PEDIATRICS

Childhood language skills and adult literacy: A twenty-nine year follow-up study

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Childhood language skills and adult literacy:

A twenty-nine year follow-up study

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Short Title: Childhood language problems and adult literacy

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This paper does not report results of a clinical trial.

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Childhood language skills and adult literacy:

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Abstract

OBJECTIVES. The aim of this paper is to assess the longitudinal trajectory of childhood receptive language skills and to examine the role of early family environment in influencing the course of language development.

METHODS. Drawing on data collected for a nationally representative British birth cohort, the 1970 British Cohort Study (BCS70), we examine 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 (EPVT) at 5 years of age were studied again at age 34 years, when they completed a direct assessment of their basic literacy skills. We contrast 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 socio-economic family background and early literacy environment in influencing the longitudinal course of developmental language problems. Statistical comparisons of rates with X^2 tests at the 0.001 0.01 and 0.05 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 socio-economic resources and 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 age 34. Factors reducing 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.

CONCLUSIONS

Effective literacy promoting interventions provided by pediatric primary care providers should target both children and adults.

Key words: childhood receptive language problems, adult literacy, family literacy, poverty, longitudinal study

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Childhood language skills and adult literacy:
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Language and literacy are important functional skills in today's technological advanced society [1]. 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 longitudinal studies examining language development have found that receptive and expressive language problems tend to persist into later childhood [2-4], into adolescence [5, 6], and adult life [7-11]. 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 [12], 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 [11, 13, 14], suggesting cumulative language deficits and negative longterm 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 [15, 16], 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 [17, 18]. Consideration of demographic information, however, may provide an opportunity to understand the risks more fully. In the following we will examine the social context in which language development takes place, directing attention to the resources required to sustain language development in the long run [19, 20]. Although there has been some recent evidence to the contrary [21, 22] in general socio-economic factors, including housing conditions, have shown to be associated with early language problems [23-26] and are a major predictor of childhood language acquisition [27, 28]. Other key factors shaping early

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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 [29-32]; more formal levels of instruction, such as pre-school attendance [34, 35]; as well as perinatal factors [36].

The aims of this paper are a) to assess the relationship between socio-economic resources within the family, indicators of early literacy environment, and early language skills (operationalised by a direct measure of receptive language at age 5 years); b) to map the long-term consequences of early receptive language problems for later language development, and c) to 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 (BCS70) is an on-going longitudinal study which takes as its subjects all 17,196 children born in one week in 1970 in England, Wales, and Scotland. The cohort was followed up on six occasions, with data collected at age 5, 10, 16, 26, 30, and at age 34. The sample is representative, in most respects, of the general UK population of that age, although there is a trend towards under-representation of males and those less educationally advantaged over time [37].

Measures

Identification of language problems at age 5

English language development at age 5 was assessed using the English Picture Vocabulary Test (EPVT), an adaptation of the American Peabody Picture Vocabulary Test (38). The test has good internal consistency ($\alpha = 0.96$) [39]. It consists of 56 sets of four different pictures with a particular word associated with each set of four pictures. The child is asked to indicate the one picture that corresponds to the given word, and the

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test proceeds with words of increasing difficulty, until the child made five mistakes in a run of eight consecutive items.

Literacy at age 34

Basic functional literacy skills were directly assessed at age 34 using 30 multiple choice questions extracted from the 2002 Skills for Life Survey [40, 41]. Questions were presented on a computer and cohort members selected from four 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 [42]. Questions concentrated on reading comprehension, writing composition, grammar, punctuation, spelling and handwriting. The test has a good overall reliability of 0.87 [13]. 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 [41]. 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 [13, 42].

