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Low Caregiver Health Literacy is Associated with Higher Pediatric Emergency Department Use and Non-urgent Visits

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Abstract

Objective—We sought to determine the association between low caregiver health literacy and child emergency department (ED) use, both the number and urgency of ED visits.

Methods—This year long cross-sectional study utilized the Newest Vital Sign to measure the health literacy of caregivers accompanying children to a pediatric ED. Prior ED visits were extracted from a regional database. ED visit urgency was classified by resources utilized during the index ED visit. Regression analyses were used to model the outcomes: 1) prior ED visits and 2) ED visit urgency, stratified by chronic illness. Analyses were weighted by triage level.

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Contributor's Statement:

Andrea K. Morrison: Dr. Morrison conceptualized and designed the study, submitted the IRB, designed the data collection instruments, trained research assistants, coordinated and supervised data collection, participated in acquisition of the data, carried out the initial data analysis and interpretation, drafted the initial manuscript, and approved the final manuscript as submitted.

Marilyn M. Schapira: Dr. Schapira participated in study conceptualization and design, critically reviewed the manuscript, and approved the final manuscript as submitted.

Marc H. Gorelick: Dr. Gorelick participated in study conceptualization and design, critically reviewed the manuscript, and approved the final manuscript as submitted.

Raymond G. Hoffmann: Dr. Hoffmann participated in study conceptualization and design, aided with data analysis by providing statistical expertise, critically reviewed the manuscript, and approved the final manuscript as submitted.

David C. Brousseau: Dr. Brousseau participated in study conceptualization and design, aided with data analysis, critically reviewed the manuscript, and approved the final manuscript as submitted.

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Andrea K. Morrison, MD, MS had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Results—Overall, 503 caregivers completed the study; 55% demonstrated low health literacy. Children of caregivers with low health literacy had more prior ED visits (aIRR 1.5; 95% C.I.1.2, 1.8) and increased odds of a non-urgent index ED visit (AOR 2.4; 1.3, 4.4). Among children without chronic illness, low caregiver health literacy was associated with an increased proportion of non-urgent index ED visits (48% vs 22%; AOR 3.2; 1.8, 5.7).

Conclusions—Over half of caregivers presenting with their children to the ED have low health literacy. Low caregiver health literacy is an independent predictor of higher ED use and use of the ED for non-urgent conditions. In children without a chronic illness, low health literate caregivers had more than three times great odds of presenting for a non-urgent condition than those with adequate health literacy.

Keywords

Health literacy; utilization; emergency service; hospital; health services accessibility; infant; child; preschool; child

INTRODUCTION

Ninety million American adults have low health literacy, impacting their capacity to “obtain, process, and understand basic health information and services needed to make appropriate health decisions.”¹ Within the pediatric emergency department (ED), an estimated one in three parents has low health literacy.² Health literacy skills are crucial in caring for children during acute illness as low health literacy can impact medication administration, health system navigation, and illness knowledge.^{1,3–7} Lack of health literacy skills may lead caregivers to seek care for their children in the ED, even for mild acute illness.

Though the relationship between low health literacy and ED utilization has been shown in adults,^{13,14} this outcome has not been fully examined in children and no previous study has investigated the relationship with non-urgent ED use. A recent review found a mixed relationship between low parent health literacy and child ED utilization- the relationship is present in patients with asthma but has not been found in overall ED populations.² In most children, acute conditions such as febrile illness, vomiting, or upper respiratory infections are treated at home or the primary care office without an ED visit.⁸ Caregivers with low health literacy may seek ED care more often for mild acute illness due to lack of health literacy skills. Many of the visits for mild acute illness would be considered non-urgent. Additionally, non-urgent ED users tend to have the same demographic characteristics as those with low health literacy, including low socioeconomic status, ethnic or racial minority, and low educational attainment, suggesting a previously unmeasured similarity with low health literacy.^{9–12}

We sought to estimate the prevalence of low health literacy in the pediatric ED and examine the relationship between caregiver health literacy with both prior and non-urgent ED use. We hypothesized that low health literacy would be related to a greater number of prior ED visits and a higher likelihood of non-urgent ED visits at the index ED visit.

