellectual disability (ID) have reported clinically significant emotional and behavior problems and/or diagnosable mental disorder in a third to a half of cases (Cormack, Brown, & Hastings, 2000; Dekker & Koot, 2003; Einfeld & Tonge, 1996; Emerson, 2003a; Koskentausta, Iivanainen, & Almqvist, 2007). In the present study we assessed behavior disorders longitudinally from age 3 to 5 in children with developmental delay (DD) or typical development (TD), focusing on ADHD. We use the term “developmental delay” rather than the more formal diagnosis of intellectual disability for this sample of young children, as classification would be less stable over time than with school-aged and older children and it was based upon IQ alone. We had three primary aims: (1) to determine the relative risk of diagnosable mental disorders in children with or without DD; (2) to determine whether early externalizing behavior problems are stable and predict subsequent ADHD diagnosis; and (3) to explore whether family characteristics relate longitudinally to ADHD diagnosis.

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Most studies of co-occurring psychiatric diagnosis among youth with ID have sampled children with a wide age range, often from age five or six years through mid or late adolescence. From these age-mixed samples, often assessed at a single time point, one can draw only limited conclusions about age of onset and trajectory of emotional and behavior problems. In one notable exception, the authors conducted three assessments over a five year period and used multi-level growth curve analyses to examine developmental trajectories in a sample that was 6 to 18 years initially (deRuiter, Dekker, Verhulst, Koot, 2007). Children with ID had a higher level of problem behaviors across all ages than children with TD; however, children with ID also decreased significantly more over time in aggressive and attention problems. In the present study, we examined problem behaviors among young children with DD at age 3 and again at age 5 years.

Many studies, as noted, have now established high rates of emotional and behavioral problems in children with ID. As most of these study samples included only youth with ID, less is known about their relative risk compared to same age youth without ID. Further evidence from several studies that also included a comparison group with typical cognitive development suggests that about two and a half to over four times as many children with ID have serious behavior/emotional problems as those with typical development (Dekker, Koot, van der Ende, & Verhulst, 2002; deRoiter et al., 2007; Emerson, 2003a; Emerson & Hatton, 2007). Dekker and colleagues (2002), for example, examined a large sample of children aged 7–12 years with and without ID. They found that 49% of the ID group had parent-reported CBCL Total Problem scores in the borderline or clinical range compared to 18% in the no-ID group. Teacher-reported scores were comparable, with 46% and 19% having elevated CBCL scores. Emerson and Hatton (2007), with a sample of over 17,000 children aged 5–16, found clinical range scores for 36% in the ID sample vs. 8% in Non-ID sample. The present study included a same-age comparison sample of typically developing (TD) children, in order to explore relative risk early in childhood.

We note that while we used a categorical approach to examine relative risk (comparing DD vs. TD samples), others have studied the relationship between cognitive level and behavior problems using a dimensional approach, considering IQ as a continuous variable. Plomin, Price, Eley, Dale, and Stevenson (2002), for example, analyzed associations using both approaches and found comparable results. They noted, however, that correlational analyses across the entire distribution require a large community sample. Our sample was selected to represent two distinct groups, resulting in a distribution that is neither representative of a community sample nor normally distributed. Thus, we have used the same categorical approach to relative risk as the above-cited studies that included a comparison group.

Most studies of disorders in children with DD have used questionnaires to assess psychopathology symptoms and employed a “clinically significant” cut-off point above which participants are deemed to meet criteria for psychiatric disorder. Relatively few studies of youth have used a diagnostic classification system to determine how many meet diagnostic criteria for various mental disorders (Dekker & Koot, 2003; Emerson, 2003a, Emerson & Hatton, 2007; Stromm & Diesth, 2000). The present study used a standardized diagnostic interview at age 5 and a questionnaire measure of emotional and behavior problems at child age 3, allowing us to examine whether young children with developmental delays exhibited elevated levels of actual psychiatric diagnoses (APA, 2000) and the continuity from earlier indicators of emotional and behavioral problems to subsequent diagnoses.

Studies that have reported specific symptoms or diagnoses in children with ID generally have found behaviors associated with disruptive behavior disorders (DBD) among the most prevalent (Dekker, et al., 2002; Dekker & Koot, 2003; Emerson, 2003a; Hardan & Sahl,

1997; Stromm & Diesth, 2000; Voigt et al., 2006). For example, Dekker and Koot (2003) found that 25.1% of their sample of 7 to 20 year old youth with borderline to moderate intellectual disability met criteria for a disruptive behavior disorder, compared to 21.9% for any anxiety disorder and 4.4% for any mood disorder. Findings of elevated disruptive behavior disorders among children with ID are not surprising, given previous research showing that young children with developmental delays exhibited elevated levels of behavior problems compared to TD children (Baker, Blacher, Crnic, & Edelbrock, 2002; Baker et al, 2003; Einfeld & Tonge, 1996). Further, children with DD are vulnerable to impairments in executive functioning, which could place them at higher biological/ neuropsychological risk for diagnoses such as ADHD in contrast to ODD which is more closely related to environmental/parenting practices.

Evidence from studies of TD children suggests that externalizing behavior problems are moderately stable across early childhood (Campbell, 1994; Heller, Baker, Henker, & Hinshaw, 1996). However, few studies have examined the continuity of behavior problems among children with DD. Baker and colleagues (2003), studying a sample of children with and without developmental delays, found high stability in behavior problems from age 3 to age 4. A further question, though, is whether early child behavior problems predict later DBD diagnoses at school entry for children with heightened vulnerability. This line of research seems important in that identifying child behavior profiles associated with later psychopathology may have significant implications for early intervention and the development of targeted prevention efforts.

Given the importance of early parenting in predicting children's later behavior (Deater-Deckard, Dodge, Bates, & Pettit, 1998; Loeber & Hay, 1997), family variables also may be predictive of later disruptive behavior disorders. Regarding ADHD, it is generally proposed that parenting and family environment variables do not cause the disorder but they have been shown to predict its early emergence as well as persistence (August, Braswell, & Thuras, 1998; Campbell, 1994; Deater-Deckard, et al., 1998). Researchers examining families of children with ADHD generally look at three domains: parenting behaviors, dyadic relationships (e.g. parent-child, sibling-child), and parental stress and psychopathology.

