Literacy and Child Health

A Systematic Review

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Objectives: To assess the prevalence of low health literacy among adolescents, young adults, and child caregivers in the United States, the readability of common child-health information, and the relationship between literacy and child health.

Data Sources: MedLine, Educational Resources Information Center, National Library of Medicine, PsychInfo, Harvard Health Literacy Bibliography, and peer-reviewed abstracts from the Pediatric Academic Societies Annual Meetings.

Study Selection: A systematic review using the following key words: health literacy, literacy, reading skill, numeracy, and Wide Range Achievement Test.

Main Outcome Measures: Descriptive studies that used at least 1 valid measure of health literacy, studies that assessed the readability of child health information, and observational or experimental studies that included a validated measure of health literacy, literacy, or numeracy skills and an assessment of child health–related outcomes.

Results: A total of 1267 articles were reviewed, and 215 met inclusion and exclusion criteria. At least 1 in 3 adolescents and young adults had low health literacy; most child health information was written above the tenth-grade level. Adjusted for socioeconomic status, adults with low literacy are 1.2 to 4 times more likely to exhibit negative health behaviors that affect child health, adolescents with low literacy are at least twice as likely to exhibit aggressive or antisocial behavior, and chronically ill children who have caregivers with low literacy are twice as likely to use more health services.

Conclusions: Low caregiver literacy is common and is associated with poor preventive care behaviors and poor child health outcomes. Future research should aim to ameliorate literacy-associated child health disparities.

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At least 1 in 3 US adults has limited health literacy, defined as an individual’s “capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions.” The 2003 National Assessment of Adult Literacy, which measured the skills of a representative sample of more than 18,000 adults older than 16 years, found that 36% had limited health literacy skills. According this assessment, 78 million US adults are unable to perform basic health tasks such as using an immunization schedule, interpreting a growth chart, or following written instructions to take medication on an empty stomach. Of those 78 million, about 30 million are unable to perform “below basic” health tasks such as dosing an over-the-counter medication, reading a clinic appointment slip, or following written instructions to drink clear liquids.

While health literacy is specifically focused on literacy in the health context, there is a strong correlation between health literacy skills and general literacy skills. Most adults with limited health literacy (66%) have a high-school or college education, but limited health literacy is more common among adults with less than a high-school education, poverty-level income, limited English language proficiency, a learning disability, or a physical disability. Adults with limited literacy skills are also more likely to experience shame, low self-esteem, and limited social support.

Several health services researchers have suggested that literacy may be an important mediator of the relationship between socioeconomic inequality and health disparities. After controlling for educational attainment and income, adults with limited health literacy are much more likely to be hospitalized, use urgent health services, and have poor control of chronic...
illness.9–13 Medicare and Medicaid enrollees with limited literacy skills have significantly higher health costs, particularly for emergency services, than enrollees with adequate literacy.14,15 It is estimated that health literacy–related disparities cost the US health care system more than $50 billion per year.16

Child health disparities may be particularly sensitive to the moderating influences of caregiver literacy skills. Parents, grandparents, and other child caregivers are inundated with a complex set of medical recommendations for the preventive care of infants and young children, including genetic and newborn screening results, immunization schedules, and nutritional guidelines. Health outcomes for children with special health care needs are dependent on each individual caregiver’s capacity to understand complicated medical regimens, nutritional regimens, school-system resources, and other health information. Adolescents and young adults are also expected to understand increasingly complex health information, including making their own health decisions, choosing appropriate over-the-counter medications, and enrolling in health care plans.

The evidence for a relationship between literacy and child health outcomes, however, remains unclear. In the developing world, maternal literacy is an important independent predictor of infant mortality,17,18 but we know little about the clinical significance of any association between literacy generally, or health literacy more specifically, and child health in the United States and other developed nations. The purpose of this review is to assess the current state of peer-reviewed literature on literacy as it relates to child health in the United States and, based on this review, to suggest future avenues for clinically meaningful research.

METHODS

To develop a plan for the systematic review, we convened a working group from the American Academy of Pediatrics Health Literacy Project Advisory Committee. The working group agreed on the following key questions for the literature review: (1) What is the state of health-literacy skills among children, adolescents, young adults, and child caregivers in the United States? (2) What is the readability of commonly-used written child health information? (3) Are literacy skills independently associated with child health outcomes?

