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*Pediatrics* published online Feb 8, 2010;

DOI: 10.1542/peds.2008-2111

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American Academy of Pediatrics

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# Childhood Language Skills and Adult Literacy: A 29-Year Follow-up Study

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## KEY WORDS

childhood receptive language problems, adult literacy, family literacy, poverty, longitudinal study

www.pediatrics.org/cgi/doi/10.1542/peds.2008-2111

doi:10.1542/peds.2008-2111

Accepted for publication Sep 3, 2009

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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**FINANCIAL DISCLOSURE:** *The authors have indicated they have no financial relationships relevant to this article to disclose.*



**WHAT'S KNOWN ON THIS SUBJECT:** Although language and vocabulary competency are well-known correlates of psychiatric, academic, and psychosocial outcomes, there has been relatively little research into the course of language development from childhood to adulthood.



**WHAT THIS STUDY ADDS:** Using a large-scale general population sample, we examined the longitudinal trajectory of childhood receptive language skills and adult functional literacy, and we examined the role of early family environment in shaping the course of language development.

## abstract

**OBJECTIVES:** Our aim was to assess the longitudinal trajectory of childhood receptive language skills and early influences on the course of language development.

**METHODS:** Drawing on data collected for a nationally representative British birth cohort, the 1970 British Cohort Study, we examined the relationship between directly assessed early receptive language ability, family background, housing conditions, early literacy environment, and adult literacy skills. A sample of 11 349 cohort members who completed the English Picture Vocabulary Test at 5 years of age were studied again at 34 years of age, when they completed a direct assessment of their basic literacy skills. We contrasted experiences of individuals with language problems at age 5 against the experiences of those with normal language skills at that age, assessing the role of socioeconomic family background and early literacy environment in influencing the longitudinal course of developmental language problems. Statistical comparisons of rates with  $\chi^2$  tests at *P* values of .001, .01, and .05 were made, as well as multivariate logistic regressions.

**RESULTS:** Cohort members with receptive language problems at age 5 had a relatively disadvantaged home life in childhood, both in terms of socioeconomic resources and the education level of their parents, but also regarding their exposure to a stimulating early literacy environment. Although there is significant risk for poor adult literacy among children with early language problems, the majority of these children develop competent functional literacy levels by the age of 34. Factors that reduce the risk for persistent language problems include the child being born into a working family, parental education beyond minimum school-leaving age, advantageous housing conditions, and preschool attendance.

**CONCLUSION:** Effective literacy-promoting interventions provided by pediatric primary care providers should target both children and parents. *Pediatrics* 2010;125:e459–e466

Language and literacy are important functional skills in today's technologically advanced society.<sup>1</sup> Adult language competencies depend in part on the learning and development occurring in childhood, yet little is known about trajectories of language development and the extent to which children with early language problems go on to have persistent language difficulties in adult life. The few authors of longitudinal studies examining language development have found that receptive and expressive language problems tend to persist into later childhood,<sup>2-4</sup> into adolescence,<sup>5,6</sup> and adult life.<sup>7-11</sup> The samples used in these studies have, however, been very heterogeneous, mostly involving children with clinical levels of language difficulties, have varied in their exclusion criteria, the outcomes under investigation, and have included differing types of speech and language impairment. Nevertheless, the findings suggest that severity of early language problems may be the key determinants of later outcomes,<sup>12</sup> and that receptive language often can be taken as a marker of severity. There is some evidence from large scale longitudinal studies that children with poor language skills are at risk of failing to attain a basic grasp of literacy in adulthood,<sup>11,13,14</sup> suggesting cumulative language deficits and negative long-term sequelae. Furthermore, poor language and literacy skills in adulthood have been linked to increased unemployment, low earnings, high rates of welfare dependency, and ill health,<sup>15,16</sup> rendering the ramifications of failing to address language problems early on far reaching.