Studies of parenting behavior have shown mothers of children with ADHD to be more negative, directive, and controlling as well as less responsive to, and rewarding of, their children's behavior (Johnson & Mash, 2001; Lange et al., 2005). Conversely, positive parenting behaviors may be a protective factor for the development of ADHD. For example, parental warmth has been found to moderate the relationship between low birth weight and ADHD (Breslau & Chilcoat, 2000; Tully et al., 2004). Parents of children with ID or DD tend to exhibit more behaviors that traditionally would be considered intrusive. Similar to parents of children with ADHD, parents of children with DD appear to give more commands and directives (Floyd, Harter, & Costigan, 2004; Floyd & Phillippe, 1993) and to display more negative-controlling parenting (Fenning, Baker, Baker, & Crnic, 2007) when contrasted with parents of TD children.

Studies of dyadic-relationships have shown increased levels of parent-child conflict among families of children with ADHD, with negative parent-child interactions in evidence in the preschool years (DuPaul, McGoey, Eckert, & VanBrakle, 2001). Although conflict in parent-child interactions appears to decrease over time, the family level of conflict remains elevated into adolescence (Barkley, Anastopoulos, Guevremont, & Fletcher, 1992). High family conflict has been found to be associated with impairment in both children with ADHD and their siblings (Pressman et al., 2006).

Studies of parenting stress have shown higher levels in parents of children with ADHD than in control families (Fischer, 1990; Johnson & Mash, 2001). Study findings variously indicate decreased parental sense of competence (Johnston & Mash, 2001), more maternal depression (Cunningham et al., 1988), decreased extended family contacts (Cunningham, Benness, Siegel, 1988), and/or increased couple conflict, separations, and divorce (Cunningham et al., 1988; Johnston & Mash, 2001).

While such family studies are more limited when the child has a cognitive disability, there is also evidence that parents of children with ID report heightened parenting stress (Baker, et al., 2003; Emerson, 2003b; Hauser-Cram, Warfield, Shonkoff, & Kraus, 2001). It appears, too, that child behavior problems mediate the relationship between child intellectual status and parenting stress (Baker et al., 2002; Baker et al., 2003; Hauser-Cram et al., 2001; Herring et al., 2006), such that behavior problems are a more salient predictor of parenting stress than child intellectual ability.

The present study, then, addressed three primary questions: First, what is the rate of diagnosable mental disorders at age 5 years in samples of children with DD or TD? Second, what is the continuity of child behavior problems from age 3 to 5, and do early behavior problems predict subsequent ADHD diagnosis for these two groups? Third, do the family domains of parenting behaviors, parent-child relationships, and/or parenting stress assessed at child age 3 predict ADHD diagnosis two years later for children with DD or TD? As a secondary focus, we also began to address a related question: Does relative frequency of symptom endorsement provide support for the contention that ADHD is the same disorder in children with and without ID?

Method

Participants

Participants were 236 families enrolled in a longitudinal study of young children with samples drawn from Southern California (76%) and Central Pennsylvania (24%). This “Collaborative Family Study” has been based at three universities: Penn State University, UCLA, and University of California, Riverside. The present sample was comprised of all families for whom data were available on the primary measures at child age 5 years. Most families (n=216) had been recruited two years earlier, with the intake assessment conducted near the child’s 3rd birthday (M=35.2 months; SD=3.0). An additional 20 families of children with DD entered the study at child age 5 and they did not differ from the original DD sample on any study variable.

Families of children with DD were recruited primarily through agencies that provide and purchase diagnostic and intervention services for persons with developmental disabilities. In California, practically all families with young children with DD register for services with one of a network of Regional Centers. Children in the DD group at intake were all in the moderate to borderline range of cognitive delay on the Bayley Scales of Infant Development (Bayley, 1993), ambulatory, and not diagnosed with autism. Families of children with TD were recruited primarily through local preschools and daycare programs. Further selection criteria were that the child score in the range of normal cognitive development and not have been born prematurely or have any developmental disability. In recruiting participants, school and agency personnel mailed brochures describing the study to families who met selection criteria and interested parents contacted the research center.

Based on the Stanford-Binet-IV (Thorndike, Hagen, & Sattler, 1986) at age 5 years, children were classified as developmentally delayed (IQ 70 or lower, n= 63), borderline (IQ 71–84, n = 32), or typically developing (IQ 85+; n=141). The developmentally delayed and borderline

groups were combined in the present analyses and referred to as "developmentally delayed" (DD). Table 1 shows demographic characteristics at child age 5, by group status (DD, TD). In the combined sample there were more boys (58%) than girls. Sixty percent of the children were white non-Hispanic, 16.2% were Hispanic, 8.1% were African American, 2.6% were Asian American, and 13.2% were classified by parents as "other". Our recruitment had initially focused on intact families, so 81% of participants were married (defined here as legally married or living together at least six months). The socioeconomic status was generally high; 56% of families had an annual income above $50,000, and the average years of schooling was three years of college for mothers and fathers. The between-sample differences in child gender or race/ethnicity, or in parents' age, race/ethnicity, income, or marital status were not statistically significant. However, TD sample mothers and fathers completed significantly more years of school.

Procedures

Procedures were approved by the Institutional Review Boards of the universities involved. Parents initially completed a telephone intake interview. Subsequently, as close as possible to child age 36 months, two research assistants visited the family. After reviewing procedures and obtaining informed consent, they administered the Bayley Scales of Infant Development (Bayley, 1993) to the child. The primary data for this study were obtained in three ways. A parent questionnaire battery at child ages 3, 4, and 5 years included measures of parent well-being and child behavior problems. During home visits at child ages 3 and 3.5 years, live observations were made of parenting practices. During a center visit at child age 5 years, measures were taken of child intelligence (Stanford-Binet), child mental health (DISC interview with mother), family demographics (interview with mother), and child regulation and maternal scaffolding (observation of parent-child interactions).