METHODS

Study Participants

Caregivers of children 12 years old presenting to the ED at a Midwest children's hospital serving urban and suburban patients were recruited for participation. Caregivers of children over 12 years old were excluded to avoid the influence of an older child's health literacy. Caregivers other than the parent were eligible if they "(took) care of the child most of the time." If multiple caregivers were present, the caregiver that "brought the child to the doctor most often" was assessed. Subjects were excluded if the caregiver had already completed the study, was non-English or non-Spanish speaking, if the child was in acute distress (e.g., highest triage acuity level), or presented for child maltreatment or non-accidental trauma. The hospital's Institutional Review Board approved this study.

Study Design

Trained research assistants enrolled patients during pre-determined four-hour blocks encompassing daytime, evening, and weekend hours between June 1, 2011 and May 31, 2012. Enrollment was intentionally spread over a year to account for seasonal variation in pediatric ED utilization patterns. To obtain a cross-sectional sample of the ED population, a room number was selected from a random list of ED room numbers every 30 minutes and a caregiver in that room was eligible for enrollment. Verbal consent was obtained using a low literacy script written at a fifth grade reading level to ensure understanding of low literacy caregivers. After consent, the research assistant administered the Newest Vital Sign to assess health literacy, the Children with Special Health Care Needs (CSHCN) questionnaire¹⁵ to determine chronic illness status, and provided a self-administered survey of sociodemographic information.

Measures

Health Literacy/Numeracy—The Newest Vital Sign (NVS) is an orally administered six-question test to assess health literacy.¹⁶ The NVS requires interpretation of a nutrition facts label to answer health related questions including the performance of calculations, tasks which are thought to measure the composite skills of both print and numeric literacy. The NVS has been validated for administration in both English and Spanish and is ideal for the ED environment, requiring only 2–6 minutes to complete.

The NVS traditionally classified adults as having adequate literacy if they answered 4–6 questions correctly.¹⁶ This initial NVS validation occurred in an older primary care adult patient population,¹⁶ leaving uncertainty that the original threshold functions well when investigating outcomes in a younger population.¹⁷ Knowing that health literacy can have dose-dependent and threshold effects,¹⁸ we analyzed the spectrum of NVS scores using ordinal chi-square testing, and found both a significant dose-dependent relationship between NVS score and our ED use outcomes. We also conducted a threshold test, the difference between the total chi-square value and the chi-square value for a threshold; as well as an ordinal chi-square test for trend, and found a significant health literacy threshold. We compared thresholds for NVS scores using a threshold of 3 or 4 and found that a threshold score of 4 accounted for almost all of the total chi-square value; therefore remaining

analyses were conducted using an adequate health literacy group (score 5–6) and a low health literacy group (score 0–4).

Prior ED Use—A regional ED database including 29 ED sites from multiple health systems in the surrounding city and state was available as part of the medical record. The research assistant reviewed the database and the number of ED visits over the prior 365 days extracted. These data were missing for 25% of subjects when the database was offline for unexpected technological issues. No analysis was available regarding the urgency of prior visits.

Non-Urgent Index ED Visit—Resources used during the visit at which the subject was enrolled, the index ED visit, were reviewed to classify visits as urgent or non-urgent. Resource use criteria to establish urgency are an accurate measure of ED visit urgency compared to a gold standard of physician chart review,^{19,20} and has been used in other studies assessing the urgency of ED visits.^{21–23} A research assistant, different from the research assistant who enrolled the caregiver, reviewed the ED chart and recorded all resources used. Consistent with prior published standards, visits were considered urgent if the child utilized any diagnostic testing (including blood work, urine studies, electrocardiography, or other fluids such as CSF or joint aspirate, excluding strep or rapid antigen swabs), radiologic studies, administration of IV fluids, or provision of any medication (excluding oral antibiotics and over the counter medications).¹⁹ All other visits were considered non-urgent.