LITERATURE SEARCH AND RETRIEVAL PROCESS

We searched 7 electronic databases with peer-reviewed literature (MEDLINE, Educational Resources Information Center, the National Library of Medicine, PsycINFO, the Harvard School of Public Health Health Literacy Bibliography, and peer-reviewed abstracts from the Pediatric Academic Societies Annual Meetings in 2006 and 2007) using the following key words: health literacy, literacy, numeracy, Rapid Estimate of Adult Literacy in Medicine (REALM), or Test of Functional Health Literacy in Adults (TOFHLA). The search was restricted to English language studies published after 1980. We further limited this analysis to studies that included children or adolescents aged 0 to 18 years or the caregivers of children (parent or caregiver).

EXCLUSION CRITERIA AND QUALITY SCORING

Review articles and studies of media literacy, mental health literacy, dyslexia, reading disorders, or the basic science of reading ability (eg, brain imaging) were excluded. For question 1, we examined only descriptive studies of general population samples that used at least 1 valid measure of health literacy. We defined a general population sample as one that represented a geographic area and that was not limited to subjects with specific clinical diagnoses. For question 2, we examined only studies that assessed the readability of health information related to children or adolescents.

For question 3, we examined only observational or experimental studies that included both a validated measure of health literacy skills (REALM or TOFHLA), literacy skills, or numeracy skills and an assessment of child health–related outcomes that we defined as caregiver health behaviors (including caregiver mental health), child health behaviors, use or quality of child health services, and child health status. Also, for question 3 we assessed the Strength of Evidence for each article based on criteria adapted from West et al.19 Each study was graded (0, poor; 1, fair; 2, good) on each of the following 7 factors: adequacy of the study population, comparability of subjects, validity and reliability of the literacy measurement, maintenance of comparable groups, validity and reliability of the outcome measurement, appropriateness of statistical analysis, and adequacy of control of confounding. The composite score was converted into the following grading scheme: A (good), a score of 10 to 14; B (fair), 6 to 9; and C (poor), 0 to 5. This scoring system is consistent with a similar system developed for a previous systematic review focused on literacy and health outcomes that included predominantly adult-focused studies.20

RESULTS

Of the 1267 articles that met the initial search criteria, 1052 were excluded. The main reasons for exclusion were no original data (48%), no data on the target age population (18%), no measure of literacy skill or readability (12%), and that the study focused on media literacy, mental health literacy, dyslexia, reading disorders, or the basic science of reading ability (12%). For the final review, 16 studies were identified that examined the prevalence of literacy or health literacy in children and caregivers; 6 were identified that measured readability of child health information; and 23 were identified that examined the relationship between literacy and child health outcomes (Figure 1).

ESTIMATES OF THE HEALTH LITERACY OF CHILDREN, ADOLESCENTS, AND CAREGIVERS

The most common instruments used to measure health literacy were the REALM and the short form of the TOFHLA (STOFHLA). Eight studies used tests of reading ability that contained no health-related content. None of the validated tools to measure health literacy specifically assessed the skills of attending to the health needs of children, and no tools assess the health literacy skills of children younger than 12 years.21–24 Several were brief screening tools with unclear validity or reliability for the child-health setting.25–28 Though the STOFHLA is validated in Spanish, some have noted the difficulty of creating health literacy measures that are culturally sensi-
tive to the barriers faced by those with limited English language proficiency.21

Table 1 shows the best estimates of health literacy in children, adolescents, and young adults. Among older adolescents and young adults (aged 16-29 years), the best estimates come from the largest, most comprehensive studies: the National Adult Literacy Survey and the National Assessment of Adult Literacy, which indicate that between 31% and 37% of US adults have low health literacy skills. According to the National Assessment of Adult Literacy, 1 in 10 young adults cannot complete “below basic” health literacy tasks such as using the dosage chart on an over-the-counter medication, and more than 1 in 3 cannot complete basic health literacy tasks such as using an immunization schedule.29 Other regional studies have found the prevalence of low health literacy among young adults and caregivers of young children to vary from 10% to 40%.30,31,34-38 Data on the health literacy of young children is difficult to gather, but as early as first grade about 1 in 3 children are identified by state and national tests as reading below grade level.36 Also of note, pediatric providers have been shown to overestimate the health literacy of the families they serve.37

