Health Literacy and Child Health Outcomes: A Systematic Review of the Literature

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KEY WORDS
health literacy, literacy, health disparities, child health outcomes

ABBREVIATIONS
REALM—Rapid Estimate of Adult Literacy in Medicine
TOFHLA—Test of Functional Health Literacy in Adults
CINAHL—Cumulative Index to Nursing and Allied Health Literature

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abstract

OBJECTIVES: To review the relationship between parent and child literacy and child health outcomes and interventions designed to improve child health outcomes for children or parents with low literacy skills.

METHODS: We searched Medline and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) for articles published from 1980 through 2008 and included studies that reported original data, measured literacy and ≥1 health outcome, and assessed the relationship between literacy and health outcomes. Health outcomes included health knowledge, health behaviors, use of health care resources, intermediate markers of disease status, and measures of morbidity. Two abstractors reviewed each study for inclusion. Included studies were abstracted into evidence tables and were assessed by using an 11-item quality scale.

RESULTS: We reviewed 4182 new titles and abstracts published since 2003. Fifty-eight articles were retained for full review, and 13 met the inclusion criteria. Eleven articles from the systematic review from 1980 to 2003 met the inclusion criteria, giving us a total of 24 articles. Children with low literacy generally had worse health behaviors. Parents with low literacy had less health knowledge and had behaviors that were less advantageous for their children's health compared with parents with higher literacy. Children whose parents had low literacy often had worse health outcomes, but we found mixed results for the relationship of literacy to the use of health care services. Interventions found that improving written materials can increase health knowledge, and combining good written materials with brief counseling can improve behaviors including adherence. The average quality of the studies was fair to good.

CONCLUSIONS: Child and parent literacy seems associated with important health outcomes. Future research can help us understand under what circumstances this relationship is causal, how literacy and health outcomes are related in noncausal pathways, the relative importance of parent and child literacy, and what interventions effectively reduce health literacy–related disparities. *Pediatrics* 2009;124: S265–S274

Health literacy is recognized by the Institute of Medicine as a critical component of high-quality health care.[1] Researchers have documented the relationship between low literacy skills and worse health outcomes.[2] Because of the strength of this relationship, and because large segments of most societies have low literacy skills,[3,4] many programs, including Healthy People 2010,[5] address the role of literacy or health literacy for improving population health. Research that assesses the relationship between literacy and health outcomes and testing interventions to mitigate the effects of low health literacy is becoming much more common in the medical and public health literature.

In health care policy and research, the term "health literacy" is often applied to a set of skills that are required to function well in the health care or public health setting. Although a useful construct, our ability to measure health literacy as a single variable is limited. Rather, research to date has focused mostly on reading ability as a proxy measure for health literacy.[1,6–8] Some measures of reading ability use health care words or paragraphs that contain health-related content to assess research participants, but such instruments (such as the Rapid Estimate of Adult Literacy in Medicine [REALM] and Test of Functional Health Literacy in Adults [TOFHLA]) are highly correlated with generic reading tests and still focus on the skill of reading or interpreting information rather than a broader set of functional skills.[2] The full TOFHLA has some items related to math skills, but they are few and are not used in most studies. As such, the body of research to date has reported the evaluation of the relationship between reading ability and health. We do not raise this issue as a limitation of current research but, rather, to clarify our understanding of health literacy. To remind the reader that research has focused on reading ability, we will refer to the exposure variable as literacy rather than the broader construct of health literacy.

The role of literacy in health care has been less extensively studied for child health compared with adult health. In a systematic review of the literature from 1980 to 2003, we found 44 articles that addressed the relationship between literacy and health outcomes and 10 that addressed the effects on child health outcomes.[2] Most of those studies examined parental knowledge as the outcome of interest. More recently, the authors of 2 review articles discussed the role of health literacy in pediatric health care and pointed to the need for further development and understanding of this field of research.[9,10]

In this article, we summarize the current evidence of the relationship between literacy and child health outcomes, review interventions designed to mitigate the effects of low literacy on child health outcomes, and expose areas of needed research.

