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Maternal Literacy and Associations Between Education and the Cognitive Home Environment in Low-Income Families

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Abstract

Objective—To determine whether maternal literacy level accounts for associations between educational level and the cognitive home environment in low-income families.

Design—Analysis of 369 mother-infant dyads participating in a long-term study related to early child development.

Setting—Urban public hospital.

Participants—Low-income mothers of 6-month-old infants.

Main Exposure—Maternal literacy level was assessed using the Woodcock-Johnson III/Bateria III Woodcock-Munoz Tests of Achievement, Letter-Word Identification Test. Maternal educational level was assessed by determining the last grade that had been completed by the mother.

Main Outcome Measure—The cognitive home environment (provision of learning materials, verbal responsivity, teaching, and shared reading) was assessed using StimQ, an office-based interview measure.

Results—In unadjusted analyses, a maternal literacy level of ninth grade or higher was associated with increases in scores for the overall StimQ and each of 4 subscales, whereas a maternal educational level of ninth grade or higher was associated with increases in scores for the overall StimQ and 3 of 4 subscales. In simultaneous multiple linear regression models including

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both literacy and educational levels, literacy continued to be associated with scores for the overall StimQ (adjusted mean difference, 3.7; 95% confidence interval, 1.7-5.7) and all subscales except teaching, whereas maternal educational level was no longer significantly associated with scores for the StimQ (1.8; 0.5-4.0) or any of its subscales.

Conclusions—Literacy level may be a more specific indicator of risk than educational level in low-income families. Studies of low-income families should include direct measures of literacy. Pediatricians should develop strategies to identify mothers with low literacy levels and promote parenting behaviors to foster cognitive development in these at-risk families.

Children who grow up in low-income households have an increased risk of developmental delay and poor school achievement, contributing to an ongoing cycle of poverty.[1,2] An important contributing factor is the cognitive home environment[3-5]; low-income families have fewer parent-child verbal interactions[6,7] and less access to resources, including learning materials.[8,9]

The impact of socioeconomic status on the cognitive home environment is, in part, related to low maternal educational level.[10] Across numerous studies, low maternal educational level has been associated with knowledge,[11] attitudes,[12] resources,[13] and practices[3,6] related to the cognitive home environment and child development, including reduced frequency of mother-child shared reading and provision of literacy materials in the home.[14,15] Consistent with these findings, higher maternal educational level has been associated with child developmental outcomes from infancy to adolescence, including early development, emergent literacy, school readiness, lower-grade retention, and high school graduation rates.[13,16-19]

Much of the impact of maternal education on the cognitive home environment and child outcomes is indirect and is related to reduced income, unemployment, and material hardship.[17,20] However, the degree to which education-related skills, such as low literacy level, account for these effects is not known. Low literacy level is likely to be an important factor in low-income households for several reasons. First, low literacy level is common among low-income adults with low educational attainment, and 41% to 44% of adults scoring in the lowest levels in the National Adult Literacy Survey live in poverty.[10,21,22] Second, recent studies have shown low parental literacy levels to be associated with adverse pediatric health outcomes generally, including infant mortality, breastfeeding, and asthma outcomes.[21,23-25] Third, parental literacy level has been associated with measures related to parenting and child developmental outcomes, including provision of children's books in the home, understanding of emergent literacy, and children's early reading trajectories.[26-28] However, to our knowledge, there has been limited study of the degree to which literacy accounts for the cognitive home environment and child developmental outcomes above and beyond low educational level in low-income households.

In this study, we therefore sought to determine the degree to which maternal literacy level accounts for associations between educational level and the cognitive home environment in low-income households. We hypothesized that, although educational level would be found to be related to the cognitive home environment, this relationship would be attenuated after accounting for literacy level, thus supporting literacy as a strong predictor of parenting behaviors targeting cognitive development. This information will be useful in creating future interventions to foster development within the home environment.