READABILITY OF CHILD HEALTH INFORMATION

Table 2 shows the peer-reviewed studies documenting the readability of child health information. The Centers for Disease Control’s polio vaccine information pamphlet reads at the fifth-grade level.30 Asthma action plans are written at a median eighth-grade level (range, fifth to ninth grade).39 Most internet health information for parents is written far above the 10th-grade level.40 Caregiver information brochures produced by the American Academy of Pediatrics and the Injury Prevention Program are written at the 10th-grade level (range, 6th to 16th grade).41-43 Caregiver information brochures for the expanded newborn screening program are written at the 10th-grade level (range, 9th to 12th grade).43,44 Twenty-six states have enrollment forms for the State Children’s Health Insurance Program that are written above the 10th-grade level.45

LITERACY AND CHILD HEALTH OUTCOMES

Table 3 shows the peer-reviewed studies demonstrating associations between literacy and child health outcomes. Study designs included cross-sectional studies, cohort studies, case-control studies, and randomized controlled trials. The number of participants enrolled varied from 38 to 19,000. Most studies referenced the socioeconomic status of the study sample and included socioeconomic status in a multivariate analysis.

CAREGIVER HEALTH AND HEALTH BEHAVIORS

Several studies have demonstrated a strong independent relationship between low maternal literacy and increased rates of maternal depressive symptoms and decreased breastfeeding. One intervention trial and 2 cross-sectional studies document a strong independent relationship between maternal depression and maternal literacy skills.46-48 Caregiver depressive symptoms decreased in 1 study of an intervention that focused on improving family literacy skills.49 One study showed a strong association between low health literacy and a significantly decreased likelihood (relative risk, 0.4) of exclusive breastfeeding at 2 months postpartum.35

Few other parenting or preventive care behaviors are clearly and independently associated with caregiver literacy skills. In one study, parents with limited literacy skills were no more likely to smoke than parents with adequate literacy,22 while another poorly described study suggests an association between decreased health literacy and maternal smoking rates.50 In an intervention trial of adults with known intellectual disabilities, home safety behaviors improved more significantly in caregivers with better reading skills.51

Dosing over-the-counter medication is significantly more difficult for caregivers with limited literacy or numeracy skills. In a randomized controlled trial, caregivers with limited literacy were more likely to inappropriately dose medications by using spoons, cups, and other nonstandard dosing instruments.52-53 Another multisite
study found that many caregivers of infant children have trouble understanding medication or powdered formula mixing instructions. For example, more than one-third had difficulty dosing liquid acetaminophen with the assistance of a dosing chart. Poorer caregiver understanding of medication or other health-related instructions was significantly correlated with lower literacy or numeracy skills.

**Table 1. Studies Assessing the Health Literacy of Adolescents, Young Adults, or Caregivers of Young Children**

<table>
<thead>
<tr>
<th>Source, y</th>
<th>Age Range, y</th>
<th>Literacy Instrument</th>
<th>Sample Size, No.</th>
<th>Sample</th>
<th>Proportion With Low Health Literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Davis, 2006</td>
<td>10-19</td>
<td>REALM-Teen</td>
<td>1247</td>
<td>School district</td>
<td>34% Below grade level</td>
</tr>
<tr>
<td>Sanders, 2005</td>
<td>12-13</td>
<td>STOFLA</td>
<td>408</td>
<td>Cohort of high-risk urban children</td>
<td>16% Inadequate, 27% marginal</td>
</tr>
<tr>
<td>Young adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kutner, 2006</td>
<td>16-18</td>
<td>NAAL</td>
<td>1546</td>
<td>Nationally representative sample</td>
<td>11% Below basic skills, 23% basic skills</td>
</tr>
<tr>
<td>NCES, 2006</td>
<td>19-24</td>
<td>NAAL</td>
<td>1551</td>
<td>Nationally representative sample</td>
<td>10% Below basic skills, 21% basic skills</td>
</tr>
<tr>
<td>Rudd, 2004</td>
<td>16-29</td>
<td>HALS (NALS)</td>
<td>4696</td>
<td>Nationally representative sample</td>
<td>38% Level 1 or 2 skills</td>
</tr>
<tr>
<td>Caregivers of young children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bennett, 2003</td>
<td>18-39</td>
<td>REALM</td>
<td>98</td>
<td>Urban, low-income, African American</td>
<td>36% &lt; Sixth-grade skills</td>
</tr>
<tr>
<td>Sanders, 2004</td>
<td>18-36</td>
<td>STOFLA</td>
<td>163</td>
<td>Urban, low-income, multiethnic</td>
<td>17% Inadequate or marginal</td>
</tr>
<tr>
<td>Moon, 1998</td>
<td>13-78</td>
<td>REALM</td>
<td>633</td>
<td>Urban and suburban, multiethnic</td>
<td>10% ≤ Sixth-grade skills</td>
</tr>
<tr>
<td>Arnold, 2001</td>
<td>12-45</td>
<td>REALM</td>
<td>600</td>
<td>Urban, low-income, white, and African American</td>
<td>28% African American vs 9% white, ≤ sixth-grade skills</td>
</tr>
<tr>
<td>Fortenberry, 2001</td>
<td>12-55</td>
<td>REALM</td>
<td>1035</td>
<td>Multiethnic, multiethnic</td>
<td>35% ≤ Ninth-grade skills</td>
</tr>
<tr>
<td>Gazmararian, 1999</td>
<td>19-45</td>
<td>STOFLA</td>
<td>406</td>
<td>Multiethnic, SES diverse</td>
<td>Almost 10% low reading skills</td>
</tr>
<tr>
<td>Lindau, 2002</td>
<td>&gt;18</td>
<td>REALM</td>
<td>529</td>
<td>Multiethnic, SES diverse</td>
<td>40% Low literacy (&lt; ninth-grade level)</td>
</tr>
<tr>
<td>Kaufman, 2001</td>
<td>18-35</td>
<td>REALM</td>
<td>61</td>
<td>Urban, multiethnic</td>
<td>36% Low literacy (Seventh- to eighth-grade level)</td>
</tr>
<tr>
<td>Davis, 1994</td>
<td>Not specified</td>
<td>REALM/WRAT-R</td>
<td>396</td>
<td>Rural, Medicaid-insured</td>
<td>28% ≤ Seventh-grade level</td>
</tr>
<tr>
<td>Lokker, 2007</td>
<td>16-35</td>
<td>STOFLA/WRAT3</td>
<td>182</td>
<td>Rural and urban, multiethnic, SES diverse</td>
<td>5% With inadequate literacy skills, 83% with &lt; ninth-grade numeracy skills</td>
</tr>
</tbody>
</table>