Measures (Age 3)

Family Impact Questionnaire (FIQ; Donenberg & Baker, 1993)—The FIQ is a 50-item questionnaire that asks about the "child's impact on the family compared to the impact other children his/her age have on their families" (e.g. Item 1: "My child is more stressful"). Parents endorse items on a 4-point scale ranging from " (1) not at all" to "(4) very much." Although there are six scales, of interest here is a composite 20 item negative impact score, alpha = .92. This FIQ score is considered an indicator of parenting stress (Baker et al., 2003). It was designed to avoid the circular reasoning of stress measures that ask about child challenges and then infer parenting stress from these (e.g. Parenting Stress Index, Abidin, 1990). However, although conceptually different, the FIQ negative impact scores have been found to relate highly to the Parenting Stress Index Child Domain scores (r = .84) obtained from mothers of young typically developing children (Donenberg & Baker, 1993).

Symptom Checklist (SCL, Derogatis & Coons, 1993)—This 35-item questionnaire assesses dimensions of adult mental health (somatization, interpersonal sensitivity, anxiety, depression and hostility). The total score was used and it had an alpha of .95.

Maternal Scaffolding—Maternal scaffolding was measured according to an adaptation of the Maternal Scaffolding Coding System (Maslin-Cole & Spieker, 1990; see Hoffman, Crnic, & Baker, 2006, for further description of the modified coding system). This was coded from videotapes of mother-child interaction on tasks at the research center. Scaffolding refers to providing the optimal level of support and assistance necessary to allow a child to succeed beyond what the child would have been able to achieve alone. Coders blind to study hypotheses rated three dimensions of scaffolding (technical, motivational, and emotional) for each of four laboratory situations: free play, mother-child problem solving tasks, delay of gratification self-regulation task, and clean up (see Baker et

al., 2007 for description of tasks). *Technical scaffolding* reflects the mother's ability to structure the task in such a way that it is within the child's abilities to successfully complete it with her support. *Motivational scaffolding* assesses the mother's ability to help the child initially become engaged with the task and her ability to maintain the child's focus on, and enthusiasm for, the task. *Emotional scaffolding* captures the mother's ability to make the task a positive experience for the child that will add to the child's sense of accomplishment and effectiveness. Each form of scaffolding was rated on a 5-point scale ranging from 1 (*low quality scaffolding*) to 5 (*high quality scaffolding*). Scores were summed over the four tasks in order to increase measurement reliability and to provide a single score for each form of scaffolding. Total scores for the three types of scaffolding were converted to z-scores and summed to create the scaffolding composite. Scores on the three dimensions of scaffolding were significantly ($p < .001$) related: Technical/Motivational $r = .81$, Technical/Emotional $r = .54$, and Motivational/Emotional $r = .58$. The overall inter-rater reliability of the Maternal Scaffolding Coding System was high (Hoffman et al., 2006). This scoring has shown good criterion validity as high mother scaffolding scores have predicted DD children's higher subsequent social skills (J. Baker et al., 2007) and lower emotional dysregulation (Hoffman et al., 2006).

Dysregulation—Behavior dysregulation was characterized by behavior that is not appropriate to the situation and/or is disruptive to completion of the task. It was coded using the Dysregulation Coding System (Baker et al., 2007; Hoffman et al., 2006) across five laboratory tasks (easy problem solving, moderate problem solving, difficult problem solving, delay of gratification, and clean-up). It was coded on 5 point Likert scales ranging from 0 (*no evidence of dysregulation*) to 4 (*very high degree of dysregulation*), and ratings were summed across the five tasks. The correlations among scores on the five tasks ranged from $r=.19$ to $r = .33$, all $p<.01$.

Naturalistic observation of parent-child interaction—Naturalistic observations of families at home provided measures of maternal parenting and child liveliness/activity. For each observation period, the researcher observed for 10 minutes and then recorded those observations for 5 minutes. This study used six dimensions of parenting: mother positivity, negativity, sensitivity, intrusiveness, detachment, and stimulation of cognition. Each was rated on a five-point Likert scale (1 = not at all characteristic, 5 = highly or predominantly characteristic) that incorporated both the frequency and intensity of the expressed affect or behavior. Consistent with previous research, two composite scores were created: *positive parenting* (positivity + sensitivity + stimulation of cognition − detachment; intercorrelations ranged from absolute $r=.53$ to .82) and *negative/controlling parenting* (negative affect + intrusiveness; $r = .52$, $p<.001$) (Aber, Belsky, Slade, & Crnic, 1999; Fenning, et al., 2007). Child behaviors during these same interactions were also scored. The l*iveliness/activity* code, used in this study, represented the extent to which the child was physically active during the observation (e.g., the speed, frequency, and intensity of motor activity). Finally, two codes were used to capture mother-child dyadic interactions during the naturalistic home observations. *Dyadic pleasure* measured the degree to which the mother and child appeared to be enjoying one another as reflected in the energy level, facial expressions, cheerfulness, positive tone and content of the conversation between them. *Dyadic conflict* was measured as the amount of conflict, tension, and vented hostility between them.

In order to increase the reliability of measurement, ratings were averaged across the six consecutive observation periods (total 90 minutes) each at 36 and 42 months. These two scores were then averaged to create an overall composite. Correlations between the 36 and 42 month scores were: Positive parenting, $r = .55$; Negative-controlling parenting, $r = .41$; Child liveliness-activity, r = 99; Dyadic pleasure, $r = .56$; Dyadic conflict, $r = .30$, all $p<.001$.

Prior to collecting observational data in the home, coders were trained on videotapes of home observations and attended live home observations with an experienced coder until reliability was established. Reliability criteria were over 70% exact agreement with the primary coder and 95% agreement within one scale point. After obtaining reliability, individual observers conducted home observations. To maintain reliability within and across project sites, a primary coder was designated at each site and reliability was collected regularly through videotaped and live home observations. The kappa coefficients for within-site reliability were .61 and .59, at the California and Pennsylvania sites respectively, and kappa for across-site reliability was .64. Kappa coefficients represent a conservative reliability index and these levels are considered acceptable (Fleiss, Cohen, & Everitt, 1969). Previous research suggests that the dimensions assessed by this rating system are relatively stable over time (Park, Belsky, Putnam, & Crnic, 1997), represent reliable and valid measures of naturalistic parent–child interaction (e.g., Aber et al., 1999; Belsky, Hsieh, & Crnic, 1998; Crnic, Gaze, & Hoffman, 2005; Park et al., 1997), and have predictive associations with young children's later inhibition (Park et al., 1997) and externalizing behavior problems (Belsky, Hsieh, & Crnic, 1998).