METHODS

This systematic review is an extension of the systematic review we performed for the Agency for Healthcare Research and Quality in 2004.[8] For this review, we included articles published through September 2008 and focused our attention on studies that evaluated the role of child or parent literacy and child health outcomes.

In this systematic review, we examine the following key questions:

1. Are caregiver or child literacy skills related to health outcomes?
2. What interventions have been studied to improve health outcomes for children who have low literacy or who have parents with low literacy, or to reduce disparities in health outcomes associated with low literacy?

Inclusion and Exclusion Criteria

On the basis of the key questions, we generated a list of inclusion and exclusion criteria, which have been listed in previous publications.[2,11] Briefly, we limited studies to those with outcomes related to health and health services and that measured literacy skills with a valid instrument. We defined a valid instrument as one that had previously been used in a published study or one that compared with other published instruments. Studies were not systematically excluded if they measured other aspects of literacy (writing or listening). In contrast to our previous review, we only included studies that evaluated child health outcomes.

To be included, studies had to (1) be conducted in a developed country (defined as the United States, Canada, Western Europe, Japan, Australia, or New Zealand), (2) be published from 1980 to 2008, (3) be written in English, (4) study >10 subjects, (5) measure literacy directly among participants, (6) measure a child health outcome or caregiver behavior directly related to child health, and, if an intervention, (7) use a controlled or uncontrolled experimental design and (8) measure the effect of an intervention on at least 1 health outcome. We defined eligible health outcomes to be:

- health knowledge, assessed by an objective scale;
- health behaviors;
- biochemical or biometric health outcomes with recognized relationships to illnesses or health conditions;
- measures of disease incidence, prevalence, morbidity, and mortality;
- self-reported general health status;
- utilization of health services; and
- cost of care.

Literature Search

We used the articles identified in our previous systematic review, and the literature search was well described in previous publications.[2,11] To update the literature search to 2008, we performed a search for pediatrics articles (children aged 0–18 in PubMed) published from 2003 through 2008. For the updated search, we searched for the key words "literacy," "WRAT," "REALM," "TOFHLA," "numeracy," "reading ability," "reading skill," "wide range achievement," "rapid estimate of adult," and "test of functional health" in the titles and abstracts of articles. We performed the search by using PubMed and the Cumulative Index to Nursing and Allied Health (CINAHL), because those databases identified 98% of the articles for our previous systematic review.[2] A PubMed search was first conducted by using each key word. We did not exclude duplicate references with each key-word search. However, only unique articles were retained for full review for each search. Then, a CINAHL search excluding PubMed references was performed to find additional unique articles.

Article Selection and Review

One reviewer initially evaluated titles and abstracts and excluded articles that did not measure literacy or a health outcome. All other articles went to a full review by both authors. Disagreements were reconciled by discussion. A reviewer (Ms Hink) entered data from included articles into an evidence table, and the second reviewer (Dr DeWalt) then examined the articles and edited the table entries for accuracy.

Evaluation of Quality and Strength of Evidence

We graded each study according to the adequacy of study population, comparability of subjects across comparison groups, 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.[8] We converted our quality ratings for each item into numeric values (0 = poor, 1 = fair, and 2 = good) and created a composite rating for each study, giving each item equal weight; we excluded items that were judged not applicable on the basis of study design. We totaled the score for each evaluator and then averaged the results for applicable elements.[8] Although our rating scale is based on previously used quality assessments, it should be interpreted with caution because it has not been validated.