**Table 2. Studies Assessing the Readability of Child Health Information**

<table>
<thead>
<tr>
<th>Source, y</th>
<th>Instrument</th>
<th>Types of Health Information</th>
<th>Source</th>
<th>Median Reading Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forbis, 2002</td>
<td>Flesch, FOG, SMOG, FORCAST</td>
<td>Written asthma action plans</td>
<td>10 Guidelines, 8 written with NHLBI</td>
<td>7th-9th grade</td>
</tr>
<tr>
<td>D’Allesandro, 2001</td>
<td>Flesch, SMOG, Fry</td>
<td>Internet-based child health information</td>
<td>Worldwide web</td>
<td>12th grade</td>
</tr>
<tr>
<td>Davis, 1994</td>
<td>Fog Index, Flesch-Kincaid</td>
<td>Child health brochures</td>
<td>AAP, March of Dimes, CDC, Pharma companies</td>
<td>10th (19% &lt; 9th-grade level)</td>
</tr>
<tr>
<td>Davis, 1990</td>
<td>Observed comprehension and reading time</td>
<td>Immunization information</td>
<td>CDC form, LSU form</td>
<td>Grade level unspecified (56% correct, 76% correct)</td>
</tr>
<tr>
<td>Arnold, 2006</td>
<td>Flesch reading ease</td>
<td>Newborn screening information</td>
<td>Brochures from 48 states plus DC</td>
<td>10th (25% &lt; 9th-grade level)</td>
</tr>
<tr>
<td>Sanders, 2007</td>
<td>Lexile, suitability assessment</td>
<td>SCHIP enrollment forms</td>
<td>49 States plus DC</td>
<td>10th (24% &lt; 9th-grade level)</td>
</tr>
</tbody>
</table>

**CHILD HEALTH BEHAVIORS**

Adolescent health behaviors are strongly associated with adolescent literacy skills. Four studies provide good evidence that children and adolescents who read below grade level, compared with children who read at or above grade level, are at increased risk for violent and aggressive behavior. Two other studies demonstrate an associa-
## Table 3. Studies Assessing the Relationship Between Literacy and Child Health Outcomes