Measures (Age 3 and 5)

Child Behavior Checklist for Ages 1 ½ – 5 (CBCL; Achenbach & Rescorla, 2001)—The preschool version of the CBCL has 99 items that indicate child problems. The respondent indicates, for each item, whether it is "not true" (0), "somewhat or sometimes true" (1), or "very true or often true" (2), now or within the past two months. The CBCL yields a total problem score, broad-band externalizing and internalizing scores, and 7 narrow-band scales, of which attention and aggression were used in the present analyses. The CBCL yields T scores for the total and broad band scores, with the mean set at 50 and a standard deviation of 10. Total score alpha for the present sample was .94 for mothers.

Measures (Age 5)

Stanford-Binet IV (SB-IV)—Children's cognitive ability was evaluated with the Stanford-Binet IV (Thorndike, Hagen, & Sattler, 1986), a widely used assessment instrument. The SB-IV yields an IQ score with a normative mean = 100 and SD = 15. It is particularly well suited to the evaluation of children with delays because the examiner adapts starting points according to the child's developmental level.

Diagnostic Interview Schedule for Children (DISC; Costello, Edelbrock, & Costello, 1985)—The DISC, administered to mothers at child age 5, is a highly structured diagnostic interview covering current DSM criteria for child psychiatric disorders. Respondents are asked about the presence of symptoms that fall under the major diagnostic categories. The DISC has undergone extensive testing, refinement and revision (Piacentini, Shaffer, Fisher, & Schwab-Stone, 1993; Shaffer, Schwab-Stone, Fisher, & Cohen, 1993) and has achieved marginally acceptable levels of reliability (Edelbrock & Costello, 1988). In the present study we used an alternative way of administering the DISC (Edelbrock, Crnic & Bohnert, 1999). We selected six modules appropriate for young children: Social Phobia, Separation Anxiety, Major Depressive Disorder, Dysthymic Disorder, ADHD and ODD. In the alternative administration, the interviewer began by reading a brief summary of the diagnostic criteria for each diagnosis. After the overview, the interviewer asked the parent to select the first diagnostic area to be covered. Standard administration of modules was followed. After the first module, the parent was asked to select the next diagnostic area. This was continued until there was no other area the parent wanted to talk about and further review of the diagnostic criteria with the parent confirmed that the child did not have any problems represented in the remaining modules. This administration procedure has been found to increase reliability, decrease attenuation (reporting fewer symptoms for disorders

assessed later in the interview and on retest), take less time, facilitate more meaningful communication between parent and interviewer, and be more interesting for parents than the standard procedure of administering all areas in a fixed order (Edelbrock, Crnic & Bohnert, 1999; Jensen, Watanabe, & Richters, 1999). In some cases the child's cognitive delays were obvious or they were alluded to by the mother, so DISC interviewers could not be kept blind to the status group.

Data Analytic Plan

Analyses were conducted within and between the DD and TD samples. To address the first research question, concerning the rate of mental disorders in each sample, frequencies were examined and Chi-square statistics were used to test for differences across the two groups. Chi-square statistics were also used to compare rate of mental disorders by child gender within the groups. To address the second research question concerning continuity of disruptive behavior from age 3 to 5, Pearson's correlations were conducted on selected CBCL scale scores. Further analyses focused on ADHD. Because the prevalence of ODD was so high in both sub-samples, we chose to use a "no disruptive behavior disorder" (No DBD) comparison group. To test for the significance of continuity between age 3 CBCL scores and age 5 ADHD diagnosis (ADHD vs. No DBD) within DD/TD groups, independent sample t-tests were applied to test for continuity from age 3 CBCL scale scores and Chi-square analyses were to test for continuity from age 3 CBCL clinical/non-clinical classifications. To address the third research question, concerning the predictive relationship of parent/family domains assessed at child age 3 to ADHD diagnosis at age 5, we first used independent-sample t-tests and chi-square tests to establish significant univariate relationships. We then conducted logistic regression analyses within each sample to determine which parent/family variables were unique predictors of ADHD at age 5. Parent/family variables that had a significant ($p<.05$) univariate relationship with ADHD at age 5 were entered into the models.

With regard to the secondary question addressing whether ADHD appears to be the same disorder in children with and without DD, our analyses included children who met ADHD diagnostic criteria and focused on symptom endorsement. Independent-sample t-tests were used to test for differences in the total number of ADHD symptoms endorsed, and whether individual DSM-IV items were endorsed differentially across the DD/TD groups. A Spearman's rank correlation was conducted to examine the relative frequency of ADHD symptom endorsement across the two samples.

Results

Descriptive Analyses

Rates of mental disorder in children with DD—Table 2 shows that 57.9% of children in the DD sample met DISC criteria for at least one of the Axis I disorders that were assessed. The most prevalent disorders in the DD sample were the disruptive behavior disorders: Oppositional Defiant Disorder (ODD: 43.2%) and Attention Deficit Hyperactivity Disorder (ADHD: 38.9%). Separation anxiety disorder was the next most prevalent (13.7%). The remaining disorders assessed had low rates: Social Phobia (5.3%), Major Depressive Disorder (3.2%) and Dysthymic Disorder (2.1%).

Rates of mental disorder by DD vs. TD samples—The prevalence of meeting criteria for any disorder was significantly higher among children with DD than those with TD. These differences are shown in Table 2 as odds and risk ratios. The highest risk ratio was for ADHD, which was 3.21 times as prevalent in the DD sample as in the TD sample.

The attention sub-type differentiated the samples most highly, with 4.43 times as many children in the DD sample meeting diagnostic criteria.

The other disruptive behavior disorder assessed, ODD, was significantly higher in the DD sample; the risk ratio was 1.79. For separation anxiety disorder, the risk ratio was 2.74. The prevalence of the remaining disorders was too low for meaningful statistical comparison.