TABLE 1 Literature Search Results From January 1, 2003, to September 1, 2008

Database and Key Word	Total References Identified, *N*	Articles Excluded at Abstract Review Phase, *n*	Articles Retained for Full Review, *n*	Articles Rejected After Full Review, *n*	Articles Included, *n*
Medline					
Literacy	1910	1859	51	40	11
WRAT	37	36	1	0	1
REALM	1063	1063	0	0	0
Reading ability	276	275	1	1	0
Numeracy	152	151	1	1	0
Reading skill	53	53	0	0	0
TOFHLA	34	34	0	0	0
Wide range achievement	0	0	0	0	0
Rapid estimate of adult	0	0	0	0	0
Test of functional health	0	0	0	0	0
CINAHL					
Literacy	519	517	2	1	1
WRAT	116	116	0	0	0
REALM	112	112	0	0	0
Reading ability	31	31	0	0	0
Numeracy	16	16	0	0	0
Reading skill	2	2	0	0	0
TOFHLA	3	3	0	0	0
Wide range achievement	3	3	0	0	0
Rapid estimate of adult	4	4	0	0	0
Test of functional health	4	4	0	0	0
Total	4335	4279	56	43	13

WRAT indicate Wide Range Achievement Test.

RESULTS

Table 1 shows the full search results. From our original systematic review, we identified 11 articles that addressed child health outcomes, 2 of which also evaluated interventions. From our updated search, we identified 13 articles: 11 articles addressed key question 1, and 3 articles addressed key question 2.

Key Question 1: Are Caregiver or Child Literacy Skills Related to Health Outcomes?

Study Characteristics

Most studies were designed as cross-sectional or longitudinal data collection and ranged in size from 30 to 3019 participants (Table 2). Fifteen studies measured parental literacy as the exposure of interest, and 6 studies measured child literacy. Only 1 study measured both.[12] Most studies presented descriptive information on the participants' age, ethnicity, and insurance status. Some of them included these important covariates in their multivariate analysis.

Literacy was measured most often by using the REALM[13] or the TOFHLA.[14] Some studies used other validated tests of reading ability. Some of the

TABLE 2 Studies on the Relationship Between Literacy and Child Health Outcomes

Author	Instrument/Cut Points	Level of Measurement	Outcome Assessed	Literacy Relationship	Quality
Knowledge					
Campbell et al[17] (2004)	REALM; Woodcock Johnson Psycho-Educational Battery-Revised, part 2/8th grade	P	Knowledge about consent information for pediatric research studies	LL was best predictor of poor understanding of consent materials ($P < .0001$)	G
Cho et al[21] (2007)	REALM-7/continuous	P	Knowledge and understanding about prenatal screening for fetal aneuploidy and neural tube defects	LL less knowledge and understanding ($P < .01$)	F
Davis et al[18] (1996)	REALM/9th, 6th, and 3rd grade	P	Comprehension of polio vaccine brochures written at 10th- and 6th-grade reading levels	LL less comprehension of both brochures; brochure written at 6th-grade reading level better understood by those at ≥6th-grade reading level (both $P < .0001$)	G
Davis et al[22] (1998)	REALM/9th, 6th, and 3rd grade	P	Comprehension of 2 polio vaccine brochures (modified CDC and novel brochure) written at 6th-grade reading level	LL less global comprehension of either brochure; overall, novel brochure had better comprehension (both $P < .01$); no statistically significant difference among those at <9th-grade level	G
Davis et al[19] (2006)	REALM/9th grade	C	Knowledge about oral contraceptive pills	LL less knowledge ($P < .01$)	F
DeWalt et al[23] (2007)	REALM/9th grade	P	Knowledge about asthma	LL less knowledge ($P < .001$)	G
Moon et al[20] (1998)	REALM/continuous	P	Knowledge about child health care	No relationship	G
Wilson et al[16] (2008)	REALM/continuous	P	Recall knowledge about childhood immunizations with brochure and teach-back method	LL less knowledge ($P = .02$)	F
Yin et al[15] (2007)	TOFHLA	P	Knowledge that liquid medication dosing is weight based	LL less knowledge about weight-based dosing compared with caregivers with adequate health literacy (61.2% vs 85.3%; $P < .001$)	G
Health services					
DeWalt et al[23] (2007)	REALM/9th grade	P	Asthma ED visits and hospitalization	LL more likely to visit ED (IRR: 1.4 [95% CI: 0.97–2.0]) LL more likely to be hospitalized (IRR 3.2 [95% CI: 1.8–12])	G
Moon et al[20] (1998)	REALM/continuous	P	Parental report of No. of hospitalizations in the past	No relationship	G
Rosenthal et al[24] (2007)	REALM/9th grade	P	Subjective quality of anticipatory well-child care	LL higher-quality family-centered care ($P = .01$) and helpfulness/confidence building ($P < .006$); no difference in other domains	G
Sanders et al[25] (2007)	S-TOFHLA/IMA	P	Child health care use Child access to care Cost of child health care	No difference according to literacy	G
Health behaviors					
Conwell et al[32] (2003)	WRAT/Score of 85	C	Adolescent tobacco smoking	LL more likely to smoke ($P < .001$, relationship was significant for boys only)	G
Davis et al[19] (2006)	REALM/9th grade	C	Adherence to oral contraceptive pills	No relationship	F
Davis et al[27] (1999)	Slosson Oral Reading Test/2 grades behind	C	Adolescent gun-carrying Adolescent fighting	LL more likely to carry gun (OR: 2.6 [95% CI: 1.1–6.2]) LL more likely to fight (OR: 3.1 [95% CI: 1.6–6.1])	G
Fredrickson et al[31] (1995)	WRAT/continuous	P	Rate of parental smoking Rate of breastfeeding Lack of private health insurance	LL more likely to smoke ($P < .05$) LL less likely to breastfeed ($P < .05$) LL less likely to have private health insurance ($P < .05$)	P