METHODS

STUDY SAMPLE

This was an analysis of mother-infant dyads enrolled from November 1, 2005, through November 30, 2006, in a longitudinal study of early child development, the Bellevue Project for Early Language, Literacy, and Education Success (BELLE Project). The BELLE Project is a randomized, long-term study assessing the role of pediatric primary care–based interventions in promoting early child development among low-income families.[29] Consecutive enrollment of eligible dyads occurred in the postpartum unit of Bellevue Hospital Center, an urban public hospital serving at-risk families. Inclusion criteria were intention to receive pediatric primary care at our institution for at least 3 years, English or Spanish as the primary language, an uncomplicated full-term delivery, no early intervention eligibility, mother as the primary caregiver, ability to contact the mother, mother's age at least 18 years, and no significant maternal medical problems. This study was approved by the New York University School of Medicine Institutional Review Board and the Bellevue Research Committee. Written, informed consent was obtained from each mother at enrollment.

PROCEDURE

Mothers were assessed during 2 different time periods. The first assessment (baseline) occurred during mothers' postpartum hospital stays. The second assessment occurred when infants reached age 6 months. Assessments were performed by bilingual research staff trained by one of us (S.B.B.), and reliability was maintained through periodic supervision.

INDEPENDENT VARIABLES

Literacy Level—Maternal literacy was assessed when the infant was aged 6 months using the Woodcock-Johnson III/Bateria III Woodcock-Munoz Tests of Achievement, Letter-Word Identification Test, which is standardized in English and Spanish and was administered in the mother's preferred language. The Letter-Word Identification Test measures word reading skills and is highly correlated (r=0.88) with an overall reading-writing factor on the Woodcock-Johnson III/Bateria III test; it is also one component of the Woodcock-Johnson III/Bateria III Basic and Broad Reading Skills Clusters, which are highly correlated (r=0.68) with reading comprehension as measured by the Wechsler Individual Achievement Test. Grade equivalent scores were calculated[30] and dichotomized as reading at high school level (≥ninth grade) or lower, which is consistent with cutoff points used on other literacy measures such as the REALM (Rapid Estimate of Adult Literacy in Medicine)[23,31,32] and corresponds approximately to the level of education associated with the transition from below basic to basic literacy skills as measured in the National Adult Literacy Survey.[10,33]

Educational Level—Educational level was assessed at baseline by interview. We determined the last grade that had been completed by the mother. As with literacy level, educational level was dichotomized as ninth grade or higher compared with less than ninth grade.[31,32,34]

DEPENDENT VARIABLE

Cognitive Home Environment—The cognitive home environment was assessed using StimQ, a questionnaire designed for use in research and clinical settings that is based on a structured interview with the child's caregiver.[35] StimQ is validated for use in low-income populations and does not require a home visit. It has good internal consistency (Cronbach α=.88), test-retest reliability (intra-class correlation coefficient, 0.93), and criterion-related

validity (correlation with HOME [Home Observation for Measurement of the Environment] score,[36] r=0.55; P<.001), and is gender neutral.[37] It also has good concurrent validity with developmental measures and is correlated with the Bayley Scales of Mental Development Mental Development Index[38] (semi-partial correlation is 0.45; P<.001). StimQ has been used in several recent studies of early child development performed with urban, economically disadvantaged populations.[8]

StimQ-I (Infant) comprises 4 subscales:

1. Availability of Learning Materials assesses provision of developmentally appropriate toys (eg, rattles, toy instruments, or dolls with a human face) (score range, 0-6).
2. READ assesses shared reading activities. Items assess frequency of reading activities, number of books in the home, and diversity of content of books shared with the child (score range, 0-19).
3. Parental Involvement in Developmental Advance assesses the frequency and quality of teaching activities parents engage in with their children, such as pointing out and naming objects around the house or in supermarkets (score range, 0-7).
4. Parental Verbal Responsivity assesses verbal interactions between parents and their children, such as whether they play peekaboo or sing lullabyes (score range, 0-11).

We calculated scores for the overall StimQ (range, 0-43) and for each subscale.