Demographic Characteristics assessed at birth

o   Sex of child (0=boy, 1=girl)

o   Father's education (0=extended education beyond minimum school leaving age, 1=father left education at minimum school leaving age)

o   Mother's education (0=extended education beyond minimum school leaving age, 1=mother left education at minimum school leaving age)

o   Ever a teenage mother (0=mother had her first child at age 20 and/or higher(20+), 1= mother had her first child before age 20)

o   Single (never married) mother at birth (0=other, 1=single mother)

o   No income from employment measured at household level (0=household has income from paid employment, 1=household has no income)

o   Social class from father's occupation (or mother's if single): social position at birth was classified by the registrar general scale ranging from class I (professional) to V

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(unskilled manual). The scale was recoded, differentiating between non-manual or skilled manual occupations versus semi- or unskilled manual occupations (0=non-manual or skilled manual, 1=IV or V manual)

Housing Conditions at age 5

o   Home ownership (0=own home, 1=other)

o   Overcrowded home (0=less than 1 person per room, 1=1+ per room)

Early literacy environment at age 4

o   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)

o   Self reported reading ability of parents (0=neither parent poor reader, 1=one or both parents report to be poor reader)

o   Parent report on siblings reading ability (0=no problems, 1=poor reader)

o   Cohort member attended pre-school (0=attended, 1=not attended)

Control variables: Indicators of biological risk

o   Birthweight (0=2515 grams+,1=below 2515 grams)

o   Gestation (0=259+ days, 1=less than 259 days)

Sample

The EPVT was not carried out on non-English speaking children. We further 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 EPVT at age 5 years (51.8 % males). 15.4% of these children were identified with language difficulties at age 5. Of these 11.5 per cent were identified as having 'poor' language skills (performance between 1 and 1.99 standard deviations below the mean EPVT score) and 3.9 per cent were identified with 'very limited' language skills (performance at least two standard deviations below the mean EPVT 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. 9,567 cohort members completed the direct literacy assessment at age 34. To

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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 non ignorable, may lead to seriously biased estimates, and multiple imputations is the preferential approach [43]. The method of imputation used was multiple imputation by chained equations (MICE) as implemented in STATA 10 [44, 45]. Five replicate data sets were created. Model estimates were averaged across these five analyses, with their standard errors calculated according to Rubin's rule [46]. All descriptive analyses were also carried out in STATA 10 and relevant statistical comparisons were made using X^2 tests at the 0.001, 0.01 and 0.05 levels. All models were controlled for by indicators of biological risk, i.e. low birth weight and gestation to adjust for associated medical conditions.

Results

Table 1 compares socio-demographic characteristics and background data of all respondents, differentiating between those identified with very limited, poor, and normal language skills.

Insert table 1 about here

Compared to 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 socio-economic 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 there was significant improvement in language skills, as 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

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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 socio-demographic 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 a 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.

Insert 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 std below average) are nearly seven times higher (6.82) than those among children with normal language skills. For children with poor language skills (1 std below average) the odds are 3.58.

Model 2: Adjusting for socio-demographic 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 five times greater than those with normal language skills (5.36).

Model 3: Adjusting for housing conditions at age 5 brings a 23 per cent reduction of risk for poor adult literacy for those with very limited language skills and 20 per cent 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

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those with very limited language skills the reduction in risk was 20 per cent (5.43), while for those individuals with poor language skills it is 15 per cent (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 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 find an independent significant effect from being born into a family receiving no income from employment, low parental education, non home-ownership, and non attendance at pre-school, 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 at the social and literacy environment in which language development takes place [29-31].

        The multivariate regression model (Model 5) suggest 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 suggest 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. The findings thus suggest that the course of

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development is not necessarily predetermined, that some individuals escape a negative trajectory. Housing conditions and early literacy environment appear to have an independent effect, in addition and above the indicators of socio-economic 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 in need given the relative inaccuracy of most procedures for screening language [17]. 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 which 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 [47]. The second concerns the age of the children. The present data refer to the long term implications of language difficulties at five years, some time after most health surveillance programmes 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 has been 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. Nonetheless 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 are also most likely to drop out of longitudinal studies [37, 48]. 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'

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technique for dealing with this problem [49, 50]. 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 socio-economic 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 pre-school 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 socio-economic 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- and community centred 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, as many children with language problems, especially those from disadvantaged background, may not be attending preschool. Screening for language problems should therefore 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.