TABLE 2 Continued

Author	Instrument/Cut Points	Level of Measurement	Outcome Assessed	Literacy Relationship	Quality
			Obesity	No relationship to obesity	
Hawthorne[29] (1997)	Not specified	C	Preteenaged tobacco use	LL more likely to use tobacco in past month (boys, OR: 4.2 [95% CI: 2.0–8.9]; girls, OR: 4.4 [95% CI: 1.8–10.7])	F
			Preteenaged alcohol use	No relationship to alcohol use	
Kaufman et al[28] (2001)	REALM/9th grade	P	Percent breastfeeding for ≥2 mo	LL less likely to breastfeed at least 2 mo ($P = .018$) (calculated RR: 0.4)	F
Sleath et al[26] (2006)	REALM/9th grade	P	Reported barriers to giving medication to children	LL more likely to report barriers ($P = .014$)	F
Stanton et al[30] (1990)	Burt Word Reading Test/continuous	C	Problem behavior in children	LL more likely to have problem behavior ($P < .01$)	F
Yin et al[15] (2007)	TOFHLA/IMA	P	Use of nonstandardized medication-dosing instruments	LL more likely to report use of a nonstandardized dosing instrument (34.7% vs 19.2%; $P = .01$)	G
Health outcomes					
Andrasik et al[33] (1988)	WRAT/continuous	C	Migraine headaches in children	No relationship	F
DeWalt et al[23] (2007)	REALM/9th grade	P	Child asthma severity	LL asthma more severe ($P = .03$)	G
			Child asthma medication use	LL more frequent medication use ($P = .03$)	
			Child missed school days because of asthma	LL more likely to miss school (IRR: 2.8 [95% CI: 2.3–3.4])	
Gong et al[34] (2007)	TOFHLiD	P	Parent-reported child dental health	No relationship	G
Ross et al[12] (2001)	National Adult Reading Test/continuous	P, C	Child diabetes control	Correlated with literacy ($r = 0.28$; $P = .01$)	G
Zaslow et al[35] (2001)	TALS/level 1 or 2	P	Child depressive symptoms and withdrawn behavior problems	LL more likely to have children with depressive symptoms and withdrawn behavior ($P < .001$)	G

S-TOFHLA indicates Short-TOFHLA; WRAT, Wide Range Achievement Test; IMA, inadequate, marginal, adequate; TOFHLiD, Test of Functional Health Literacy in Dentistry; TALS, Test of Applied Literacy Skills; P, Parent; C, Child; CDC, Centers for Disease Control and Prevention; ED, emergency department; LL, lower literacy; HL, higher literacy; RR, relative risk; IRR, Incidence rate ratio; OR, odds ratio; G, good; F, fair; P, poor.

tests were based on health care words or phrases, and others were generic reading tests.