POTENTIAL CONFOUNDERS

Potentially confounding sociodemographic variables were assessed, including infant's age, sex, and birth order, socioeconomic status,[39] country of origin, primary language (based on language chosen for literacy test), and maternal depression and social risks. Higher rates of depression in low-income households are related to differences in parent-child interactions.[9,40-42] We assessed maternal depressive symptoms using the Patient Health Questionnaire 9.[43] We used a cutoff score of 5 to define the presence of symptoms, corresponding to “mild depression.” Maternal social risk factors were also assessed, including homelessness, being a victim of violence, having involvement with child protective services, and having limited or late prenatal care.[44] In our analyses, mothers were considered at increased social risk if they had 1 or more of these factors.

STATISTICAL ANALYSES

Unadjusted associations between independent (educational and literacy levels) and dependent (cognitive home environment) variables were analyzed using independent-sample t tests. Simultaneous multiple regression analyses including both educational and literacy levels were performed to assess independent associations between these variables and the cognitive home environment. In these regression analyses, we adjusted for all potential confounders, including child's age, sex, and birth order and maternal age, primary language, country of origin, marital status, presence of social risk factors, and presence of depressive symptoms, as well as exposure to interventions within the larger study. Socioeconomic status was not included in multiple regression models because of its strong relationship to level of education. Based on these analyses, we calculated unadjusted and adjusted mean differences and associated 95% confidence intervals. Multiple regression analyses were also used to determine the degree to which literacy and educational levels each explained independent variance in the cognitive home environment.

RESULTS

STUDY SAMPLE

From November 1, 2005, through November 30, 2006, 369 mother-newborn dyads were identified as eligible, of whom 278 (75.3%) were enrolled in the study. Those who elected not to enroll primarily cited time constraints or partner reluctance. A total of 210 (75.5%) of these families underwent assessment when the infants were a mean (SD) age of 6.7 (1.1) months.

DESCRIPTIVE DATA

Table 1 shows descriptive data for the sample. Most mothers were immigrants and of Latina ethnicity. Mean (SD) maternal educational grade level was 10.0 (3.5), and 31.9% did not complete ninth grade. Mothers who did and did not complete the 6-month assessment were similar for country of origin, ethnicity, and infant's sex and birth order. However, mothers who completed the 6-month assessment were somewhat less likely to have completed ninth grade (P=.09) and somewhat less likely to be English speaking (P=.09). Regarding literacy, mean (SD) reading grade level was 12.0 (4.8), and 34.5% read below the ninth grade level. Educational and reading levels showed only small to moderate correlation (r=0.37; P<.001); 24.1% of those who completed ninth grade did not read at a ninth grade level, and 43.9% of those who did not complete ninth grade read at a ninth grade level or higher.

LITERACY LEVEL, EDUCATIONAL LEVEL, AND PARENTING

As shown in **Table 2**, in unadjusted analyses, maternal literacy of ninth grade level or higher was associated with scores for overall StimQ and each of the 4 subscales, whereas a maternal educational level of ninth grade or higher was associated with scores for overall StimQ and 3 of 4 subscales. In multiple regression analyses including literacy and educational levels and all potential confounders, such as maternal language, country of origin, ethnicity, age, marital status, social risk factors, depressive symptoms, and infant's age, sex, and birth order, literacy continued to be associated with scores for overall StimQ and all subscales except for Parental Involvement in Developmental Advance (ie, teaching), whereas maternal educational level was no longer significantly associated with scores for StimQ or any of its subscales. In the multiple regression analysis predicting overall StimQ score, literacy level accounted for 5.7% of the variance, whereas educational level accounted for 1.0% of the variance.

COMMENT

We found that maternal literacy level was associated with a wide range of parenting behaviors important for child development, including provision of toys and learning materials, shared reading activities, teaching activities, and verbal responsivity in the home. As hypothesized, whereas educational level was associated with the cognitive home environment, these associations were attenuated and became nonsignificant after adjusting for literacy level. These findings suggest that literacy level may account for the well-established effect of educational level on parenting, which has important implications for research and clinical practice.