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Table 1 Characteristics in early childhood by language development at age 5

| | **Language Development at age 5** | | | | |
	Very Limited %	**Poor** %	**Normal** %	**0verall** %	*Overall* *(n)*
1970 (age 0): Medical report					
Child has low birthweight (<2515 grams)	12.6***	9.3***	5.3	6.0	*11349*
Child born prematurely (gestation <259 days)	9.0***	7.3***	5.0	5.4	*11349*
1970 (age 0): Demographics					
Child mother ever a teenage mother	27.6***	28.0***	17.1	18.7	*11349*
Child born to single mother (never married)	6.4***	4.6***	3.0	3.3	*11349*
Child mother minimum education	82.1***	80.5***	64.2	66.6	*11349*
Child father minimum education	84.2***	81.8***	64.5	67.1	*11349*
Child father's semi or unskilled job in 1970	36.0***	33.9***	19.3	21.5	*11349*
Child family no income from employment	10.9***	7.9***	4.1	4.7	*11349*
1975 (age 5): Housing					*11349*
Child lived in an overcrowded home (1+ per room)	58.7***	56.7***	35.2	38.4	*11349*
Child lived in a rented home	69.0***	61.6***	40.0	43.5	*11349*
1975 (age 5): Early literacy environment					
Child's parents did not read to child	37.0***	33.1***	18.5	20.8	*11349*
Child's parent read to them everyday	22.9***	24.1***	39.6	37.3	*11349*
Child's parent(s) a poor reader	12.8***	7.0***	2.6	3.5	*11349*
Child's sibling(s) a poor reader	11.0***	9.4***	5.9	6.5	*11349*
Child did not go to pre-school	43.9***	36.2***	23.8	25.9	*11349*
2004 (age 34): Adult Literacy					
Level 1 or 2	67.6***	80.1***	93.7	91.2	*11349*
N=	*410*	*1264*	*9675*	*11349*	

Statistical significance ***p<.001 **p<.01 *p<.05.

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Table 2: Multiple logistic regression predicting poor adult literacy at age 34 (odds ratios and 95% Confidence Interval) (controlling for biological risk)

	Model 1	Model 2	Model 3	Model 4	Model 5
Receptive Language at age 5					
EPVT very limited	6.82***	5.36***	5.26***	5.43***	4.43***
	4.68-9.93	3.57-8.04	3.55-7.78	3.76-7.84	3.01-6.52
EPVT poor	3.58***	2.86***	2.86***	3.04***	2.51***
	2.80-4.58	2.19-3.73	2.21-3.71	2.37-3.89	1.93-3.25
EPVT normal	1.00	1.00	1.00	1.00	1.00
Demographics (age 0)					
Child a girl		0.91			0.94
		0.76-1.10			0.78-1.14
Child mother ever a teenage mother		1.42**			1.25
		1.13-1.77			0.99-1.56
Child born to single mother		1.23			1.19
		0.78-1.94			0.75-1.90
Child mother left school at minimum age		1.56**			1.33
		1.14-2.13			0.95-1.84
Child father left school at minimum age		2.20***			1.81**
		1.51-3.19			1.25-2.61
Child father in semi or unskilled manual job in 1970		1.27*			1.14
		1.00-1.61			0.90-1.44
Child born in family with no income from employment		1.95**			1.74*
		1.19-3.23			1.05-2.89
Housing Conditions (age 5)					
Child lived in an overcrowded home (1+ per room)			1.57***		1.33*
			1.26-1.94		1.06-1.67
Child lived in *non* owner-occupied home			2.16***		1.60***
			1.66-2.82		1.26-2.03
Family literacy environment (age 5)					
Parent did not read to child in the week#				1.76***	1.20
				1.35-2.29	0.92-1.57
Parent read to child 1-6 days in the week#				1.58***	1.27*
				1.26-1.97	1.03-1.57
Child's parent(s) a poor reader				1.66**	1.40
				1.14-2.42	0.95-2.06
Child's sibling(s) a poor reader				1.50*	1.35
				1.06-2.12	0.95-1.90
Child did not go to pre-school				1.57***	1.23*
				1.35-1.82	1.05-1.44
df	*4*	*11*	*7*	*9*	*19*
N(100%)=	*11,349*	*11,349*	*11,349*	*11,349*	*11,349*

Statistical significance ***p<.001 **p<.01 *p<.05.
Note: reference category is: parents read to child every day.

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1.   OECD. Literacy in the Information Age: Final report of the International Adult Literacy Survey. Paris: Organization for Economic Cooperation and Development (OECD); 2000.

2.   Aram DH, Nation JE. Pre-school language disorders and subsequent language and academic difficulties. J Comm Disord 1980;13:159-198.