Relationship Between Literacy and Knowledge Outcomes

Nine studies measured the relationship between literacy and knowledge regarding health outcomes, behaviors, or services (Table 2).[15–23] Eight of these studies examined parental literacy as the exposure of interest, and all but one[20] revealed that people with lower literacy had less knowledge about health outcomes, behaviors, and health services.

Relationship Between Literacy and Use of Health Care Services

Four studies evaluated the relationship between literacy and use of health care services.[20,23–25] All studies were of young children, and parental literacy was the exposure of interest. One study showed that asthmatic children of parents with low literacy have higher rates of hospitalizations and emergency department visits even after controlling for potential confounding variables.[23] The study by Sanders et al,[25] which was not limited to 1 disease, did not find statistically significant relationships between literacy and preventive care, emergency or hospital care, or cost. Moon et al[20] did not find a relationship between literacy and previous hospitalizations or number of chronic diseases. In a qualitatively different study of health services, Rosenthal et al[24] found that parents with low literacy were more likely than those with higher literacy to report family-centered care, helpfulness, and confidence building after an appointment with a physician.

Relationship Between Literacy and Health Behaviors

Nine studies evaluated the relationship between literacy and health behaviors.[15,19,26–32] All studies analyzed behavior of the person whose literacy was measured, and 5 studies measured child literacy. Davis et al[27] and Stanton et al[30] both evaluated adolescent literacy and problem behaviors including fighting and gun-carrying. After controlling for race, gender, and age, Davis et al found that adolescents with lower literacy

were more likely to fight and carry guns than those with higher literacy. Stanton et al assessed regression models that included variables for family adversity, early problem behavior, and school-age IQ and found that literacy was most correlated with problem behavior. Hawthorne[29] found that adolescents with lower literacy were more likely to use alcohol and tobacco than those with higher literacy. Conwell et al[32] found that 14-year-olds with lower literacy were more likely to smoke tobacco than those with higher literacy, although this finding was only significant among boys. Davis et al[19] evaluated adherence to oral contraceptive pills and found that one third of the sample had missed 1 or 2 pills in the previous 2 weeks, but missing the pill was not related to literacy.

Four studies measured literacy and behavior among parents or caregivers.[15,26,28,31] Yin et al[15] found that caregivers with low literacy were more likely to use a nonstandard dosing instrument when administering liquid medication to infants. Kaufman et al[28] found that mothers with low literacy were less likely to continue breastfeeding for ≥2 months. Sleath et al[26] found that homeless women with low literacy were more likely to report barriers for giving medications to their children than homeless women with higher literacy.

Relationship Between Literacy and Health Outcomes

Five studies attempted to examine the relationship between literacy and health outcomes.[12,23,33–35] Two studies measured child literacy and the outcome of interest.[12,33] Andrasik et al[33] found no relationship between literacy among children and migraine headaches. Ross et al[12] found no relationship between child literacy and glycemic control among children aged 5 to 17 years with diabetes, but it is interesting to note that they did find a relationship between maternal literacy and the child's glycemic control.

Three studies measured only parental literacy and evaluated the child's health outcome. Zaslow et al[35] evaluated maternal literacy, maternal depression, and children's scores on depressive/withdrawn measurement scales. Children of mothers with more depressive symptoms had more depressive/withdrawn symptoms only in the presence of low maternal literacy. The positive interaction between maternal literacy and depression on child depressive symptoms indicates that literacy may be a mediating variable between parental and child health outcomes. Gong et al[34] found no relationship between parental literacy and parents' reports of their child's oral health. DeWalt et al[23] found that children with parents who have low literacy are more likely to have moderate or severe persistent asthma and miss more school days because of asthma compared with children whose parents have higher literacy.

Key Question 2: What Interventions Have Been Studied to Improve Health Outcomes for Children Who Have Low Literacy or Who Have Parents With Low Literacy, or to Reduce Disparities in Health Outcomes Associated With Low Literacy?