Researchers have historically focused on maternal educational level as one of the most important risk factors related to the cognitive home environment and child developmental outcomes. However, whereas educational level has been recognized as a marker for literacy level, it has also been recognized that education and literacy are not equivalent.[45] Educational level, which is measured as years completed or degrees obtained, does not necessarily measure literacy level, which is a more specific measure of functional skills that

are relevant to the "demands of everyday life."[33(p865)] As seen in our sample, as well as others, literacy level is often seen to vary in individuals with the same educational attainment.[33,46] In finding that literacy level attenuates the impact of educational level, our results strongly suggest that researchers should measure literacy level in studies of the cognitive home environment and child development in at-risk, low-income populations.

Clinically, there has been a recent focus regarding literacy and health literacy as important factors related to health disparities among at-risk pediatric and adult populations.[21,47-49] Using the National Adult Literacy Survey database, Sentell and Halpin[33] found literacy to be a more powerful predictor of adult health status than education or race and suggested that interventions to improve literacy might be effective in reducing health disparities. Studies of parental health literacy have shown associations with child outcomes including infant mortality,[24] breastfeeding rates,[23] management of chronic diseases such as asthma and diabetes,[25,50] and health care access and utilization.[21,51,52] The recent focus on literacy as an explanation for health disparities has led to the development of new preventive strategies. The American Academy of Pediatrics has sought to improve the effectiveness of anticipatory guidance by creating plain-language handouts more appropriate for all parents, including those with low literacy levels.[53] Other studies have created pictograms to better explain medication regimens and have been successful in improving adherence.[54,55] Pediatric programs to improve child emergent literacy, such as Reach Out and Read, have sought to work with mothers at varying literacy levels.[56,57] Our results provide strong support for developing strategies that take low maternal literacy levels into account in providing health and developmental guidance, and for explicitly addressing some of the ways that low literacy levels may affect access to information or the cognitive home environment. It is also important to consider ways that low literacy level may limit a parent's ability to provide stimulation and to consider interventions, which directly identify and address the issue of maternal literacy as a risk factor.

There are a number of limitations to our results. The measure that we used to test mothers' literacy was a measure of word reading, not comprehension. Future studies should include specific measures of additional literacy skills, such as those used in the National Assessment of Adult Literacy, which measured prose, document, and quantitative literacy.[10] In addition, the overall variance in StimQ accounted for by maternal literacy was relatively small in magnitude. Further study of the relationship between literacy and developmental outcomes is needed to delineate the clinical significance of these findings; this work is presently in progress. Also, measurement of the cognitive home environment, the primary outcome variable, was collected via parent report; results therefore may have been affected by social desirability bias. In addition, whereas we hypothesized that both reading level and educational level would affect the cognitive home environment, it is possible that these are only markers of other parental attributes that were not directly measured in this study. Finally, most mothers were Spanish-speaking, and approximately half were born outside of the United States; many completed school in their country of origin. Because completion of ninth grade may have different implications depending on the country, these results may not be generalizable to other populations.

In conclusion, literacy may be a more specific indicator of risk than educational level in low-income families. Studies of low-income populations should therefore include direct measures of literacy level. Given the relationship between low literacy level and parenting behaviors known to be related to child outcomes, pediatricians should consider developing strategies to identify mothers with low literacy levels in order to support the cognitive home environments for children of low-literacy parents.

