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# A Brief Measure of Language Skills at 3 years of age and Special Education Use in Middle Childhood

**Laura Lee McIntyre, PhD**[a], **William E. Pelham III, MA**[b], **Matthew H. Kim, PhD**[a], **Thomas J. Dishion, PhD**[b,c], **Daniel S. Shaw, Ph.D.**[d], and **Melvin N. Wilson, Ph.D**[e]

[a]University of Oregon, Eugene, Oregon

[b]Arizona State University, Tempe, Arizona

[c]Oregon Research Institute, Eugene, Oregon

[d]University of Pittsburgh, Pittsburgh, Pennsylvania

[e]University of Virginia, Charlottesville, Virginia

## Abstract

**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-2) at ages 3 and 4, a standardized measure of academic achievement at age 5, and parent report of special education services at ages 7.5, 8.5, and 9.5.

**Results—**Results showed that higher scores on the Fluharty-2 predicted a reduced likelihood of having an individualized education program (odds ratio: 0.48), being referred for special education (odds ratio: 0.55), and being held back a grade (odds ratio: 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.

**Conclusion—**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.

**Address correspondence to:** Laura Lee McIntyre, Department of Special Education and Clinical Sciences and Prevention Science Institute, 6217 University of Oregon, University of Oregon, Eugene, OR 97403-6217, [ llmcinty@uoregon.edu], 541-346-7452.



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**Keywords**

developmental screening; early childhood; communication skills; disabilities

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 (e.g., 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 education[6] 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 language measure at age 3 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 two or more of the following risk factors for future problem behavior: child behavior problems, family functioning problems (e.g., 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 (FCU) 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, 9.5) to complete extensive study assessments, and those that were in the intervention group were also offered the FCU. 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 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 ($M$ = 100; $SD$ = 15) was used for all analyses. Scores were divided by 15 so that odds ratios reflect the effect of a one-SD change in the Fluharty score.

The Woodcock Johnson III Tests of Achievement[10] were administered at age 5 years. The Overall Academic Skills standard score ($M$ = 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 odds ratios reflect the effect of a one-SD change in the WJIII 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). 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 Inventory[11] (ECBI) at age 3 was included as a measure of child problem behavior. Scores were divided by 36 so that odds ratios reflect the effect of a one-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 three 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, version 3.3.1.[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 standard deviation (i.e., 15-pt.) increase in Fluharty-2 standard score, the odds of having an IEP at age 7.5, 8.5, or 9.5 decreased by 51% (odds ratio [*OR*] = 0.49, 95% CI = [0.37, 0.66]), the odds of ever being referred for special education decreased by 44% (*OR* = 0.56, 95% CI = [0.42, 0.75]), and the odds of ever being held back a grade decreased by 61% (*OR* = 0.39, 95% CI = [0.22, 0.70]).

### Moderation by Sex, Race, or Ethnicity

We next examined interactions of the Fluharty-2 standard score with sex, race, and ethnicity in predicting each of the three special education outcomes. Consistent with our expectations, the interaction term was not statistically significant in any of these nine regressions, suggesting the prediction from the brief assessment of early language skills to later special education use was robust across child sex, race, and ethnicity.

### Adding Covariates

We next ran regressions with a set of covariates of interest—child sex, race, and ethnicity; parental education and family income; child problem behavior, and academic achievement at age 5—to examine whether the brief assessment of early language skills predicted special education outcomes over and above these variables (Table II). The Fluharty-2 standard score remained significantly predictive of all 3 special education outcomes, and the magnitude of

this prediction was unaffected by the addition of the 7 covariates, which included several known risk factors that predict poor educational outcomes.[16,17] Most notable, the prediction from early language to special education use remained despite the inclusion of academic achievement at age 5 (Woodcock-Johnson III), a more proximally associated variable with special education use in later elementary school.

### Sensitivity Analyses

Finally, we conducted several sensitivity analyses, including (a) using the language assessment at age 4 rather than at age 3, (b) using only the special education information at age 9.5, and (c) collapsing the 3 special education outcome variables into a single binary outcome. Early language skills remained significantly and strongly predictive of later special education use in nearly all these regressions (Table III), suggesting the prediction is robust in terms of the timing of early language skill assessment and the encoding of outcome variable.