Rates of mental disorder by child sex—We found no differences in DISC diagnosis by child sex. ADHD criteria were met in the DD sample by 40.4% of boys and 36.8% of girls, X^2 (1, N = 95) = 0.12, ns, OR=1.16 (95% CI .50–2.70), and in the TD sample by 13.8% of boys and 9.8% of girls, X^2 (1, N = 141) = 0.50, ns, OR=1.46 (CI .51–4.20). ODD criteria were met in the DD sample by 43.9% of boys and 42.1% of girls, X^2 (1, N = 95) =0.3, ns, OR=1.07 (95% CI .47–2.46), and in the TD sample by 23.8% of boys and 24.6% of girls, X^2 (1, N = 141) = 0.01, ns, OR=.96 (95% CI .44–2.08). Separation Anxiety Disorder criteria were met less often and similarly for boys and girls in both samples.

Co-morbidity of mental disorder—The co-morbidity of mental disorders in this sample was high. Of the children who met criteria for one disorder, 39.6 percent met criteria for more than one disorder. There were more children with comorbid mental disorders in the DD sample (54.5%) than in the TD sample (23.5%), X^2 (1, N = 105) = 10.64, p<.01, OR=3.90 (95% CI 1.69–9.01). The two disorders that were most highly co-morbid were ADHD and ODD. Among children in the DD sample who met criteria for either of these disorders, 52.9% met criteria for both disorders; in the TD sample only 21.4% met criteria for both disorders, X^2 (1, N= 93) = 9.64, p <.01, OR=4.13 (95% CI 1.65–10.35).

Continuity Analyses

CBCL externalizing scores were moderately stable across early childhood. Mother's reports of their child's externalizing behavior problems at age 3 years were significantly correlated with their reports at age 5 (DD Pearson's r=.69; TD r=.65, both p<.001). For 83.6% of the DD sample and 86.2% of the TD sample, the clinical vs. non-clinical classification of externalizing behavior problems (non-clinical <60/borderline or clinical >=60) was consistent from age 3 to 5, X^2 (1, N = 73) = 29.44, p <.001, OR=22.17 (95% CI 6.32–77.73) and X^2 (1, N = 138) = 26.11, p <.001, OR=12.39 (95% CI 4.05–37.87) respectively.

Table 3 shows the continuity of disruptive behavior across early childhood – whether CBCL scores at age 3 were related to subsequent ADHD diagnosis at age 5. Children were grouped at age 5 by No DBD vs. ADHD, and their CBCL scores at age 3 were compared with t tests. We examined five sub-scales of the age 3 CBCL: total score, externalizing broad-band, aggression and attention narrow bands, and the DSM-oriented ADHD scale. Within the DD and TD groups, each CBCL scale at age 3 significantly differentiated the ADHD and non-DBD groups at age 5. Additionally, all comparisons had medium to large effect sizes according to the conventions for Cohen's *d* (Cohen, 1988).

We examined continuity further by whether externalizing behavior problems at age 3 in the clinical range were predictive of age 5 ADHD diagnosis. Chi Square analyses were run between age 3 CBCL Externalizing T score non-clinical/clinical classifications and age 5 ADHD diagnosis (ADHD/No DBD) within each sample. The CBCL categorization agreed with the DISC classification in 71.2% of the DD cases, X^2 (1, N = 66) = 10.35, p <.01, OR=5.64 (95% CI 1.89–16.81) and 86.2% of the TD cases, X^2 (1, N = 116) = 17.98, p <.001, OR=10.85 (95% CI 3.05–38.66). However, in the DD group, 26.2% of children were reported to have non-clinical levels of externalizing behavior problems at age 3 but did meet criteria for ADHD at age 5 and 33.3% of children were classified as having clinical levels of behavior problems at age 3 but did not meet criteria for ADHD at age 5. In the TD group,

9.7% of children who were reported to have non-clinical levels of behavior problems at age 3 met criteria for ADHD at age 5 and 46.2% of children who were reported to have clinical levels of behavior problems at age 3 did not meet criteria for ADHD at age 5.

Continuity of child behavior from age 3 to 5 was also examined using two observational measures: child behavior dysregulation, coded during a task in the lab, and liveliness/activity, coded during naturalistic interaction in the family home. In both samples, five year old children with ADHD had exhibited significantly more behavior dysregulation at age 3 compared to children with no DBD (DD $t(95)=2.39$, $p<.05$, $d=.62$; TD $t(141)=2.17$, $p<.05$, $d=.58$). Also, children in the DD sample who met criteria for ADHD at age 5 were rated more highly in liveliness/activity during the home observation at age 3 ($t(95) = 2.88$, $p<.01$, $d=.43$); in the TD sample the group difference in liveliness/activity was not significant.

Predictive Analyses

Table 4 shows univariate analyses for the relationships between parent/family characteristics at age 3 and subsequent ADHD diagnosis vs. no DBD at age 5. In the DD sample mothers of children later diagnosed with ADHD were found at age 3 to exhibit less maternal scaffolding, and more negative parenting, mother-child dyadic conflict, mental health problems, and parenting stress. In the TD sample, mothers of children who would subsequently meet ADHD criteria had fewer years of education, less positive parenting, less mother-child dyadic pleasure, and more negative parenting, mental health problems, and parenting stress.

We conducted logistic regression in each sample to determine which variables were unique predictors of ADHD. Given the persistence of behavior problems over time, we examined whether parent/family predictors predicted ADHD after controlling for earlier behavior problems. Table 5 shows the logistic regression model. The independent variables were age 3 child externalizing behavior problems and the parent/family variables with significant relationships in Table 4. In the DD sample maternal scaffolding and parenting stress emerged as unique predictors of ADHD at age 5. For maternal scaffolding, the odds ratio (Exp(B)) was .65, meaning that the odds of being classified as ADHD versus no DBD were multiplied by .65 for every one unit increase in the maternal scaffolding score; thus, the odds of being classified as ADHD decreased as maternal scaffolding increased. The odds ratio was 1.13 for maternal parenting stress, meaning that the odds of being classified as ADHD became greater (multiplied by 1.13) for every one unit increase in parenting stress scores. In the TD sample maternal parenting stress was the only unique predictor of ADHD and the odds ratio was 1.18.