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REFERENCES

1. Bus AG, van Ijzendoorn MH, Pellegrini AD. Joint book reading makes for success in learning to read: a meta-analysis on intergenerational transmission of literacy. Rev Educ Res. 1995; 65(1):1–21.
2. Parker S, Greer S, Zuckerman B. Double jeopardy: the impact of poverty on early child development. Pediatr Clin North Am. 1988; 35(6):1227–1240. [PubMed: 3059296]
3. Roberts J, Jurgens J, Burchinal M. The role of home literacy practices in preschool children's language and emergent literacy skills. J Speech Lang Hear Res. 2005; 48(2):345–359. [PubMed: 15989397]
4. Sénéchal M, LeFevre J, Thomas EM, Daley KE. Differential effects of home literacy experiences on the development of oral and written language. Read Res Q. 1998; 33(1):96–116.
5. Sénéchal M, LeFevre JA. Parental involvement in the development of children's reading skill: a five-year longitudinal study. Child Dev. 2002; 73(2):445–460. [PubMed: 11949902]
6. DeBaryshe BD. Maternal belief systems: linchpin in the home reading process. J Appl Dev Psychol. 1995; 16(1):1–20.
7. Hart, B.; Risley, TR. Meaningful Differences in the Everyday Experience of Young American Children. Paul H. Brookes Publishing; Baltimore, MD: 1995.
8. Tomopoulos S, Dreyer BP, Tamis-LeMonda C, et al. Books, toys, parent-child interaction, and development in young Latino children. Ambul Pediatr. 2006; 6(2):72–78. [PubMed: 16530142]
9. Bradley RH, Corwyn RF. Socioeconomic status and child development. Annu Rev Psychol. 2002; 53:371–399. doi:10.1146/annurev.psych.53.100901.135233. [PubMed: 11752490]
10. Karsh, I.; Jungeblut, A.; Jenkins, L.; Kolstad, A. Adult Literacy in America: a First Look at the Result of the National Adult Literacy Survey. National Center for Education Statistics, US Department of Education; Washington, DC: 2006.
11. Zill N. Parental schooling & children's health. Public Health Rep. 1996; 111(1):34–43. [PubMed: 8610189]
12. Berkule SB, Dreyer BP, Huberman HS, Fierman AH, Mendelsohn AL. Attitudes about shared reading among at-risk mothers of newborn babies. Ambul Pediatr. 2007; 7(1):45–50. [PubMed: 17261482]
13. Dollaghan CA, Campbell TF, Paradise JL, et al. Maternal education and measures of early speech and language. J Speech Lang Hear Res. 1999; 42(6):1432–1443. [PubMed: 10599625]
14. Aram D, Levin I. Mother-child joint writing in low SES: sociocultural factors, maternal mediation and emergent literacy. Cogn Dev. 2001; 16(3):831–852.
15. Raikes H, Pan BA, Luze G, et al. Mother-child bookreading in low-income families: correlates and outcomes during the first three years of life. Child Dev. 2006; 77(4):924–953. [PubMed: 16942498]
16. Magnuson K, Lahaie C, Waldfogel J. Preschool and school readiness of children of immigrants. Soc Sci Q. 2006; 87(suppl 1):1241–1262.
17. Gershoff ET, Aber JL, Raver CC, Lennon MC. Income is not enough: incorporating material hardship into models of income associations with parenting and child development. Child Dev. 2007; 78(1):70–95. [PubMed: 17328694]
18. Ivanans T. Effect of maternal education and ethnic background. Arch Dis Child. 1975; 50(6):454–457. [PubMed: 1147687]
19. Pachter LM, Auinger P, Palmer R, Weitzman M. Do parenting and the home environment, maternal depression, neighborhood, and chronic poverty affect child behavioral problems differently in different racial-ethnic groups? Pediatrics. 2006; 117(4):1329–1338. [PubMed: 16585331]