## Discussion

This study examined the predictive power of a brief assessment of early language skills on later special education outcomes. Results demonstrated that an early language screening can robustly predict special education use in later childhood, confirming our hypotheses, which bolsters the growing literature pointing to the importance of early identification and intervention of communication difficulties. Because early communication difficulties may be a marker for broader cognitive or developmental risk, assessing the early language domain may be useful in primary pediatric care. Findings from this study suggest that the association between early communication and later special education outcomes was significant across demographic subgroups, indicating that this link remains meaningful after controlling for risk factors such as low socioeconomic status and behavior problems. The predictive utility of early language was significant even after controlling for a measure of academic skills administered 2 years after the language screening. The current sample included children and families with several risk factors, including sociodemographic risk factors (e.g., poverty, low maternal education) and child behavior problems. Thus, findings may not generalize to children without these known risk factors.

Although early developmental surveillance and monitoring have been recommended for use in primary care,[1,2] practitioners must be judicious regarding which developmental screenings to use. Previous research that has examined the utility of early language screeners has largely found mixed evidence regarding their usefulness,[18] thus universal speech and language screening has not been widely adopted as part of routine pediatric practice. Our findings suggest that early communication was robustly associated with later special education outcomes. The distinction between pure language outcomes and special education outcomes is important because special education outcomes may be a combination of developmental, behavioral, and learning difficulties—a grouping of heterogeneous outcomes and comorbidities.[19] Education outcomes are relatively stable, and children who enter school with lower levels of academic performance tend to stay on that trajectory throughout their educational years.[20]

In our study, we found that the Fluharty-2 still significantly predicted future special education use even after controlling for academic skills measured 2 years *after* the language screener. Given the close link between academic skills at age 5 (kindergarten) and later special education placement our findings are especially noteworthy. Thus, it may be useful to assess and consider children's early communication skills when providing early intervention.

Study findings provide further evidence that screening may be worthwhile for certain subgroups of children at heightened risk for special education referral and placement. We found that children who scored low at ages 3 and 5 (<70 at age 3 and <81 at age 5) had a 74% chance of receiving an IEP, compared with 34% for children who scored in the normal range at both time points. This finding complements the work of Law et al,[21] who explored patterns of change between ages 3 and 5 and found significant differences between groups on language performance as well as other child and family indicators. In our study, children who scored low on the language screening at ages 3 and 5 were significantly more likely to receive special education in middle childhood than were children who scored in the normal range. It may be prudent to actively monitor those children with low initial scores in order to more effectively intervene and provide supplemental intervention that would enable children to perform at normative levels. To save money on costly evaluations, we recommend that a multiple gating procedure be used for screening and identification of communication delays and other developmental delays or disorders. A multiple gating system of developmental screening is consistent with recommendations of the American Academy of Pediatrics[1] and has been shown to have utility with social-emotional screening for infants and toddlers in primary care.[22] Children who score below normative criteria on a validated screening instrument (e.g., 1 *SD* below the mean) can be referred for additional evaluation and possible intervention. Continuity of care can be provided through a medical home that includes routine developmental screening for children.

Research has demonstrated that there is relatively high stability of initial language impairment predicting later impairment.[23,24] Fortunately, evidence also suggests that children whose language delay had resolved by age 5.5 years experienced outcomes similar to those of children without a delay in early childhood.[25] Taken together, childhood language studies suggest that if early language impairment is identified and addressed as early as possible, children are likely to experience positive outcomes in later childhood. Children with below-average scores on the Fluharty-2 at age 3 may warrant closer monitoring to ensure that they receive additional services to address their initial language difficulties before it becomes more difficult to intervene, especially by age 6. Thus, there is promise that with early identification of risk comes intervention and positive developmental outcomes.

A limitation of this study was the lack of access to family history of communication difficulties and lack of information about perinatal factors, such as prematurity status and low birth weight, all of which have been shown to be related to later communication difficulties.[26–28] Yet although examination of risk factors is important, such factors should not be the central focus when one is examining screening tools and improving screening methods. Family history and perinatal factors cannot be changed, and other demographic

characteristics, such as maternal education and family income, are likely to be fairly stable over time and unlikely to provide a means to affect children's language skills and academic achievement in a meaningful, lasting way.