<table>
<thead>
<tr>
<th>Source, y</th>
<th>Group Studied</th>
<th>Sample Size, No.</th>
<th>Study Design</th>
<th>Control for SES</th>
<th>Measurement of Literacy (Cut Point)</th>
<th>Child Health Outcome</th>
<th>Relationship With Low Health Literacy</th>
<th>Strength of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weiss, 1992</td>
<td>Women of childbearing age</td>
<td>193</td>
<td>RCT</td>
<td>Income and education</td>
<td>TABE (not specified)</td>
<td>Maternal depressive symptoms</td>
<td>Increased depressive symptoms prior to a literacy training program</td>
<td>B</td>
</tr>
<tr>
<td>Bennett, 2006</td>
<td>Low-income women from an urban obstetric practice</td>
<td>202</td>
<td>C-S</td>
<td>Education</td>
<td>REALM</td>
<td>Use and obstacles to prenatal care Maternal depressive symptoms</td>
<td>No relationship</td>
<td>B</td>
</tr>
<tr>
<td>Poriesky, 2001</td>
<td>Caregivers of children in Head Start</td>
<td>80</td>
<td>RCT</td>
<td>Income and education</td>
<td>REALM (continuous)</td>
<td>Maternal depressive symptoms</td>
<td>Increased depressive symptoms prior to a literacy training program</td>
<td>B</td>
</tr>
<tr>
<td>Arnold, 2001</td>
<td>Low-income pregnant women</td>
<td>600</td>
<td>C-S</td>
<td>Reading level in (place of education)</td>
<td>REALM (continuous)</td>
<td>Smoking</td>
<td>No relationship</td>
<td>B</td>
</tr>
<tr>
<td>Frederickson, 1995</td>
<td>Mothers of infants</td>
<td>646</td>
<td>C-S</td>
<td>Income and education</td>
<td>WRAT (continuous)</td>
<td>Breastfeeding, infant second-hand tobacco exposure</td>
<td>Less likely to breastfeed, more likely to smoke</td>
<td>B</td>
</tr>
<tr>
<td>Llewellyn, 2003</td>
<td>Parents with intellectual disability</td>
<td>45</td>
<td>RCT</td>
<td>Income and education</td>
<td>Neale Reading Ability (continuous)</td>
<td>Caregiver understanding of child home safety</td>
<td>Decreased understanding of child health (r = −0.49; P &lt; .01), life-threatening emergencies (r = −0.87; P &lt; .01), and symptoms of poisoning (r = −0.67; P &lt; .01)</td>
<td>B</td>
</tr>
<tr>
<td>Kaufman, 2001</td>
<td>First-time mothers</td>
<td>61</td>
<td>C-C</td>
<td>Income</td>
<td>REALM (&lt; ninth grade)</td>
<td>Breastfeeding ≥2 mo</td>
<td>Decreased likelihood (RR, 0.4)</td>
<td>B</td>
</tr>
<tr>
<td>Yin, 2007</td>
<td>Caregivers presenting with a child to the emergency department</td>
<td>292</td>
<td>C-S</td>
<td>Education</td>
<td>STOFHLA (marginal)</td>
<td>Dosing of liquid medication</td>
<td>Increased use of nonstandard equipment (eg, spoons) (OR, 2.4)</td>
<td>A</td>
</tr>
<tr>
<td>Kumar, 2007</td>
<td>Parents of children presenting to an out-patient clinic</td>
<td>105</td>
<td>C-S</td>
<td>Income and education</td>
<td>STOFHLA (marginal), WRAT3 (&lt; ninth grade)</td>
<td>Caregiver use of OTC medications and infant formula</td>
<td>Inappropriate use or formula mixing</td>
<td>B</td>
</tr>
<tr>
<td>Loikker, 2007</td>
<td>Parents of children presenting to an out-patient clinic in 1 of 3 states</td>
<td>182</td>
<td>C-S</td>
<td>Income and education</td>
<td>WRAT3 (&lt; ninth grade)</td>
<td>Caregiver use of child OTC cough/cold medications</td>
<td>More likely to inappropriately use OTC medication (adjusted OR 1.3; 95% CI, 1.1-1.6)</td>
<td>A</td>
</tr>
<tr>
<td>Sanders, 2007</td>
<td>Parents of children with asthma</td>
<td>290 Dyads</td>
<td>C-S</td>
<td>Income and education</td>
<td>REALM (&lt; ninth grade)</td>
<td>Maternal depressive symptoms</td>
<td>Increased depressive symptoms</td>
<td>B</td>
</tr>
<tr>
<td>Sanders, 2004</td>
<td>Parents presenting to urban public health clinics for well-child care</td>
<td>183</td>
<td>C-S</td>
<td>Income and education</td>
<td>STOFHLA (marginal)</td>
<td>Caregiver reading aloud with child</td>