3.   Conti-Ramsden G, Botting N, Simkin Z, Knox E. Follow-up of children attending infant language units: outcomes at 11 years of age. Int J Lang Commun Disord 2001;36:207-220.

4.   Johnson CJ, Beitchman JH, Young A, Escobar M, Atkinson L, Wilson B, et al. Fourteen year follow up study of children with and without speech/language impairments: Speech/language stability and outcomes. J Speech Lang Hear Res 1999;42:744-760.

5.   Aram DH, Ekelman BL, Nation JE. Preschoolers with language disorders: 10 years later. J Speech Lang Hear Res 1984;27:232-244.

6.   Stothard SE, Snowling MJ, Bishop DVM, Chipchase BB, Kaplan CA. Language-impaired preschoolers: A follow-up into adolescence. J Speech Lang Hear Res 1998;41:407-418.

7.   Clegg J, Hollis C, Mawhood L, Rutter M. Developmental language disorders - a follow-up in later adult life. Cognitive, language and psychosocial outcomes. J Child Psychol Psychiatry 2005;46:128-149.

8.   Mawhood L, Howlin P, Rutter M. Autism and developmental receptive language disorder - a comparative follow-up in early adult life. I: Cognitive and language outcomes. J Child Psychol Psychiatry 2000;41:547-559.

9.   Richards M, Sacker A. Lifetime antecedents of cognitive reserve. Journal of Clinical and Experimental Psychology 2003;25:614-624.

10.   Beichtman JH, Jiang H, Koyama E, Johnson CJ, Escobar M, Atkinson L, et al. Models and determinants of vocabulary growth from kindergarten to adulthood. J Child Psychol Psychiatry 2008;49:626-634.

11.   Richards M, Power C, Sacker A. Paths to literacy and numeracy problems: evidence from two British birth cohorts. J Epidemiol Community Health 2009;63:239-244.

12.   Law J, Tomblin JB, Zhang. Characterising the growth trajectories of language-impaired children between 7 and 11 years of age. J Speech Lang Hearing Res 2008;51 739-749.

13.   Bynner J, Parsons S. New light on literacy and numeracy: results of the literacy and numeracy assessment in the age 34 follow-up of the 1970 British Cohort Study (BCS70). London: National Research and Development Centre for Adult Literacy and Numeracy; 2006.

14.   Parsons S, Bynner J. Illuminating Disadvantage London: National Research and Development Centre for Adult Literacy and Numeracy (NRDC); 2007.

15.   DeWalt DA, Berkman ND, Sheridan S, Lohr KN, Pignone MP. Literacy and health outcomes: A systematic review of the literature. J Gen Intern Medicine 2004;19:1228-1239.

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16.   Grinyer J. Literacy, numeracy and the labour market: Further analysis of the Skills for Life survey. London: Department for Education and Skills; 2006.

17.   Hall D, Elliman D, editors. Health for all children, 4th edition. Oxford: Oxford University Press 2003.

18.   Laing G, Logan S, Law J, Levin A. Evaluation of a structured test and a parent led method for screening for speech and language problems: prospective population based study. BMJ 2002;325:1152-1154B.

19.   Bradley R, Corwyn R. Socioeconomic status and child development. Annu Rev Psychol 2002;53:371-399.

20.   Engle PL, Black MM. The Effect of Poverty on Child Development and Educational Outcomes. Ann NY Acad Sci 2008;1136:243-256.

21.   Reilly S, Wake M, Bavin EL, Prior MW, Bretherton J, Eadie P, et al. Predicting language at two years of age: a prospective community study. Pediatrics 2007;120:1441-1449.

22.   Zubrick SR, Taylor CL, Rice ML, Seigers DW. Late language emergence at 24 months: A epidemiological study of prevalence, predictors and covariates. J Speech Lang Hear Res 2007;50:1562-1592.

23.   Brooks-Gunn J, Duncan G, J. The effects of poverty on children. Children and Poverty 1997;7:55-71.

24.   Hoff E. Poverty effects. In: Kent RD, editor. MIT encyclopedia of communication disorders. Cambridge, MA: MIT Press; 2004.

25.   Weigel DJ, Martin SS, Bennett KK. Contributions of the home literacy environment to preschool-aged children's emerging literacy and language skills. Early Child Dev Care 2006;176:357 - 378.