Concerns have been raised about the value of screening children for language problems on the grounds that the assessments used are insufficiently accurate.<sup>17,18</sup> Consideration of demographic information, however, may provide an opportunity to under-

stand the risks more fully. In the following we examine the social context in which language development takes place, directing attention to the resources required to sustain language development in the long run.<sup>19,20</sup> Although there has been some recent evidence to the contrary,<sup>21,22</sup> in general, socioeconomic factors, including housing conditions, have shown to be associated with early language problems<sup>23-26</sup> and are a major predictor of childhood language acquisition.<sup>27,28</sup> Other key factors shaping early verbal responsiveness and vocabulary include a child-centered literacy orientation, indicated for example by a family's ability and willingness to read to the child<sup>29-33</sup>; more formal levels of instruction, such as preschool attendance<sup>34,35</sup>; as well as perinatal factors.<sup>36</sup>

Our aims were to (1) assess the relationship between socioeconomic resources within the family, indicators of early literacy environment, and early language skills (operationalized by a direct measure of receptive language at 5 years of age), (2) map the long-term consequences of early receptive language problems for later language development, and (3) determine to what extent adult literacy is a function of early language problems rather than family circumstances or early literacy support. To our knowledge, this is the first study to link early language problems to adult literacy rates, drawing on data collected for a national population sample across an extended period of time, and to compare the home environment of children with language problems to those with normal language development.

## METHODS

### Data

The 1970 British Cohort Study is an ongoing longitudinal study that takes as its subjects all 17 196 children born in

1 week in 1970 in England, Wales, and Scotland. The cohort was followed up on 6 occasions, with data collected at 5, 10, 16, 26, 30, and 34 years of age. The sample is representative, in most respects, of the general UK population of that age, although there is a trend toward underrepresentation of male participants and those less educationally advantaged over time.<sup>37</sup>

## Measures

### Identification of Language Problems at 5 Years of Age

English language development at age 5 was assessed by using the English Picture Vocabulary Test, an adaptation of the American Peabody Picture Vocabulary Test.<sup>38</sup> The test has good internal consistency ( $\alpha = .96$ ).<sup>39</sup> It consists of 56 sets of 4 different pictures with a particular word associated with each set of 4 pictures. The child is asked to indicate the 1 picture that corresponds to the given word, and the test proceeds with words of increasing difficulty, until the child made 5 mistakes in a run of 8 consecutive items.

### Literacy at 34 Years of Age

Basic functional literacy skills were directly assessed at age 34 by using 30 multiple-choice questions extracted from the 2002 Skills for Life Survey.<sup>40,41</sup> Questions were presented on a computer and cohort members selected from 4 alternative answers. Of the 30 questions, only 20 would be attempted by any single respondent. Answers to an initial set of 10 questions determined whether they went on to answer 10 questions at a higher or lower level of difficulty.<sup>42</sup> Questions concentrated on reading comprehension, writing composition, grammar, punctuation, spelling, and handwriting. The test has a good overall reliability of 0.87.<sup>13</sup> Converting performance on the literacy assessment into levels, it is possible to classify respondents according to

their achieved level within the UK National Qualification Framework, as described in the Skills for Life Survey.<sup>41</sup> Here, we differentiate between scores at entry level, reflecting poor literacy skills, and more competent scores (level 1 or higher), indicating literacy functioning at least at a level expected of an 11-year-old at the start of their secondary education.<sup>13,42</sup>

### Demographic Characteristics Assessed at Birth

- Gender of child (0 = boy, 1 = girl)
- Father's education (0 = extended education beyond minimum school-leaving age, 1 = father left education at minimum school-leaving age)
- Mother's education (0 = extended education beyond minimum school-leaving age, 1 = mother left education at minimum school-leaving age)
- Ever a teenaged mother (0 = mother had her first child at age 20 or higher (>20), 1 = mother had her first child before age 20)
- Single (never married) mother at birth (0 = other, 1 = single mother)
- No income from employment measured at household level (0 = household has income from paid employment, 1 = household has no income from paid employment)
- Social class from the father's occupation (or the mother's occupation, if single): social position at birth was classified by the registrar general scale ranging from class I (professional) to V (unskilled manual); the scale was recoded, differentiating between nonmanual or skilled manual occupations versus semiskilled or unskilled manual occupations (0 = nonmanual or skilled manual, 1 = IV or V manual)