20. Ross CE, Wu C. The links between education and health. Am Sociol Rev. 1995; 60(5):719–745.
21. Yin HS, Forbis SG, Dreyer BP. Health literacy and pediatric health. Curr Probl Pediatr Adolesc Health Care. 2007; 37(7):258–286. [PubMed: 17656324]
22. Weiss, BD. Health Literacy: A Manual for Clinicians. American Medical Association; Chicago, IL: 2003.
23. Kaufman H, Skipper B, Small L, Terry T, McGrew M. Effect of literacy on breast-feeding outcomes. South Med J. 2001; 94(3):293–296. [PubMed: 11284516]
24. Gokhale MK, Rao SS, Garole VR. Infant mortality in India: use of maternal and child health services in relation to literacy status. J Health Popul Nutr. 2002; 20(2):138–147. [PubMed: 12186194]
25. DeWalt DA, Dilling MH, Rosenthal MS, Pignone MP. Low parental literacy is associated with worse asthma care measures in children. Ambul Pediatr. 2007; 7(1):25–31. [PubMed: 17261479]
26. Fitzgerald J, Spiegel DL, Cunningham JW. The relationship between parental literacy level and perceptions of emergent literacy. J Read Behav. 1991; 23(2):191–213.
27. Sanders LM, Zacur G, Haecker T, Klass P. Number of children's books in the home: an indicator of parent health literacy. Ambul Pediatr. 2004; 4(5):424–428. [PubMed: 15369414]
28. Dexter, ER. Literacy Development in US Families: A Multilevel Analysis of the Effects of Maternal Literacy, Maternal Schooling, Family Income, and Home Literacy Supports on Children's Growth in Reading [dissertation]. Graduate School of Education, Harvard University; Boston, MA: 2000.
29. Mendelsohn AL, Dreyer B, Flynn V, et al. Use of videotaped interactions during pediatric well-child care to promote child development: a randomized, controlled trial. J Dev Behav Pediatr. 2005; 26(1):34–41. [PubMed: 15718881]
30. McGraw, KS.; Woodcock, RW., editors. Woodcock-Johnson III Technical Manual. Riverside Publishing; Itasca, IL: 2001.
31. Trifiletti LB, Shields WC, McDonald EM, Walker AR, Gielen AC. Development of injury prevention materials for people with low literacy skills. Patient Educ Couns. 2006; 64(1-3):119–127. [PubMed: 16723205]
32. Wallace LS, Rogers ES, Roskos SE, Holiday DB, Weiss BD. Brief report: screening items to identify patients with limited health literacy skills. J Gen Intern Med. 2006; 21(8):874–877. [PubMed: 16881950]
33. Sentell TL, Halpin HA. Importance of adult literacy in understanding health disparities. J Gen Intern Med. 2006; 21(8):862–866. [PubMed: 16881948]
34. Fredrickson DD, Washington RL, Pham N, Jackson T, Wiltshire J, Jecha LD. Reading grade levels and health behaviors of parents at child clinics. Kans Med. 1995; 96(3):127–129. [PubMed: 8583738]
35. Mendelsohn, A.; Dreyer, BP. StimQ cognitive home environment.. http://www.med.nyu.edu/pediatrics/stimq/.
36. Caldwell, B.; Bradley, R. Home Observation for Measurement of the Environment. University of Arkansas; Little Rock: 1984.
37. Dreyer BP, Mendelsohn AL, Tamis-LeMonda CS. Assessing the child's cognitive home environment through parental report: reliability and validity. Early Dev Parenting. 1996; 5(4):271–287.
38. Bayley, N. Bayley Scales of Infant Development. 2nd ed.. Psychological Corporation; San Antonio, TX: 1993.
39. Hollingshead, A. Four Factor Index of Social Status. Yale University; New Haven, CT: 1975.
40. Tamis-LeMonda CS, Bornstein MH, Baumwell L. Maternal responsiveness and children's achievement of language milestones. Child Dev. 2001; 72(3):748–767. [PubMed: 11405580]
41. White KR. The relation between socioeconomic status and academic achievement. Psychol Bull. 1982; 91(3):461–481.
42. Anthony LG, Anthony BJ, Glanville DN, Naiman DQ, Waanders C, Shaffer S. The relationships between parenting stress, parenting behaviour and preschoolers' social competence and behaviour problems in the classroom. Infant Child Dev. 2005; 14(2):133–154.