Symptom Endorsement

Toward understanding whether ADHD is the same disorder in children with DD and TD, we examined how similar the symptom presentation was for the two groups. The two samples did not differ significantly in the total number of ADHD symptoms endorsed (DD, M = 12.57 (2.6); TD, M = 11.65 (2.0)) or in the number of inattentive (DD; M =6.27 (2.0) and TD, M =5.17 (2.2)) or hyperactive symptoms (DD, M=6.30 (1.4) and TD, M=6.47 (1.1)). We further examined the percent of children in each sample who met criteria for the three subtypes of ADHD. In the DD sample, diagnosis based on meeting subtype criteria was as follows: Inattentive (18.9%), Hyperactive/Impulsive (27%) and Combined (54.1%) subtypes. In the TD sample, these percentages were 17.6, 47.1, and 35.3 respectively. The samples did not differ significantly by subtype, X^2 (2, N = 53) = 2.26, $p=.32$.

We then examined if the specific ADHD symptoms were being endorsed at the same relative frequency in each sample. We ranked the symptoms in each sample by the percent

of respondents who endorsed them. A Spearman's rank correlation coefficient on the endorsement frequency between items for the two samples was moderately high (ρ = .64, p<.001) indicating that symptoms were endorsed at similar relative frequencies within the two samples. There were two symptoms that were endorsed differentially. Mothers of TD children who met criteria for ADHD reported more frequently that their "child talks more than other children his/her age" (70.6%) compared to mothers of DD children (18.9%), X^2 (1, N = 53) = 13.64, p<.001, OR =.10 (95% CI .03–.37). This difference is not surprising given that many of the children with DD had language delays. Also, mothers of DD sample children who met criteria for ADHD reported that their child "often has trouble keeping his/her mind on what he/she is doing for more than a short period of time" (86.5%) compared to mothers of TD children (58.8%), X^2 (1, N = 53) = 5.16, p<.05, OR=4.48 (95% CI 1.16–17.27).

Discussion

We examined the rate, continuity, and predictors of mental disorders among young children with and without developmental delays. Our first question asked about rates of mental disorders. Findings suggest that such rates, especially of disruptive behavior disorders, are high by age 5 among children with DD. Over half of the children with DD met criteria for at least one of six disorders included at age 5, with the disruptive behavior disorders (ADHD and ODD) being the most prevalent. Consistent with studies of behavior disorders in adolescents and adults with intellectual disability that included a typically developing comparison group, the risk ratio of young children in our sample meeting diagnostic criteria for ADHD in DD and TD was 3 to 1.

The rates of psychopathology within each of our samples seem high relative to DSM-IV-TR reports (APA, 2000). These were 57.9% in the DD group and 36.2% in the TD group. The rate in the TD group was largely accounted for by the 24.1% who met criteria for ODD, a rate higher than the DSM-IV-TR (APA. 2000) prevalence range of 2–16%.

In the DD group, 38.9% met criteria for ADHD. We note, however, that Hardan and Sahl (1997) reported a similar rate of 41% in their study of children and adolescents with intellectual disabilities. In the TD sample, 12.1% met criteria for ADHD, a rate that is higher than those commonly reported (3–7%, APA 2000; 4–12%, Brown et al., 2001). However, a recent study with a large community sample of 4-year-old TD children reported an ADHD rate of 12.8%, very similar to ours (Lavigne et al., 2009). This same study reported a rate of 13.4% for ODD in 4 year olds, still well below the rate we found at age 5 years. One explanation for higher rates of disruptive behavior diagnoses in involves the criteria used. We considered only symptoms and not impairment, and we had only one reporter and not two (home and school). Either of these stricter criteria results in lower rates of diagnosis (Dekker & Koot, 2003; Lavigne, LeBailly, Hopkins, Gouze, & Binns, 2009). Too, it is possible that our assessment of children at age 5 years was a factor, as DSM-IV ADHD symptoms seem more normative for young children and there is evidence for a downward trajectory in ADHD symptoms across middle childhood (Biederman, Mick, & Faraone, 2000; Langberg et al., 2008). The comparative rates cited above were based on children ranging in age from about 6 to 12 (APA, 2000; Brown et al., 2001). Future studies should examine the trajectory of disruptive behavior disorders across early childhood in DD and TD samples to determine whether there is a downward trend (c.f. deRuiter et al., 2007).

We further conducted descriptive analyses examining DD/TD differences in diagnosable mental disorders by child gender and co-morbidity. There were no differences in disorder rates between boys and girls in either sample. The gender finding is notably different from studies with TD samples, where rates of disruptive behavior disorders are usually higher

among boys than girls. ADHD, for example, is reported in the DSM-IV to have a 4:1 boy to girl ratio (APA, 2000). However, our gender finding is consistent with several studies of behavior problems/mental disorder in children with DD (deRuiter, Dekker, Douma, Verhurlst, & Koot, 2008; Gadow, deVincent, Pomeroy, & Azizian, 2004; Hartley, Sikora, & McCoy, 2008; Hastings, Beck, Daley, & Hill, 2005). As expected, the rates of co-morbidity were high and significantly more so for children with DD. The two most common co-occurring disorders were ADHD and ODD, which is consistent with past research on TD children (Jensen et al., 2001).

Our second question asked about the continuity of behavior problems across early childhood and their predictive relationships to ADHD diagnosis at age 5. Behavior problems were moderately stable from ages 3 to 5 years, and early externalizing behavior problems significantly predicted subsequent ADHD diagnoses for children with and without developmental delays. The continuity of these behaviors was further supported by observational measures of child behavior at age 3 that significantly differentiated children in both samples who would later meet criteria for ADHD vs. no DBD. Our results suggest that disruptive behavior disorders also emerge early in life for children with developmental disabilities. Given the high stability of behavior problems in early childhood within both samples, these results underscore the importance of early interventions to help parents to reduce behavior problems among children with and without delays (Feinfield & Baker, 2004; Hudson, Cameron, & Matthews, 2008; Webster-Stratton, Reid, & Hammond, 2004).