### Housing Conditions at 5 Years of Age

- Home ownership (0 = own home, 1 = other)
- Overcrowded home (0 = <1 person per room, 1 = >1 person per room)

### Early Literacy Environment at 4 Years of Age

- Parents reading to child in a week at home (0 = did not read to child, 1 = read to child 1–6 days, 2 = read to child everyday)
- Self-reported reading ability of parents (0 = neither parent poor reader, 1 = 1 or both parents report to be a poor reader)
- Parent report on siblings reading ability (0 = no problems, 1 = poor reader)
- Cohort member attended preschool (0 = attended, 1 = not attended)

### Control Variables: Indicators of Biological Risk

- Birth weight (0 =  $\geq 2515$  g, 1 = <2515 g)
- Gestation (0 =  $\geq 259$  days, 1 = <259 days)

### Sample

The English Picture Vocabulary Test was not conducted on non-English-speaking children. In addition, we restricted our sample to only include children where English was the primary language spoken in their home, comprising 11 349 children (all white British/European) who completed the English Picture Vocabulary Test at 5 years of age (51.8% of male participants). Of these children, 15.4% were identified with language difficulties at age 5. Of these, 11.5% were identified as having "poor" language skills (performance between 1 and 1.99 SDs below the mean English Picture Vocabulary Test score) and 3.9% were identified as having "very limited" language skills (performance at least 2 SDs below the mean English Picture

Vocabulary Test score). All others were coded as having "normal language performance."

### Analysis

A series of nested logistic regression models were run, using adult literacy as the outcome. Overall, 9567 cohort members completed the direct literacy assessment at age 34. To account for missingness in the data, we used multiple imputations as a best effort technique. Discarding cases from a representative sample, especially when missingness is nonignorable, may lead to seriously biased estimates, and multiple imputations is the preferential approach.<sup>43</sup> The method of imputation used was multiple imputation by chained equations as implemented in Stata 10 (Stata Corp, College Station, TX).<sup>44,45</sup> Five replicate data sets were created. Model estimates were averaged across these 5 analyses, with their SEs calculated according to Rubin's rule.<sup>46</sup> All descriptive analyses were also conducted in Stata 10 and relevant statistical comparisons were made by using  $\chi^2$  tests at the .001, .01, and .05 levels. All models were controlled for by indicators of biological risk (ie, low birth weight and gestation to adjust for associated medical conditions).

### RESULTS

Table 1 shows comparisons of sociodemographic characteristics and background data of all respondents, differentiating between those identified with very limited, poor, and normal language skills.

Compared with children with normal language ability, those with very limited or poor language skills were more likely to grow up in relatively disadvantaged circumstances, in terms of socioeconomic conditions as well as early literacy environment. Table 1 also shows the performance in adult

literacy assessment by early language development. Among cohort members with very limited language at age 5 about a third still have a poor grasp of literacy at age 34. However, for many cohort members there was significant improvement in language skills because 67.6% acquired at least basic literacy functioning. Among those with poor language skills, the improvement was even greater with 80.1% demonstrating a functional grasp of literacy in their adult years.

### Predicting Poor Adult Literacy

In a next step we ran a series of nested multivariate logistic regressions to assess the risk of poor adult literacy among cohort members with receptive language problems at age 5, and whether this risk is moderated by early experiences in the family context. We first assessed the direct effect of early receptive language problems on adult literacy (model 1). We then added sociodemographic indicators such as gender, family characteristics, parental education, and employment situation at birth (model 2). We then assessed the effect of housing conditions experienced at age 5 (model 3), and indicators of early literacy environment (model 4). In the last model, we added all variables simultaneously (model 5). Normal language skills were used as a baseline. Results of the multivariate logistic regression models are given in Table 2.