43. Löwe B, Kroenke K, Herzog W, Grafe K. Measuring depression outcome with a brief self-report instrument: sensitivity to change of the Patient Health Questionnaire (PHQ-9). J Affect Disord. 2004; 81(1):61–66. [PubMed: 15183601]
44. Sameroff AJ, Seifer R, Baldwin A, Baldwin C. Stability of intelligence from preschool to adolescence: the influence of social and family risk factors. Child Dev. 1993; 64(1):80–97. [PubMed: 8436039]
45. DeWalt DA, Pignone MP. Reading is fundamental: the relationship between literacy and health. Arch Intern Med. 2005; 165(17):1943–1944. [PubMed: 16186462]
46. Baker DW, Gazmararian JA, Sudano J, Patterson M. The association between age and health literacy among elderly persons. J Gerontol B Psychol Sci Soc Sci. 2000; 55(6):S368–S374. [PubMed: 11078114]
47. Saha S. Improving literacy as a means to reducing health disparities. J Gen Intern Med. 2006; 21(8):893–895. [PubMed: 16881955]
48. Osborn CY, Paasche-Orlow MK, Davis TC, Wolf MS. Health literacy: an overlooked factor in understanding HIV health disparities. Am J Prev Med. 2007; 33(5):374–378. [PubMed: 17950402]
49. Carmona RH. Health literacy: a national priority. J Gen Intern Med. 2006; 21(8):803. doi:10.1111/j.1525-1497.2006.00569.x.
50. Ross LA, Frier BM, Kelnar CJ, Deary IJ. Child and parental mental ability and glycemic control in children with type I diabetes. Diabet Med. 2001; 18(5):364–369. [PubMed: 11472446]
51. Sanders LM, Thompson VT, Wilkinson JD. Caregiver health literacy and the use of child health services. Pediatrics. 2007; 119(1):e86–e92. doi:10.1542/peds.2005-1738. [PubMed: 17200263]
52. Sanders, LM.; Ahmed, F. Maternal health literacy: a moderator of infant health disparities.. Paper presented at: Pediatric Academic Societies Annual Meeting; San Francisco, CA. May 1, 2006;
53. Abrams, MA., editor. Plain Language Pediatric Patient Education: Handouts for Common Pediatric Topics. American Academy of Pediatrics; Elk Grove Village, IL: 2008.
54. Yin HS, Dreyer BP, van Schaick L, Foltin GL, Dinglas C, Mendelsohn AL. Randomized controlled trial of a pictogram-based intervention to reduce liquid medication dosing errors and improve adherence among caregivers of young children. Arch Pediatr Adolesc Med. 2008; 162(9): 814–822. [PubMed: 18762597]
55. Wolf MS, Fitzner KA, Powell EF, et al. Costs and cost effectiveness of a health care provider–directed intervention to promote colorectal cancer screening among veterans. J Clin Oncol. 2005; 23(34):8877–8883. [PubMed: 16314648]
56. Mendelsohn AL. Promoting language and literacy through reading aloud: the role of the pediatrician. Curr Probl Pediatr Adolesc Health Care. 2002; 32(6):183–210.
57. Willis E, Kabler-Babbitt C, Zuckerman B. Early literacy interventions: reach out and read. Pediatr Clin North Am. 2007; 54(3):625–642. [PubMed: 17543913]

Table 1

Descriptive Data for All Participants

Characteristic	Total No. of Participants	Mean (SD) or % of Participants
Maternal age, y	210	27.4 (5.6)
Spanish language	210	73.9
Latina	210	89.5
Married/partner	210	79.0
Low income	210	88.1
Mother's highest grade completed	210	10.0 (3.5)
Mother's highest grade completed <ninth grade	210	31.9
Presence of any social risk factors[a]	210	21.0
Child's age, mo	210	6.7 (1.1)
Female child	210	52.9
First-born child	210	41.0
Mother's reading level, grade[b]	206	12.0 (4.8)
Mother's reading level <ninth grade[b]	206	34.3
StimQ score		
Total[c]	209	17.7 (6.8)
ALM[d]	210	2.5 (1.1)
PIDA[e]	209	2.7 (1.6)
PVR[f]	209	5.0 (2.4)
READ[g]	210	7.6 (4.2)

[a] One or more of late prenatal care, history of homelessness, victim of violence, or contact with child protective services.

[b] Woodcock-Johnson/Woodcock-Munoz literacy tests missing for 4 mothers.