<td>Less likely to read aloud, fewer children’s books in the home</td>
<td>B</td>
</tr>
<tr>
<td>Davis, 1999</td>
<td>Middle school</td>
<td>386</td>
<td>C-S</td>
<td>Education</td>
<td>School testing (below grade level)</td>
<td>Adolescent weapons use (firearms, knives) and violent behavior</td>
<td>Increased weapons use (OR, 2.6; 95% CI, 1.1-5.2) and violent behavior (OR, 2.1; 95% CI, 1.6-2.5)</td>
<td>A</td>
</tr>
<tr>
<td>Stanton, 1980</td>
<td>Preteens in New Zealand</td>
<td>779</td>
<td>P-cohort</td>
<td>Income and education</td>
<td>Burt Word Reading Test (continuous)</td>
<td>Child behavior problem</td>
<td>More likely to have behavior problem</td>
<td>B</td>
</tr>
<tr>
<td>McGee, 2002</td>
<td>Preteens in New Zealand</td>
<td>1754</td>
<td>P-cohort</td>
<td>Income and education</td>
<td>Burt Word Reading Test (continuous)</td>
<td>Delinquent behavior</td>
<td>More likely to exhibit antisocial behavior (OR, 2.4)</td>
<td>A</td>
</tr>
<tr>
<td>Miles, 2006</td>
<td>Low-income elementary school students</td>
<td>377</td>
<td>P-cohort</td>
<td>None</td>
<td>Woodcock-Johnson (continuous)</td>
<td>Child aggressive behavior</td>
<td>Increased aggression third grade (r = −0.22; P &lt; .01), fifth grade (r = −0.26; P &lt; .01)</td>
<td>A</td>
</tr>
<tr>
<td>Hawthorne, 1997</td>
<td>Preteens in Australia</td>
<td>3019</td>
<td>C-S</td>
<td>Income and education</td>
<td>Not specified</td>
<td>Preteen tobacco and alcohol use Screening for gonorrhea</td>
<td>More likely to use tobacco and alcohol Decreased screening rates (OR, 0.74; 95% CI, 0.52-0.98)</td>
<td>C</td>
</tr>
<tr>
<td>Fortenberry, 2001</td>
<td>Unspecified</td>
<td>809</td>
<td>C-S</td>
<td>Income and education</td>
<td>REALM (&lt;9th grade)</td>
<td></td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Sanders, 2007</td>
<td>Parents of children with asthma</td>
<td>221</td>
<td>C-S</td>
<td>Income and education</td>
<td>REALM (&lt;9th grade)</td>
<td>Child depressive symptoms</td>
<td>No relationship</td>
<td>B</td>
</tr>
<tr>
<td>Sanders, 2005</td>
<td>Parents presenting to public hospital for general emergency care</td>
<td>290 Dyads</td>
<td>C-S</td>
<td>Income and education</td>
<td>STOFHLA (marginal)</td>
<td>Child use of urgent and preventive care</td>
<td>No relationship</td>
<td>B</td>
</tr>
<tr>
<td>DeWalt, 2007</td>
<td>Parents presenting to public hospital for care of child asthma</td>
<td>150 Dyads</td>
<td>R-cohort</td>
<td>Both</td>
<td>REALM (&lt; ninth grade)</td>
<td>Child use of asthma care</td>
<td>Increased hospitalization (RR, 4.6; 95% CI, 1.8-12) and missed school days (RR, 2.4; 95% CI, 2.3-3.4)</td>
<td>A</td>
</tr>
<tr>
<td>Shone, 2007</td>
<td>Parents of school-aged children with asthma</td>
<td>220</td>
<td>C-S</td>
<td>Income and education</td>
<td>REALM (&lt; ninth grade)</td>
<td>Child use of urgent care</td>
<td>No relationship</td>
<td>A</td>
</tr>
<tr>
<td>Rosenthal, 2007</td>
<td>Parents presenting to public clinic for well-child care before age 48 mo</td>
<td>157</td>
<td>C-S</td>
<td>Income and education</td>
<td>REALM (&lt; ninth grade)</td>
<td>Family-centered care</td>
<td>Decreased family-centered care (73% v 61%; P &lt; .01), no difference in issues discussed</td>
<td>A</td>
</tr>
<tr>
<td>Ross, 2001</td>
<td>Parents of children with diabetes</td>
<td>78 Dyads</td>
<td>C-S</td>
<td>Income and education</td>
<td>National Adult Reading Test (continuous)</td>
<td>Hemoglobin A1c in child T1DM</td>
<td>Increased hemoglobin A1c (r = −0.28; P = .01)</td>
<td>B</td>
</tr>
<tr>
<td>Shone, 2007</td>
<td>Parents of school-aged children with asthma</td>
<td>220</td>
<td>C-S</td>
<td>Income and education</td>
<td>REALM (&lt; ninth grade)</td>
<td>General child health rating</td>
<td>Poor rating of child health (OR, 2.3; 95% CI, 1.1-4.7)</td>
<td>A</td>
</tr>
</tbody>
</table>