#### Model 1

Differences in adult literacy were significantly associated with early receptive language problems. The odds for poor adult literacy among children with very limited early language skills (2 SDs below average) are nearly 7 times higher (6.82) than those among children with normal language skills. For children with poor language skills (1 SD below average) the odds are 3.58.

**TABLE 1** Characteristics in Early Childhood by Language Development at 5 Years of Age

Characteristics	Language Development at 5 y of Age (N = 11 349), %			Overall, %
	Very Limited <sup>a</sup>	Poor <sup>a</sup>	Normal	
1970 (age 0): medical report				
Child has low birth weight, <2515 g	12.6	9.3	5.3	6.0
Child born prematurely, gestation <259 d	9.0	7.3	5.0	5.4
1970 (age 0): demographic				
Child's mother ever a teenaged mother	27.6	28.0	17.1	18.7
Child born to single mother, never married	6.4	4.6	3.0	3.3
Child's mother had minimum education	82.1	80.5	64.2	66.6
Child's father had minimum education	84.2	81.8	64.5	67.1
Child's father had a semiskilled or unskilled job in 1970	36.0	33.9	19.3	21.5
Child's family had no income from paid employment	10.9	7.9	4.1	4.7
1975 (age 5): housing				
Child lived in an overcrowded home, >1 person per room	58.7	56.7	35.2	38.4
Child lived in a rented home	69.0	61.6	40.0	43.5
1975 (age 5): early literacy environment				
Child's parent(s) did not read to him or her	37.0	33.1	18.5	20.8
Child's parent(s) read to him or her everyday	22.9	24.1	39.6	37.3
Child's parent(s) was a poor reader	12.8	7.0	2.6	3.5
Child's sibling(s) was a poor reader	11.0	9.4	5.9	6.5
Child did not go to preschool	43.9	36.2	23.8	25.9
2004 (age 34): adult literacy				
Level 1 or 2	67.6	80.1	93.7	91.2
<i>n</i>	410	1264	9675	11 349

<sup>a</sup> *P* < .001.

#### Model 2

Adjusting for sociodemographic characteristics of the family environment significantly reduces the risk for poor literacy in adulthood by about a fifth among individuals with very limited and poor language skills. However, the odds of poor literacy among children with very limited language were still more than 5 times greater than those with normal language skills (5.36).

#### Model 3

Adjusting for housing conditions at age 5 brings a 23% reduction of risk for poor adult literacy for those with very limited language skills and 20% reduction for those with poor language. The associated risk of poor adult literacy among children with early receptive language problems remains very significant for both groups of children (5.26 and 2.86, respectively).

#### Model 4

Adjusting for indicators of early literacy environment also brings a significant reduction of risk. Interestingly, the reduction of risk is slightly stronger among those with very limited language skills than among those with poor receptive language. Among those with very limited language skills, the reduction in risk was 20% (5.43), whereas for those individuals with poor language skills it was 15% (3.04), suggesting that early literacy environment is especially beneficial in the long-term for those children with severe early language problems.

#### Model 5

The full model is adjusted for all the above factors. Although the risk for poor adult literacy among those children demonstrating poor and very limited language skills in early childhood has reduced by around a third, it still remained very significant: 4.43

**TABLE 2** Multiple Logistic Regression Predicting Poor Adult Literacy at 34 Years of Age, Controlling for Biological Risk