We identified 5 studies that measured literacy in the child or the parent and studied the effect of an intervention on health outcomes (Table 3).[17,18,22,36,37] The intervention for 4 studies was targeted for the parents, and all 4 studies were in the context of children younger than 5 years.[17,18,22,37] All 4 of those studies were controlled clinical trials,[17,18,22,37] and 3 stratified their results according to literacy level.[17,18,22]One uncontrolled study targeted the intervention for the children (aged 6 to 14 years) themselves.[36]

Interventions to Improve Health-Related Knowledge

Four studies measured knowledge as 1 of the outcomes.[17,18,22,37] Two studies by Davis et al[18,22] demonstrated that well-designed written materials can improve comprehension across the continuum of reading ability, but the disparity in comprehension between good and poor readers remained about the same.

Campbell et al[17] evaluated the understanding of informed consent by using 4 different strategies for delivering information: (1) original consent form; (2) enhanced easy-to-read consent form; (3) computer-based presentation; and (4) video. Of the 4 methods, they found that the enhanced written materials were as effective as the video and computer-based materials for the total sample. In the subgroup of parents who read below the 9th-grade level, the enhanced written materials were generally superior to all other methods.

Yin et al[37] tested a pictogram-based medication-instruction sheet combined with brief counseling and teach-back sessions. Parents who received the intervention had more knowledge about the medication and dose frequency compared with those in a usual-care control group.

Interventions to Improve Health Behaviors

One study measured actual health behaviors; Yin et al[37] measured parent-reported medication dosing and observed parents preparing a medication dose. Parents in the intervention group were more likely to use the correct dose. They also found that the parents in the intervention group had greater self-reported adherence to the prescribed medication regimen. Although not stated in the article, the author confirmed that effect sizes were similar for parents with low literacy

TABLE 3 Interventions to Improve Child Health Outcomes by Addressing Child or Low Caregiver Literacy

Author	Study Design	Literacy Measure	Level of Measurement	Type of Intervention	Intervention	Outcome Description	Quality
Campbell et al[17] (2004)	RCT	REALM; Woodcock Johnson Psycho-Educational Battery-Revised, Part 2	P	Modified print, video, and computer	Consent information for a high- and low-risk pediatric study was presented via modified print, video, and laptop presentation compared with original print materials	Recall of consent information positively correlated with literacy ($P < .001$); modified print materials equivalent or superior to original print, video, and computer materials for parents with LL	G
Davis et al[18] (1996)	NRCT	REALM	P	Brochure	Polio vaccine information pamphlet written at 6th-grade level, compared to standard pamphlet (10th-grade level)	LL intervention pamphlet elicited better comprehension than the standard pamphlet ($P < .0001$), but not for readers at ≤3rd-grade reading level	G
Davis et al[22] (1998)	NRCT	REALM	P	Brochure	Locally designed polio vaccine pamphlet (intervention) written at <9th-grade reading level, compared with an improved CDC pamphlet, also written at <9th-grade level	Readers of intervention pamphlet had higher comprehension than readers of the CDC pamphlet ($P < .01$); comprehension improved with intervention pamphlet among those at ≥9th-grade reading level ($P < .001$) but not those below; the intervention was easier to read overall	G
Robinson et al[36] (2008)	UCT	Gilmore Oral Reading Test	C	Classes and camp	Asthmatic children attended 2-h literacy and asthma education classes on Saturdays for 6 mo and a 5-d camp	ED asthma-related visits dropped from 63% 6 mo before study to 33% 6 mo after study; improved self-efficacy decreased ED visits (OR: 0.27; $P < .01$) and hospitalizations (OR: 0.33; $P < .001$); improved reading level not directly associated with hospitalizations	F
Yin et al[37] (2008)	RCT	TOFHLA	P	Pictogram-based instructions and counseling	Parents of children taking daily and as-needed liquid medications were randomly assigned to receive pictogram-based medication instruction sheets with teach-back counseling or standard care	Intervention caregivers significantly less likely to make errors in dosing frequency ($P = .0007$ daily), less likely to report incorrect medication preparation ($P = .04$ daily; $P = .0006$ as needed), and more likely to report using a standardized dosing instrument ($P = .008$ daily; $P = .002$ as needed)	G