Our third question asked whether earlier parent and family characteristics were predictive of subsequent mental disorder diagnosis, even after controlling for early child externalizing behavior problems. Focusing on ADHD, we found that that early maternal scaffolding was predictive in the DD sample. Mothers who exhibited less scaffolding behavior at age 3 were more likely to have children who met criteria for ADHD at age 5. A previous finding from this longitudinal study, also holding only in the DD sample, was that maternal scaffolding at child age 4 predicted social skills two years later more strongly than other child factors including developmental level and behavior problems (Baker et al., 2007). Mothers' parenting stress was also a unique predictor of later ADHD diagnosis, with mothers' higher parenting stress significantly predicting ADHD at age 5 in both DD and TD samples.

In preliminary analyses, we also asked whether the ADHD diagnosis appeared to be reached in the same way in children with or without developmental delays. The total number of ADHD symptoms endorsed did not differ between children meeting ADHD criteria in the DD and TD samples nor did the percent of children meeting criteria for ADHD by the IA, HI, or Combined sub-type. Too, the individual symptoms were endorsed at similar frequencies across the two samples. Very few studies have investigated variability in the core symptoms of ADHD and, to our knowledge, none has examined the patterns of DSM-IV ADHD symptoms in children with and without DD. The present findings contribute to the literature investigating the validity of ADHD among children with developmental and intellectual disabilities. Some researchers have questioned the diagnostic validity because some ADHD symptoms (e.g. inattentiveness, overactive/impulsive behavior) are characteristic of some individuals with low cognitive functioning (Gjaerum & Bjornerem, 2003; Reiss & Valenti-Hein, 1994). However, our finding that the ADHD symptom picture is similar for children with and without developmental delays is consistent with the position that ADHD is the same disorder regardless of disability status.

These findings, however, must be considered within the context of several study limitations. Regarding our question about diagnostic rates, the DISC was obtained only from mothers, while full DSM-IV-TR criteria for ADHD (APA, 2001) include, for young children, impairment from symptoms in school as well as home. While the parent-completed DISC

asks questions about symptoms in school, neither the DISC nor another symptom measure was administered to teachers at child age 5. Regarding the question of whether ADHD is the same disorder in children with DD as TD, our analysis of symptom picture is only a beginning. Further research examining the etiological correlates (e.g. carrier genes, neuropsychological test performance) and associated outcomes (e.g. degree of impairment, social competence) of ADHD among children with vs. without DD is needed to understand better the validity of this diagnosis for children with DD.

Implications for Research, Policy, and Practice

There are several implications for further research on mental disorders in children with DD. One is the clear advantage of obtaining longitudinal data in order to examine the continuity and trajectory of ADHD symptoms among children with delays across childhood and adolescence. Another is to conduct similar descriptive examinations of other disorders that emerge early in development (e.g. oppositional defiant disorder, separation anxiety disorder). Additional contributions could be made by studies investigating the validity of mental disorder diagnoses in children with delays, and/or further examining parent and family domains that are associated with the onset and course of ADHD and other disorders in children with DD.

Our findings point to early parenting stress as a domain that may be associated with the child's later meeting diagnostic criteria for ADHD, a relationship previously found in TD children (Heller et al., 1996). However, it is possible, and probably likely, that the opposite direction of effect would also be supported -- early ADHD symptoms associated with later parenting stress. Research examining parenting stress and behavior problems among children with and without delays has supported both directions of effect (Baker et al, 2003). The early intervention implications of these findings are underscored by Singh and colleagues' (2007) study, wherein reductions in parenting stress following a mindfulness-based intervention were associated with decreases in aggression and increases in social skills among children with developmental disabilities. Reciprocally, there is evidence that reducing child behavior problems results in reduced parenting stress (Feinfield & Baker, 2004). Taken together, these studies speak to the importance of parenting stress as an influence on children's behavior and reduction in parenting stress as a target in early intervention programs.

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Table 1

Demographics Characteristics for Children at Age 5 (n = 236)

	Delayed	**Typically Developing**	**χ^2 or *t***	
	n = 95	**n = 141**		**Effect Size (Cohen's *d* or odds ratio)**
Children				
Gender (% boys)	60.0	56.7	$\chi^2 = 0.13$	OR=1.14
Race (% Caucasian)	58.5	61.0	$\chi^2 = 0.06$	OR=0.90
Stanford Binet IQ	60.2 (15.4)	103.5 (11.4)	$t=23.36^{***}$	*d*=5.18
Parent and family				
Marital Status (% married)	76.6	83.7	$\chi^2=1.40$	OR=.64
Mother's Race (% Caucasian)	57.4	67.4	$\chi^2=2.40$	OR=.65
Mother's Education (Mean grade in school)	14.4 (2.1)	15.5 (2.4)	$t = 4.02^{***}$	*d*=0.53
Mothers' Mean Age in Years (SD)	34.9 (6.2)	36.1 (5.8)	t = 1.52	*d*=0.20
Family Annual Income (% > $50K)	47.9	61.4	$\chi^2 = 3.66$	OR=.58
	n=81	n=134		
Father's Education (Mean grade in school)	14.4 (2.6)	15.8 (3.0)	$t = 3.28^{**}$	*d*=0.48
Fathers' Mean Age in Years (SD)	38.6 (7.1)	38.5 (6.2)	t = 0.15	*d*=0.02

** $p < .01$;

*** $p < .001$

Table 2

Diagnostic Status of Sample at Age 5 (n=236)

Variable	DD n=95	TD n=141	X^2	Relative Risk (DD: TD)	Odds Ratio	CI for Odds Ratio
Any Mental Disorder	57.9	36.2	$X^2=9.97^{**}$	1.60:1	2.43	1.42–4.13
ADHD (Any Subtype)	38.9	12.1	$X^2=21.76^{***}$	3.21:1	4.65	2.42–8.94
ADHD-Inattention Subtype	28.4	6.4	$X^2=19.65^{***}$	4.43: 1	5.82	2.59–13.08
ADHD-Hyperactivity/Impulsive Subtype	31.6	9.9	$X^2=16.14^{***}$	3.19:1	4.19	2.08–8.44
Oppositional Defiant Disorder	43.2	24.1	$X^2=8.64^{**}$	1.79:1	2.39	1.37–4.18
Separation Anxiety Disorder	13.7	5.0	$X^2=4.60^{*}$	2.74:1	3.04	1.16–7.92
Social Phobia	5.3	3.5	-	-		
Major Depressive Disorder	3.2	0.7	-	-		
Dysthymia Disorder	2.1	0.7	-	-		

$^{*}p < .05$;

$^{**}p < .01$;

$^{***}p < .001$.