26.   Evans G, Maxwell L, Hart B. Parental language and verbal responsiveness to children in crowded homes. Dev Psychol 1999;35:1020-1023.

27.   Chaney C. Language-development, metalinguistic awareness, and emergent literacy skills of 3-year-old children in relation to social-class. Appl Psycholinguist 1994;15:371-394.

28.   Hoff E. The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. Child Dev 2003;74:1368-1378.

29.   High P, Hopmann M, LaGasse L, Sege R, Moran J, Guiterrez C, et al. Child Centered Literacy Orientation: A form of social capital? Pediatrics 1999;103:1-7.

30.   High P, LaGasse L, Becker S, Ahlgren I, Gardner A. Literacy promotion in primary care pediatrics: Can we make a difference? Pediatrics 2000;105:927-934.

31.   Klass P. Pediatrics by the book: Pediatricians and literacy promotion. Pediatrics 2002;110:989-995.

32.   Mendelsohn AL, Mogilner LN, Dreyer BP. The impact of a clinic-based literacy intervention on language development in inner-city preschool children. Pediatrics 2001;107:130-134.

33.   Raikes HH, Raikes HA, Pan BA, Luze G, Tamis-LeMonda CS, Rodriguez ET, et al. Mother-child bookreading in low-income families: Correlates and outcomes during the first three years of life. Child Dev 2006;77:924-941.

34.   Brooks G. What works for children with literacy difficulties? The effectiveness of intervention schemes. London: Department for Education and Skills (reference RR380) 2003.

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35.   Sammons P, Elliot K, Sylva K, Melhuish E, Siraj-Blatchford I, Taggart B. The impact of pre-school on young children's cognitive attainments at entry to reception. Br Educ Res J 2004;30:691-713.

36.   Nelson HD, Nygren P, Walker M, Panoscha R. Screening for speech and language delay in preschool children: Systematic evidence review for the US preventative services task force. Pediatrics 2006;117:e298-e319.

37.   Elliott J, Shepherd P. Cohort profile of the 1970 British Birth Cohort (BCS70). Int J Epidemiol 2006;35:836-843.

38.   Brimer MA, Dunn LM. English Picture Vocabulary Test. Bristol: Education Evaluation Enterprises; 1962.

39.   Osborn AF, Butler NR, Morris AC. The social life of Britain's five-year-olds: a report of the Child Health and Education Study. London: Routledge & Kegan Paul; 1984.

40.   Brooks G, Heath K, Pollard A. Assessing adult literacy and numeracy: a review of Research instruments. London: National Research and Development Centre for Adult Literacy and Numeracy (NRDC); 2005.

41.   Williams J, Clemens S, Oleinikova K, Tarvin K. The Skills for Life Survey: A national needs and impact survey of literacy, numeracy and ICT skills. London: DfES Research Report 490; 2003.

42.   Parsons S, Bynner J. Measuring basic skills for longitudinal study: the design and development of instruments for use with cohort members in the age 34 follow-up in the British Cohort Study (BCS70). Literacy and Numeracy Studies 2006;14(2):7-30.

43.   Schafer JL. Analysis of Incomplete Multivariate Data. London: Chapman & Hall; 1997.

44.   Royston P. Multiple imputation of missing values. STATA Journal 2004;4:227-241.

45.   Royston P. Multiple Imputation of Missing Values: Update. STATA Journal 2005;5:188-201.

46.   Rubin DB. Multiple Imputation for Nonresponse in Surveys. New York: John Wiley & Sons; 1987.

47.   Sacker A, Schoon I, Bartley M. Sources of bias in special needs provision in mainstream primary schools: Evidence from two British cohort studies European Journal of Special Needs Education 2001;16:259-276

48.   Plewis I, Calderwood L, Hawkes D, Nathan G. National Child Development Study and 1970 British Cohort Study. Technical Report: Changes in the NCDS and BCS70 populations and samples over time. London: Institute of Education, Centre for Longitudinal Studies; 2004.

49.   Little RJA, Rubin DB. Statistical analysis with missing data, 2nd edition. Hoboken: Wiley; 2002.

50.   Menard S. Longitudinal Research. 2nd ed. London: Sage; 2002.