RCT indicates randomized, controlled trial; NRCT, non–randomized, controlled trial; UCT, uncontrolled trial; P, Parent; C, Child; CDC, Centers for Disease Control and Prevention; LL, lower literacy; HL, higher literacy; OR, odds ratio; ED, emergency department; G, good; F, fair.

and those with higher literacy (H. S. Yin, MD, MS, personal communication, September 12, 2008).

Interventions That Measured Use of Health Services

Robinson et al[36] performed an innovative intervention for children with asthma and studied it with a before/after research design. Children with asthma were enrolled in a reading-skills and asthma-education program. They measured hospitalization and emergency visits in the 6 months before the start of the intervention and over the first 6 months of the intervention. Of the children enrolled, 63% had an emergency visit before the intervention, and only 33% had an emergency visit during the intervention. Likewise, 37% had been hospitalized preceding the intervention, and only 22% had been hospitalized during the intervention. Using multivariate modeling, they found that children whose reading improved the most were least likely to have repeat emergency visits.

DISCUSSION

This body of research indicates that low parental literacy is related to worse health outcomes, particularly for young children. Lower-than-average literacy among adolescents seems to be related to more risk-taking or violent behaviors. Our overall understanding of the relative

importance of parental and child literacy over the continuum of development is weak.

As observed in our previous systematic review, health-related knowledge is almost always associated with literacy. Although knowledge is often not closely associated with health outcomes, health-behavior experts assert that all health-behavior theories assume adequate knowledge.[38] As such, it is important to not ignore this meaningful relationship.

Few studies have examined the impact of knowledge-related interventions stratified according to literacy level. The studies that have done so have had mixed results.[11] In some cases, improved written materials were better for everyone but did not reduce the gap in knowledge between those with higher literacy and those with lower literacy.[18,22] The study by Campbell et al[17] showed a greater effect of the enhanced written materials among those with the lowest literacy. Future studies should focus on the health information that is most closely related to behaviors and outcomes when they evaluate changes in knowledge from intervention. We often refer to this as the "need to know and need to do."[39] As in the study by Yin et al,[37] measuring behaviors closely related to knowledge is another advance in this type of research.

We did find that low literacy is associated with a variety of adverse health behaviors among parents and adolescents. Many of the behaviors, such as smoking, violence, and lack of breastfeeding, are likely to have other societal influences related to but not caused by low literacy. However, some behaviors such as adherence, correct dosing, and ability to get medicines could have a more direct link to the ability to read and understand health care–related instructions. These relationships are still quite unclear given the numerous studies that have not found a relationship between literacy and adherence.[19,40] We may conclude that understanding what one needs to do is necessary, but not sufficient, for adherence to medical recommendations.

Fewer studies have evaluated the relationship between caregiver or child literacy and health service use or health outcomes. Although most studies have shown a relationship between parental literacy and child health outcomes, some have presented negative findings, which prevents us from drawing firm conclusions. Although DeWalt et al[23] found that children with asthma who have parents with low literacy skills had higher incidence of emergency department visits, hospitalizations, and missed school days, Sanders et al,[25] who studied a broader sample of children, did not find a relationship between parental literacy and children's health service. Moon et al[20] also did not find more hospitalizations or chronic illnesses for children whose parents had lower literacy. These findings suggest that not all situations lead to health literacy–related disparities, and research is needed to enhance our understanding of those situations that may respond to literacy-sensitive interventions.