[c] Range of possible scores, 0 to 43.

[d] Availability of Learning Materials (score range, 0-6).

[e] Parental Involvement in Developmental Advance (score range, 0-7).

[f] Parental Verbal Responsivity (score range, 0-11).

[g] Shared reading (score range, 0-19).

Table 2

Maternal Literacy and Educational Levels and Associations With Cognitive Home Environment

Dependent Variable	Maternal Literacy Level					Maternal Educational Level				
	Reading Grade-Level Equivalent	Mean (SD) StimQ Score	Mean Difference (95% CI)[a]	Adjusted Mean Difference (95% CI)[a,b]	Variance Accounted for in the Dependent Variable, sr^2, [b,c]%	Highest Grade Completed	Mean (SD) StimQ Score	Mean Difference (95% CI)[d]	Adjusted Mean Difference (95% CI)[b,e]	Variance Accounted for in the Dependent Variable, sr^2, [b,e]%
StimQ, Total[f]	<9	15.3 (6.5)	3.7 (1.8 to 5.6)	3.7 (1.7 to 5.7)	5.7	<9	14.7 (7.6)	4.3 (2.4 to 6.2)	1.80 (-0.5 to 4.0)	1.0
	≥9	19.0 (6.5)	1 [Reference]	1 [Reference]	...	≥9	19.0 (6.0)	1 [Reference]	1 [Reference]	...
ALM[g]	<9	2.2 (1.1)	0.4 (0.1 to 0.7)	0.4 (0.1 to 0.8)	2.7	<9	2.1 (1.2)	0.5 (0.2 to 0.8)	0.1 (-0.2 to 0.5)	0.3
	≥9	2.6 (1.1)	1 [Reference]	1 [Reference]	...	≥9	2.6(1.1)	1 [Reference]	1 [Reference]	...
PVR[h]	<9	4.1 (2.3)	1.3 (0.7 to 2.0)	1.2 (0.5 to 1.9)	4.5	<9	3.9 (2.4)	1.5 (0.8 to 2.2)	0.6 (-0.2 to 1.5)	1.1
	≥9	5.4 (2.4)	1 [Reference]	1 [Reference]	...	≥9	5.4 (2.3)	1 [Reference]	1 [Reference]	...
PIDA[i]	<9	2.3 (1.5)	0.5 (0.1 to 1.0)	0.4 (-0.04 to 0.9)	1.4	<9	2.4 (1.6)	0.4 (0.1 to 0.8)	0.4 (-0.1 to 0.9)	1.0
	≥9	2.9 (1.6)	1 [Reference]	1 [Reference]	...	≥9	2.8 (1.6)	1 [Reference]	1 [Reference]	...
READ[f]	<9	6.7 (4.2)	1.4 (0.2 to 2.6)	1.6 (0.4 to 2.9)	3.0	<9	6.3 (4.5)	1.9 (0.7 to 3.1)	0.6 (-0.8 to 2.0)	0.3
	≥9	8.1 (4.1)	1 [Reference]	1 [Reference]	...	≥9	8.2 (3.8)	1 [Reference]	1 [Reference]	...

Abbreviations: ALM, Availability of Learning Materials; CI, confidence interval; ellipses, not applicable; PIDA, Parental Involvement in Developmental Advance: PVR, Parental Verbal Responsivity; READ, shared reading; sr, semipartial correlation.

[a] Difference compares mothers with a ninth grade reading level or higher with mothers with a reading level lower than ninth grade.

[b] Each line is based on a single, simultaneous multiple regression model predicting the dependent variable and including reading level, educational level, and all potential confounders.

[c] Variance in dependent variable accounted for by reading level.

[d] Difference compares mothers with educational levels of ninth grade and higher with mothers with an educational level of lower than ninth grade.

[e] Variance in dependent variable accounted for by educational level.

[f] F=3.4; P< .001.

[g] F=2.5; P< .003.

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[h] F=3.5; P< .001.

[i] F=2.4; P< .001.

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