Abbreviations: C-C, case-control; CI, confidence interval; C-S, cross-sectional; OR, odds ratio; OTC, over-the-counter; P-cohort, prospective cohort; R-cohort, retrospective cohort; RCT, randomized clinical trial; REALM, Rapid Estimate of Adult Literacy in Medicine; RR, relative risk; SES, socioeconomic status; T1DM, type 1 diabetes mellitus; TABE, Test of Adult Basic Education; WRAT, Wide Range Achievement Test.

aStrength of Evidence criteria were adapted from West et al. Each study was assessed according to the adequacy of study population, comparability of subjects, validity and reliability of the literacy measurement, maintenance of comparable groups, appropriateness of the outcome measurement, appropriateness of statistical analysis, and adequacy of control of confounding.

bControl in a multivariate analysis for at least 1 measure of socioeconomic status (eg, education, income).
tion between adolescents reading below grade level and 2 additional categories of risky behaviors: substance use and acquisition of sexually transmissible illnesses.33,60

USE AND QUALITY OF CHILD HEALTH SERVICES

There is conflicting evidence about the relationship between caregiver literacy and use of child health services, especially in the context of special health care needs. In one study, children of caregivers with low health literacy were found to have decreased access to primary health care and greater unmet health care needs,61 but in another, children of caregivers with low health literacy were no more likely to use emergency health services than children of caregivers with adequate health literacy.62 In a study of children with asthma, emergency department visits and hospitalizations were more likely for children with low-literacy caregivers,63 but in another well-designed study of a similar population, there was no significant association between caregiver literacy and child use of urgent asthma care.64 Though the clinical implications are unclear, parents with low literacy are more likely than those with adequate literacy to report satisfaction with their relationship with the pediatric provider.65

CHILD CHRONIC ILLNESS OUTCOMES

Studies directly assessing child health status indicate that children with chronic illness may be at greater risk for poor health outcomes if their caregiver has limited literacy skills. In 2 small studies of children with diabetes, those who had caregivers with low literacy had worse glycemic control.66,67 In a larger study of children with asthma, after controlling for socioeconomic factors and illness severity, caregivers with low literacy were more likely to judge their children as having fair or poor health.68

Based on this review of the literature, we found significant evidence of limited health literacy skills in the households of young children and significant evidence that most written child health information remains too complex for most US adults to understand. More than 1 in 3 young adults of child-bearing age has limited health literacy. Despite clear standards for developing and delivering low-literacy health information68,69 and specific advice from parents with limited health literacy to make materials more clear,43,70 most written child health information is written above the eighth-grade level—the median grade level of US adults.71

We found limited evidence, however, for a consistent independent relationship between literacy skills and child health outcomes. In fact, only 2 studies examined the relationship between literacy skills and child health status. Still, adjusting for socioeconomic status, adults with low health literacy are between 1.2 and 4 times more likely to exhibit negative parenting or child preventive care behaviors, including maternal depression, errors in closing child medication, and decreased use of preventive-care services. Adolescents with low literacy skills are twice as likely to exhibit antisocial or aggressive behavior, and some studies suggest they are more likely to participate in other risky health behaviors, including substance use and unsafe sexual practices. There are also independent but less consistently documented associations between low caregiver literacy skills and negative child health outcomes among children with asthma and type 1 diabetes.

Several limitations apply to this systematic review. Its conclusions are limited to the quality and availability of peer-reviewed literature. Comparison across studies is made difficult by the variation in measures of health literacy, health outcomes, and the cut points chosen for each study’s analyses. Most studies were cross-sectional, preventing any inferences about causality. Sample sizes and study settings varied considerably, making it difficult to account for variability due to selection bias and to generalize study findings.

Nonetheless, this review supports the hypothesis that caregiver literacy may serve as an important modifiable factor influencing child health disparities. As a result of mounting evidence about the influence of literacy on health outcomes, the Institute of Medicine has identified health literacy as one of the most important cross-cutting themes in efforts to address health disparities, patient safety, and quality improvement.2,72-74 The US Department of Health and Human Services includes health literacy in 5 of the 6 health communications objectives for Healthy People 2010.75 The Joint Commission issued recommendations for hospitals to create accommodations for those with limited health literacy as part of patient safety improvement.76 The American Medical Association has sponsored a nationwide physician training initiative to address health literacy,77 and the American Academy of Pediatrics will soon publish a guidebook on health literacy.