One of the most challenging aspects of studying the role of literacy or health literacy for children's health is taking into account the relative responsibility of the parent and the child for the child's health outcome. Maturational cognitive abilities may affect a child's ability to understand and implement self-care.[41] Moreover, children demonstrate variations in their ability to engage in self-care within the same age group, and parents use different cues to determine the child's readiness to assume self-care.[42–44] Child maturity, initiation of self-care activities, self-concept, family support and organization, shared decision-making with medical providers, maternal self-efficacy, duration of disease, the perceived disease knowledge of the child, child academic achievement, and participation in outside activities have been found to influence the transfer of medical care activities from parent to child.[45–49] Parents of children with chronic medical needs often transfer self-care responsibilities when their child is between the ages of 11 and 15 years.[49,50] Oftentimes adolescents do not implement the necessary level of self-care activities when the transfer of care occurs, which results in poorer health outcomes.[45,51] Parent or child literacy may also influence the transfer of care. We suggest that studies examining the role of literacy in childhood health outcomes focus on parental literacy among children younger than 7 years and child literacy for children in their late teenage years. When studying children between those ages, it would be worthwhile to measure both parent and child literacy to determine their degree of association to health outcomes during the "transition" years. Of course, these ages are approximate and will vary on the basis of the health behaviors and outcomes under study.

We found relatively few studies of interventions to improve child health outcomes for children or parents with low literacy. Most studies have demonstrated improving knowledge. One study improved important health behaviors (giving the correct medication dose and completing the regimen).[37] The studies by Yin et al[37] and Davis et al[18,22] demonstrated improvement across all levels of literacy but not a reduction in the disparity between parents with low and higher literacy. We are particularly interested in those that could narrow the gap in outcomes between low and higher literacy, but few studies in adult health have demonstrated such effects,[52,53] and no studies in child health have done so thus far.

From this relatively small number of studies, it is difficult to draw conclusions about the cause-and-effect relationship between literacy and child

health outcomes. Although there is a strong relationship between literacy and the measured outcome, particularly knowledge, the nonexperimental nature of the study designs leaves us wondering whether important other factors explain the relationship between literacy and the outcome. Many studies attempted to adjust for age, socioeconomic status, race/ethnicity, and insurance status, but such statistical adjustment does not ensure detection of a causal relationship. Intervention studies that target the effects of low literacy and find a reduction in the relationship between literacy and the outcome could help to increase our confidence that the literacy-outcome relationship is causal.

Our findings reflect the quality of the published literature. Most studies were cross-sectional design, and many did not control for important covariates in the analysis. By limiting our inclusion to the published English-language literature and to studies that have measured literacy in the population of interest, we may have excluded some interventions that could be effective for patients or caregivers with low literacy skills. However, exclusion of those studies was necessary, because literacy measurement was required to answer questions about the role of literacy. Our ratings of quality are approximate and meant to address the ability of the study to answer our questions of interest. Some studies may have been focused on other questions for which they are "good" but had "fair" data related to the relationship between literacy and health. Finally, it is important to recognize that the current research literature documents the relationship between reading ability and health outcomes rather than the broader construct of health literacy.

Some view the fact that health literacy measures do not address every possible facet of health literacy as a limitation, but we do not hold that opinion. This body of research has identified an important measured variable that predicts disparities in health outcomes. This variable, mostly reading ability for prose and documents, may lend itself very well as a target for interventions, as demonstrated in this review and research in adults.[11,52–54] Efforts to measure health literacy broadly may identify other areas to target for intervention, but that should not prevent us from pursuing interventions that mitigate this important disparity.

This review has important implications for researchers and practitioners who are interested in child health. Practitioners should consider the role of literacy and use interventions such as those described by Yin et al,[37] Robinson et al,[36] Campbell et al,[17] and Davis et al,[18,22] which can improve health behaviors and health outcomes.

CONCLUSIONS

Researchers should seize on the emerging recognition of the importance of literacy for child health outcomes. We need to expand our understanding of the relative roles of caregiver and child literacy. Studies to identify the key health literacy skills needed by children as they transition to self-management can lead to better curricula for clinician training and primary and secondary schools. We need a better understanding of the relationship between knowledge and behaviors so that our interventions can affect behaviors that are most closely associated with positive health outcomes. Finally, interventions should improve outcomes for all patients but also narrow the gap in outcomes between people with low and higher literacy.

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