



A Brief Measure of Language Skills at 3 Years of Age and Special Education Use in Middle Childhood

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Objective To test whether a language screener administered during early childhood predicts special education referrals and placement in middle childhood.

Study design A series of logistic regressions was conducted in a longitudinal study of 731 children. Predictor variables included scores on the early language screener (Fluharty Preschool Speech and Language Screening Test-Second Edition [Fluharty-2]) at ages 3 and 4 years, a standardized measure of academic achievement at age 5 years, and parent report of special education services at ages 7.5, 8.5, and 9.5 years.

Results Results showed that higher scores on the Fluharty-2 predicted a reduced likelihood of having an individualized education program (OR 0.48), being referred for special education (OR 0.55), and being held back a grade (OR 0.37). These findings did not vary by sex, race, or ethnicity, and remained significant after controlling for male sex, behavior problems, parental education, and family income. The Fluharty-2 remained predictive of special education outcomes even after controlling for children's academic skills at age 5 years.

Conclusions Results suggest that structured, brief assessments of language in early childhood are robust predictors of children's future engagement in special education services and low academic achievement. Primary care physicians may use a multipronged developmental surveillance and monitoring protocol designed to identify children who may need comprehensive evaluation and intervention. Early intervention may reduce the need for costly special education services in the future and reduce comorbid conditions. (*J Pediatr* 2017;181:189-94).

The American Academy of Pediatrics recommends regular developmental screening surveillance to detect early developmental delay in children.¹ Such early screening has been shown to increase the rates of referral to early intervention programs to a greater extent than do medical provider impressions alone.² Access to early intervention and high-quality early childhood education programs may improve health outcomes and school readiness among children with developmental delay and high-risk backgrounds (eg, low maternal education, poverty).³ Pediatricians can improve detection rate of early developmental delay by using screening instruments.^{1,2,4}

Screening for early communication delay may be an efficient means of identifying children who may be at risk for poor developmental and educational outcomes, such as those found with a potential for later learning disabilities.^{4,5} Speech and language development in early childhood is a useful indicator of overall development and cognitive ability and is related to education outcomes.⁵ Those with later diagnosed pediatric disorders, such as specific learning disability and autism spectrum disorder, often have early histories of communication problems.⁴ Early communication delays are also associated with certain sociodemographic factors, such as low maternal education⁶ or family poverty.⁷ Certain demographic characteristics have been associated with risk for developmental delay or special education.^{6,7} Thus, the extent to which child and family demographic characteristics are associated with early communication delay and poor developmental or learning outcomes may be important for practitioners to consider.

The association between communication delays in early childhood and special education eligibility in middle childhood is less established. Our study examined the relationship of an early language screener administered during preschool to later special education use during elementary school in a large, diverse sample. Special education use may represent a broad range of academic, cognitive, health, and developmental factors in children. Although 13 disability categories are captured under special education federal law (Individuals with Disabilities Education Improvement Act, 2004), these categories represent comorbid conditions and heterogeneous learning problems. Thus, early identification of children at risk for a range of poor developmental, health, and education outcomes may be valuable for providing early intervention services to reduce costly service use later in life. The present study tests the following hypotheses: (1) a brief early

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Fluharty-2	Fluharty Preschool Speech and Language Screening Test-Second Edition
IEP	Individualized education program
Woodcock-Johnson III	Woodcock Johnson III Tests of Achievement

language measure at age 3 years will be predictive of special education use in middle childhood; (2) this relationship will be robust across sex, race, and ethnicity; (3) this relationship will remain significant even in the presence of other known risk factors for special education; and (4) this relationship will prove robust to sensitivity analyses. Hypothesis 1 tests a main effect of early communication predicting special education outcomes and hypotheses 2, 3, and 4 investigate moderation, confounding, and robustness of this effect. Thus, hypotheses 2, 3, and 4 are subordinate to our primary hypothesis.