In conclusion, this study found a strong association between scores on a brief, early language screening and special education outcomes approximately 5 years later. Assessing young children's communication during routine pediatric care may be critical to identifying risk for poor developmental and education outcomes.

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## Abbreviations

| | |
|---|---|
| **FCU** | Family Check-Up |
| **IEP** | individualized education program |

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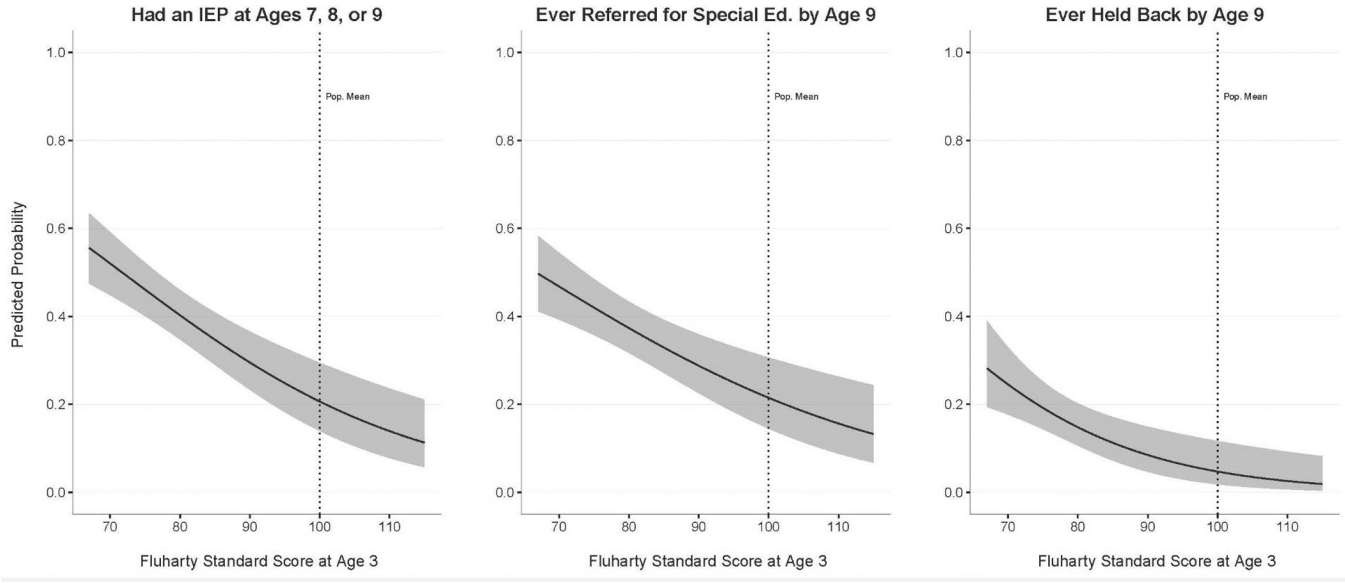


**Figure.**

Effect of Early Language Skills on Later Special Education Outcomes

IEP = Individualized Education Program. Shading indicates 95% confidence interval about the predicted mean. Fluharty score is the General Language Quotient score. Predictions calculated with intervention dummy covariate fixed at zero.

## Table 1

Descriptives for Variables in Models

| Variable | Descriptives | *N* |
|---|---|---|
| **Covariates** | | |
| Male | 50% | 731 |
| African American | 28% | 724 |
| Hispanic | 14% | 713 |
| Parental education[a] | 5 [5, 6] | 731 |
| Gross monthly income[b] | $1458 [624, 1874] | 723 |
| Woodcock-Johnson III Overall Academic Skills standard score at age 5 | 98 (15) | 559 |
| Eyberg Child Behavior Inventory total intensity score at age 3 | 128 (33) | 654 |
| **Predictors** | | |
| Fluharty General Language Quotient standard score at age 3 | 81 (10) | 539 |
| Fluharty General Language Quotient standard score at age 4 | 88 (13) | 555 |
| **Outcomes** | | |
| Had an IEP at age 7.5 | 28% | 564 |
| Had an IEP at age 8.5 | 29% | 564 |
| Had an IEP at age 9.5 | 29% | 587 |
| –Had an IEP at ages 7.5, 8.5, or 9.5 | 41% | 731* |
| Ever referred for special education reported at age 8.5 | 24% | 545 |
| Ever referred for special education reported at age 9.5 | 27% | 567 |
| –Ever referred for special education by age 9.5 | 40% | 731* |
| Ever held back a grade by age 7.5 | 8% | 519 |
| Held back a grade at age 8.5 | 4% | 558 |
| Held back a grade at age 9.5 | 2% | 582 |
| –Ever held back a grade by age 9.5 | 16% | 731* |

Abbreviations: IEP, individualized education program.