For families with limited health literacy, the complexity of health information may present significant barriers to accessing child health care, threats to child safety, and hurdles to effective management of special health care needs.78,79 To advance our understanding of the clinical significance of literacy in the pediatric context, this review highlights several areas that should be addressed in future research.

BEFTER MEASURES OF HEALTH LITERACY IN CHILD HEALTH

Most tools to measure health literacy are inadequate because they measure only word recognition or reading ability, to the exclusion of the other components of health literacy, which include numeracy skills, oral skills, and navigational skills. Few scales have been developed to specifically assess health literacy in the child-health environment. The REALM-Teen is a word recognition test for adolescents and an adaptation of the REALM.23 A Pediatric Health Activities Test has recently been validated to assess parental health literacy and numeracy skills related to the care of infant children.33 Two scales have recently been developed to assess diabetes-related numeracy in adolescents with diabetes or parents of younger children with diabetes.80

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New measures of pediatric health literacy should take into account the developmental context of child health care and the special health needs of children. Because the health literacy skill set changes along a developmental continuum from childhood through young adulthood, measurement tools should take into account the age and developmental stage of those being assessed (Table 4). Also, measures of pediatric health literacy should be specific to child health needs. Most children and their caregivers, for example, benefit from a set of health literacy skills adequate to meet common preventive health needs (eg, nutrition, development, home safety, vision and lead screening, immunizations) and common acute health needs (eg, fever, dehydration, upper respiratory tract infections, sexually transmitted infections). At least 1 in 10 children and their families, however, require special health literacy skills to meet special health care needs (eg, adherence to chronic medication regimens, frequent blood glucose monitoring, care of tracheostomy or gastrostomy tubes, seizures, pain crises). Little is known, for example, about the influence of adults’ health literacy on their children’s health literacy or about the cognitive capacity, efficacy, and safety of children managing their own special health care needs.

### INTERDISCIPLINARY COLLABORATION

Better measures of pediatric health literacy could help contribute to an interdisciplinary model that places health literacy in the context of other social determinants of child health, such as that suggested in Figure 2. Given the dependence of children on many caregivers, studies of pediatric health literacy may want to consider the “collective health literacy” of all people responsible for that child’s health care—including the child, parents, siblings, family members, school staff, and others—as a form of social capital.

To better understand the role of literacy in child health, interdisciplinary collaboration is needed across many...
fields, including sociology, public health, education, psychology, nursing, pharmacy, health communications, health informatics, health services research, social marketing, and health economics. Most of this scholarly work can be integrated into conventional health research settings such as large hospital systems or clinical research networks. This review suggests that the most clinically significant associations between health literacy and child health occur in the settings of highest clinical demand, especially newborn care and the care of children with special health care needs.

**INTERVENTION RESEARCH**

Both targeted and population-based interventions should be developed to address health literacy–based disparities in child health. In addition to clinical research, pediatric health research should involve community-based, participatory research in nonclinical settings, including postpartum home visits, early child care centers, kindergarten through 12th-grade classrooms, adult education classrooms, out-of-school programs, and parenting programs. At least 4 categories of intervention could be subjected to rigorous evaluation that includes measures of both health literacy and child health outcomes: (1) reducing the complexity of child health information (eg, pictograms, interactive video)\(^{30-35}\); (2) enhancing shared decision-making and communication skills of child health professionals\(^{36-39}\); (3) easing a family’s navigation of the child health system (eg, patient navigators, telephone systems, waiting-room kiosks)\(^{40-42}\); and (4) directly improving the health literacy of children and their caregivers (eg, postpartum nurse home visits, kindergarten through 12th-grade curricula, adult skills education)\(^{43,44}\).

**CONCLUSION**

Addressing health literacy should be part of any effective framework for improving the delivery of quality child health services. Research in pediatric health literacy, however, is in its infancy. This review of the literature points to gaps in knowledge, especially regarding the normal progression of health literacy skills from childhood through parenthood, the relationship between health literacy and child health outcomes, and the most effective interventions for addressing health literacy in the pediatric setting. Child health care providers, researchers, and policy makers can work together to fill these gaps with innovative multidisciplinary approaches designed to increase the collective health literacy of the nation’s children and families.

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