Variables	Odds Ratio (95% Confidence Interval)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Receptive language at age 5					
EPVT very limited	6.82 (4.68–9.93) <sup>a</sup>	5.36 (3.57–8.04) <sup>a</sup>	5.26 (3.55–7.78) <sup>a</sup>	5.43 (3.76–7.84) <sup>a</sup>	4.43 (3.01–6.52) <sup>a</sup>
EPVT poor	3.58 (2.80–4.58) <sup>a</sup>	2.86 (2.19–3.73) <sup>a</sup>	2.86 (2.21–3.71) <sup>a</sup>	3.04 (2.37–3.89) <sup>a</sup>	2.51 (1.93–3.25) <sup>a</sup>
EPVT normal	1.00	1.00	1.00	1.00	1.00
Demographics, age 0					
Child is a girl	—	0.91 (0.76–1.10)	—	—	0.94 (0.78–1.14)
Child's mother ever a teenaged mother	—	1.42 (1.13–1.77) <sup>b</sup>	—	—	1.25 (0.99–1.56)
Child born to single mother	—	1.23 (0.78–1.94)	—	—	1.19 (0.75–1.90)
Child's mother left school at minimum age	—	1.56 (1.14–2.13) <sup>b</sup>	—	—	1.33 (0.95–1.84)
Child's father left school at minimum age	—	2.20 (1.51–3.19) <sup>a</sup>	—	—	1.81 (1.25–2.61) <sup>b</sup>
Child's father in semiskilled or unskilled manual job in 1970	—	1.27 (1.00–1.61) <sup>c</sup>	—	—	1.14 (0.90–1.44)
Child born in family with no income from paid employment	—	1.95 (1.19–3.23) <sup>b</sup>	—	—	1.74 (1.05–2.89) <sup>c</sup>
Housing conditions, age 5					
Child lived in an overcrowded home, >1 person per room	—	—	1.57 (1.26–1.94) <sup>a</sup>	—	1.33 (1.06–1.67) <sup>c</sup>
Child lived in non-owner-occupied home	—	—	2.16 (1.66–2.82) <sup>a</sup>	—	1.60 (1.26–2.03) <sup>a</sup>
Family literacy environment, age 5					
Parent did not read to child in the week <sup>d</sup>	—	—	—	1.76 (1.35–2.29) <sup>a</sup>	1.20 (0.92–1.57)
Parent read to child 1–6 d in the week <sup>d</sup>	—	—	—	1.58 (1.26–1.97) <sup>a</sup>	1.27 (1.03–1.57) <sup>c</sup>
Child's parent(s) was a poor reader	—	—	—	1.66 (1.14–2.42) <sup>b</sup>	1.40 (0.95–2.06)
Child's sibling(s) was a poor reader	—	—	—	1.50 (1.06–2.12) <sup>c</sup>	1.35 (0.95–1.90)
Child did not go to preschool	—	—	—	1.57 (1.35–1.82) <sup>a</sup>	1.23 (1.05–1.44) <sup>c</sup>
Degree of freedom	4	11	7	9	19
<i>n</i>	11 349	11 349	11 349	11 349	11 349

EPVT indicates English Picture Vocabulary Test.

<sup>a</sup>  $P < .001$ .<sup>b</sup>  $P < .01$ .<sup>c</sup>  $P < .05$ .<sup>d</sup> Reference category is parents read to child every day.

for those with very limited language and 2.51 for those with poor language at age 5. In addition and above the direct influence of early language problems on poor adult literacy, we found an independent significant effect from being born into a family receiving no income from paid employment, low parental education, non-home-ownership, and nonattendance at preschool, suggesting that these are key factors undermining potential catch-up in language development.