Percentages indicate proportion coded as “yes” on corresponding variable. For parental education and gross monthly income, values are medians with interquartile range in brackets. For the Woodcock-Johnson and Fluharty, values are means with standard deviations in parentheses. Figures are based on available data for each variable (see *N* column; * = based on imputed data).

[a] A value of 5 corresponds with high school graduate (or GED), a value of 6 corresponds with partial college or specialized training.

[b] Figures reflect the middle of categories in an interval scale.

## Table 2

Predictors of Special Education Outcomes

| Predictor | Outcome: Had an IEP at Ages 7.5, 8.5, or 9.5 OR [95% CI] | Outcome: Ever Referred for Spec. Ed. by Age 9.5 OR [95% CI] | Outcome: Ever Held Back by Age 9.5 OR [95% CI] |
|---|---|---|---|
| Fluharty-2 | 0.56 [0.41, 0.77] | 0.62 [0.45, 0.85] | 0.48 [0.27, 0.87] |
| Male | 1.26 [0.87, 1.81] | 1.58 [1.09, 2.29] | 1.11 [0.67, 1.86] |
| African American | 1.15 [0.76, 1.76] | 0.93 [0.61, 1.41] | 1.51 [0.87, 2.62] |
| Hispanic | 0.29 [0.15, 0.59] | 0.58 [0.31, 1.09] | 0.58 [0.22, 1.50] |
| Parental education | 1.28 [1.06, 1.54] | 1.27 [1.05, 1.53] | 0.78 [0.60, 1.01] |
| Gross monthly income | 0.97 [0.88, 1.07] | 0.95 [0.86, 1.05] | 1.04 [0.90, 1.19] |
| Woodcock-Johnson III | 0.46 [0.36, 0.59] | 0.61 [0.49, 0.77] | 0.73 [0.53, 1.00] |
| Eyberg Child Behavior Inventory | 1.13 [0.91, 1.40] | 1.20 [0.97, 1.49] | 1.02 [0.75, 1.38] |

Abbreviations: IEP, individualized education program.

Fluharty-2 is the General Language Quotient standard score at age 3; Woodcock-Johnson III is the Overall Academic Skills standard score at age 5; Eyberg Child Behavior Inventory is the total intensity score at age 3. Values are odds ratios from logistic regression, and bracketed numbers indicate associated 95% confidence interval.

## Table 3

Sensitivity Analyses

| Outcome | Predictor: Fluharty at age 3 OR [95% CI] | Predictor: Fluharty at age 4 OR [95% CI] |
|---|---|---|
| *Sensitivity analysis (A)* | | |
| Had an IEP at ages 7.5, 8.5, or 9.5 | - | 0.47 [0.37, 0.59] |
| Ever referred for special education by age 9.5 | - | 0.55 [0.44, 0.69] |
| Ever held back by age 9.5 | - | 0.48 [0.34, 0.69] |
| *Sensitivity analysis (B)* | | |
| Had an IEP at age 9.5 | 0.43 [0.31, 0.60] | - |
| Was referred for special education at age 9.5 | 0.60 [0.43, 0.82] | - |
| Was held back at age 9.5 | 0.47 [0.17, 1.32] | - |
| *Sensitivity analysis (C)* | | |
| "Yes" to any of 3 special education outcomes[a] | 0.48 [0.37, 0.64] | - |

Abbreviations: IEP, individualized education program.

Fluharty is the General Language Quotient standard score. Intervention status was included as a covariate in all regressions. Values are odds ratios from logistic regression, and bracketed numbers indicate associated 95% confidence interval.

[a]Fifty-seven percent of sample responded "yes" to any of the 3 special education outcomes at 1 or more of the assessed time points.