ADHD = Attention Deficit Hyperactivity Disorder

Table 3

Continuity of Child Behavior from Age 3 to 5: Age 3 CBCL scores, categorized by subsequent Age 5 DISC classifications.

	Developmentally Delayed				Typically Developing			
CBCL Scales (Age 3)	**No DBD (Age 5) (n=44)**	**ADHD (Age 5) (n=37)**	**t-value**	**Cohen's *d***	**No DBD (Age 5) (n=99)**	**ADHD (Age 5) (n=17)**	**t-value**	**Cohen's *d***
Total Beh. Prob.	53.69 (9.00)	63.15 (10.35)	3.95***	0.98	47.60 (8.94)	57.82 (8.46)	4.39***	1.17
Externalizing Beh. Prob.	52.36 (8.39)	62.26 (10.64)	4.22***	1.03	46.92 (9.17)	58.53 (8.36)	4.88***	1.32
Aggression	54.51 (5.28)	61.85 (10.32)	4.11***	0.90	52.73 (5.67)	59.06 (8.09)	4.62***	0.91
Attention Problems	56.95 (6.88)	63.15 (10.27)	2.76**	0.71	52.29 (4.58)	57.76 (7.36)	4.55***	0.89
ADHD Scale	55.44 (5.81)	60.15 (8.76)	2.75**	0.63	52.33 (4.44)	57.53 (7.07)	4.58***	0.88

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 4

Associations between Parent/family Characteristics and ADHD.

Variable	Developmentally Delayed				Typically Developing			
	No DBD (n=44)	ADHD (n=37)	t/X^2	Effect Size (*d* or OR)	No DBD (n=99)	ADHD	t/X^2	Effect Size (*d* or OR)
Maternal Education	14.10 (2.14)	14.63 (2.57)	t=.91	*d*=0.22	15.95 (2.41)	14.29 (2.09)	t=2.67**	*d*=0.74
Fam. Income (% > 50 K)	38.5	44.4	X^2=2.91	OR= 1.27	60.60	47.01	X^2=.09	OR= 0.36
Scaffolding[1]	−0.09 (2.34)	−1.94 (2.57)	t=2.94**	*d*=0.75	0.70 (2.42)	−0.34 (2.11)	t=1.67	*d*=0.46
HO Positive Parenting[2]	−0.06 (1.24)	−0.47 (1.75)	t=1.13	*d*=0.28	0.27 (1.68)	−1.00 (1.64)	t=2.82**	*d*=0.77
HO Negative Parenting[3]	−0.42 (1.30)	0.64 (2.05)	t=2.35*	*d*=0.61	−0.22 (1.45)	0.65 (1.38)	t=2.24*	*d*=0.62
HO M-C Pleasure[4]	1.54 (.48)	1.40 (.45)	t=1.23	*d*=0.31	1.79 (.64)	1.44 (.25)	t=3.99***	*d*=0.73
HO M-C Conflict[5]	1.07 (.12)	1.25 (.42)	t=2.19*	*d*=0.59	1.18 (.24)	1.28 (.27)	t=1.54	*d*=0.39
SCL Total Score[6]	18.72 (13.13)	27.00 (19.83)	t=2.04*	*d*=0.49	17.47 (18.06)	35.59 25.15)	t=2.85*	*d*=0.83
FIQ Negative	13.05 (8.27)	25.89 (13.24)	t=4.47***	*d*=1.16	8.65 (5.57)	19.59 12.70)	t=3.49**	*d*=1.12

* $p < .05$;

** $p < .01$;

*** $p < .001$

[1] Maternal scaffolding composite comprised by summing z-scores of the total scores for three types of scaffolding (technical, motivational, and emotional)

[2] Home observation positive parenting composite comprised by summing z-scores for maternal positivity, sensitivity, and stimulation of cognition and subtracting the z-score for maternal detachment at 36 and 42 months

[3] Home observation negative parenting composite comprised by summing z-scores for maternal negativity and intrusiveness at 36 and 42 months

[4] Home observations mother-child dyadic pleasure subscale, composite of 36 and 42 months

[5] Home observations mother-child dyadic conflict subscale, composite of 36 and 42 months

[6] Symptom Checklist;

Family Impact Questionnaire, Negative Impact scale

Table 5

Logistic Regression Testing Predictors of ADHD at Age 5.

Variable	Developmentally Delayed (n=81)					Typically Developing (n=116)				
	B	**SE**	**Wald**	**Exp (B)**	**95% CI for Exp (B)**	**B**	**SE**	**Wald**	**Exp (B)**	**95% CI for Exp (B)**
Child Externalizing Behavior Problems	.05	.06	.77	1.05	.94–1.18	.02	.06	.12	1.02	.91–1.14
Maternal Education	-	-	-	-		−.17	.16	1.16	.84	.61–1.15
Scaffolding	−.43	.18	5.95	.65*	.46–.92	-	-	-	-	
Home Obs. Positive Parenting Composite	-	-	-	-		−.28	.28	.94	.76	.44–1.33
Home Obs. Negative Parenting Composite	−.19	.31	.39	.83	.45–1.50	.34	.22	2.48	1.41	.92–2.16
Symptom Checklist Total Score	−.03	.03	1.00	.97	.92–1.03	.02	.02	1.92	1.02	.99–1.06
Family Impact Ques. Negative Impact	.12	.05	6.14	1.13*	1.03–1.23	.16	.07	5.63	1.18*	1.03–1.34
Mother-Child Dyadic Pleasure	-	-	-	-		−.22	.84	.07	.81	.16–4.18
Mother-Child Dyadic Conflict	2.56	3.18	.64	12.87	.03–6615.52	-	-	-	-	

*$p < .05$