## DISCUSSION

Early receptive language problems are a significant risk factor for poor adult literacy. Although the risk of continuing language problems remained significant for those with poor early language skills, it could significantly be reduced by adjusting for family socio-

economic background, housing, and early literacy environment, suggesting that at least some of the risk for continuing language problems is moderated by experiences in the family environment during early childhood. The findings suggest that efforts to raise language skills of young children should be targeted not only at the child but also at the social and literacy environment in which language development takes place.<sup>29–31</sup>

The multivariate regression model (model 5) reveals that after controlling for social background, housing conditions, and early literacy environment, the risk for poor adult literacy levels is reduced for those with poor language development at age 5. Furthermore, the findings reveal that adult literacy depends on language

development that occurs during childhood, yet that catch-up in later years is possible. Although early language problems are associated with poor literacy skills in adulthood, we found a considerable number of individuals who developed competent adult literacy levels, despite early language problems. Thus, the findings reveal that the course of development is not necessarily predetermined, that some individuals escape a negative trajectory. Housing conditions and early literacy environment seem to have an independent effect, in addition and above the indicators of socioeconomic adversity, in moderating the course of the trajectory.

The close association between early language skills and social disadvantage, and the fact that the combination

of the two can exacerbate long-term negative outcomes, makes the early identification of these children a priority. We need to consider how to identify those children in need given the relative inaccuracy of most procedures for screening language.<sup>17</sup> To use a “health surveillance” or “health promotion” approach might be considered as alternative. Depending, of course, on how such systems are administered, two issues emerge from our data that question whether such approaches are likely to be more effective than universal screening. The first is that the health surveillance approach emphasizes the role of parents in seeking help. Previous evidence would suggest that many of the parents of the most vulnerable children may not be inclined to engage with the services.<sup>47</sup> The second concerns the age of the children. The present data refer to the long-term implications of language difficulties at 5 years, some time after most health surveillance programs have ceased to function. It is clear that the issue of identification is not just an issue for children in the preschool period.

In interpreting the findings some limitations of the study have to be considered. Much of the data used in the analysis was collected over 30 years ago, reflecting theoretical considerations and research questions prevalent at the time. Important measures of family literacy environment, such as availability of books in the household, reading habits, or visits to local libraries were not collected at age 5. Nonethe-

less, it was possible to identify key indicators of a family literacy in early childhood, such as parental reading to the child. Another concern in longitudinal studies is missing data both because of survey loss and incomplete response, especially in analyses drawing on data from several waves. There is some indication that the most socially disadvantaged participants are also most likely to drop out of longitudinal studies.<sup>37,48</sup> Response bias at the individual level would tend to underestimate the magnitude of the effects of social disadvantage on individual development. We used multiple imputation methods to address the issue of missingness and selective drop-out of the study, a method recommended as a “best-effort” technique for dealing with this problem.<sup>49,50</sup> On the positive side, the strengths of this study lies in its size, resulting in high statistical power, its longitudinal nature, the direct assessment of early language and adult literacy skills, the information included on socioeconomic circumstances, and the wider context for development, as well as the comparison of the long-term development of children with poor language skills to those of normal ability.

## CONCLUSIONS

The data presented here identifies aspects within the early family environment that could foster children’s language development and their subsequent potential to reach basic competence in literacy in adulthood. Some of the factors, including parental education, housing conditions, access

to preschool education, but also parental reading to children may be amenable to intervention. By identifying specific factors associated with early language skills and adult functional literacy, we hope to have offered a clearer picture of the populations at risk, and the wider social context in which language development takes place. Without attempts in improving the socioeconomic and housing conditions, as well as the literacy environment experienced by the child during the early years, the likelihood of success in improving language and literacy skills may be diminished.

Advocates and policymakers should encourage family-centered and community-centered support resources to include early detection and intervention for language problems among the most disadvantaged populations. The identification of language problems should not be restricted to the preschool context because many children with language problems, especially those from a disadvantaged background, may not be attending preschool. Screening for language problems, therefore, should involve enhanced surveillance by primary care clinicians, and routine developmental surveillance should continue through into school or this role should be formally taken on by schools.

## ACKNOWLEDGMENT

This work was sponsored by the Economic and Social Science Research Council (RES-000-22-1748).

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*Pediatrics* published online Feb 8, 2010;

DOI: 10.1542/peds.2008-2111

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