Methods

The sample consisted of 731 families recruited from the Women, Infants, and Children Nutritional Supplement Program in Eugene, Oregon; Charlottesville, Virginia; and Pittsburgh, Pennsylvania as part of the Early Steps Multisite Study.⁸ Families were invited to participate if they had a 2-year-old child and demonstrated 2 or more of the following risk factors for future problem behavior: child behavior problems, family functioning problems (eg, maternal depression, parental substance use), and sociodemographic risk (income, maternal education). Primary caregivers were almost universally biological mothers, 65% had a high school education or less, and 40% did not have a live-in partner. Approximately 50% of families had a gross monthly income of less than \$1250, and 71% were home renters. The mean number of people living in the home was 4.5 (SD = 1.6), and the mean number of children living in the home was 2.4 (SD = 1.2). The population of children was 50% male, 24% African American, and 14% Hispanic. A detailed description of recruitment and of the sample was published elsewhere.⁸

Data were drawn from a randomized, controlled trial of the family check-up intervention strategy in early childhood to prevent growth in conduct problems in middle childhood. All families were contacted annually (ages 2, 3, 4, 5, 7.5, 8.5, and 9.5 years) to complete extensive study assessments, and those that were in the intervention group were also offered the family check-up. This article presents only the developmental, longitudinal aspects of the study design. Nonetheless, intervention/control group membership was controlled for in all analyses. This research received approval from each site's Institutional Review Board.

Measures

Early language skills were assessed at ages 3 and 4 years by using the Fluharty Preschool Speech and Language Screening Test-Second Edition (Fluharty-2),⁹ a brief screening measure of performance in articulation, receptive language, expressive language, and composite language. The General Language Quotient standard score (mean = 100; SD = 15) was used for all analyses. Scores were divided by 15 so that ORs reflect the effect of a 1 SD-change in the Fluharty-2 score.

The Woodcock Johnson III Tests of Achievement (Woodcock-Johnson III)¹⁰ were administered at age 5 years. The Overall Academic Skills standard score (mean = 100;

SD = 15), a composite of the Letter-Word Identification, Spelling, and Calculation subtests, was used for all analyses. Scores were divided by 15 so that ORs reflect the effect of a 1 SD-change in the Woodcock-Johnson III score.

Special education use was assessed by using 3 dichotomous, parent-reported variables assessed via interview at multiple time points during elementary school. First, parents were asked at child ages 7.5, 8.5, and 9.5 years whether their child currently had an individualized education program (IEP). Second, they were asked at child ages 8.5 and 9.5 years whether their child had ever been referred for special education review or evaluation. Third, they were asked at child ages 7.5, 8.5, and 9.5 years whether their child had ever been held back in school.

Demographic variables, including child sex (0 = female, 1 = male), race (0 = not African American, 1 = African American), and ethnicity (0 = not Hispanic, 1 = Hispanic) were collected at baseline (age 2 years). Parents also indicated their educational history (ranging from 1 [no formal schooling] to 9 [graduate degree]) and gross monthly household income (ranging from 1 [$< \$415$] to 13 [$> \7500]); both of these variables were treated as continuous for analyses. Finally, the total intensity score on the Eyberg Child Behavior Inventory¹¹ at age 3 years was included as a measure of child problem behavior. Scores were divided by 36 so that ORs reflect the effect of a 1-unit change on the 7-option Likert response scale.

Statistical Analyses

First, the relation between language skills at age 3 years and later special education use measures was analyzed by using logistic regressions on the 3 binary outcome variables. Second, these regressions were run again with interaction terms added as predictors to examine moderation of this relationship by sex, race, and ethnicity.¹² Third, the regressions were run again with several covariates of interest added to examine whether early language skills predicted later special education use above and beyond demographic risk and child problem behaviors. Finally, sensitivity analyses were conducted by using different timings and encodings of the early language skills assessment and special education outcomes. Missing data (Table I) were handled using multiple imputation by chained equations, a state-of-the-art practice^{13,14}; thus, all reported analyses used the full sample of 731 participants. All analyses were conducted in the R statistical software environment v 3.3.1 (R Foundation for Statistical Computing, Vienna, Austria).¹⁵

Results

Consistent with our expectations, logistic regressions indicated that a brief assessment of early language skills was significantly predictive of all 3 later special education outcomes. The Figure displays these 3 results graphically. For each 1 SD (ie, 15-point.) increase in Fluharty-2 standard score, the odds of having an IEP at age 7.5, 8.5, or 9.5 years decreased by 51%

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