Statistical analyses

Demographic characteristics were compiled using descriptive statistics. Low and adequate health literacy were compared with ED use outcomes using chi-square for categorical data and a Poisson regression model for count data. Multivariable analyses were conducted using logistic regression (for urgency outcome) or Poisson regression (for number of prior visits outcome) with bidirectional stepwise entry of variables related to health literacy and ED use. Variables analyzed included caregiver health literacy, age, ethnicity/race, education, foreign-born status, child insurance, child chronic illness status, and child age. In stepwise multivariable logistic regression, only health literacy and chronic illness were selected into the model. Caregiver ethnicity/race and child insurance status were forced into the model. In the multivariable Poisson regression, an age dependent offset was used for children less than one year of age to analyze visits in the prior year. Caregiver health literacy, child insurance status, child chronic illness status, and child age were significant in the model and caregiver ethnicity/race was forced into the model. We also examined for effects of multicollinearity and interactions in both regression models and for overdispersion in the Poisson model. An interaction between health literacy and chronic illness status was found; therefore stratified analyses were used for interpretation.

Due to the short visit length of lower acuity levels, leaving less time in a room and therefore less chance of being enrolled, the subject selection method resulted in an under-sampling of lower acuity cases, ESI levels 4–5 (40% sample, 58% ED), and over-sampling of moderate acuity cases, ESI level 3 (50% sample, 34% ED). We a priori determined that the best

sample would have the same triage level distribution as the ED in order to have the correct distribution of non-urgent and urgent patients. To account for the difference in the triage level distribution, we weighted the data analyses on triage level. Eight patients (1.6%) were not included in analyses due to missing triage level. Study data were collected and managed using REDCap electronic data capture tools hosted at Medical College of Wisconsin. SAS OnDemand Enterprise Guide software, Version 4.3 (SAS Institute, Inc, Cary NC) was used for all statistical analyses.

Sample size calculations using an α of 0.05 and power of 0.80, revealed a required sample size of 484 caregiver/child pairs to detect a minimum difference of 12.5% in non-urgent ED visits, a change from 25% to 37.5% in the non-urgent visit proportion between adequate and low health literacy.

RESULTS

Overall, 744 caregiver/child pairs were eligible for enrollment, 531 (71%) consented, and 495 completed all materials and had triage data needed for weighting (Figure 1). Weighted caregiver and child demographic data are presented in Table 1. Child ethnicity and race mirrors that of caregivers, and 97% of children have a usual source of care other than the ED by parent report.

Low Health Literacy Prevalence Estimate

We found that 55.6% (95% CI 51.2, 59.9) of caregivers were classified in the low health literacy group. Low health literacy was associated with the caregiver being foreign born, being of minority ethnicity/race, having lower educational attainment, being in the ages of teens and twenties, and with the child being publicly insured (Table 2).

Prior ED Use

Children had a median of 0.5 (IQR 0–2) prior ED visits. In bivariate analysis, low health literacy was associated with a higher rate of prior ED visits (IRR 1.7; 95% CI 1.4, 2.0) as was black race, Hispanic ethnicity, child age < 1 year, child with public insurance, and child chronic illness. In multivariable analysis, caregiver low health literacy was associated with a 50% higher rate of prior ED visits (aIRR 1.5, 95% CI 1.2, 1.8). Weighting did not change the level of statistical significance and had minor effects on the strength of the relationship.

Non-Urgent Index ED Visit

Overall, 29% of index ED visits were categorized as non-urgent. In bivariate analysis, caregiver low health literacy was associated with significantly higher proportion of non-urgent ED visits (37% vs. 19% non-urgent; OR 2.6, 95% CI 1.6, 4.2). Additionally, younger parent age, black race, child public insurance, and child without chronic illness were associated with higher odds of non-urgent ED visits. After multivariable regression, caregiver low health literacy (AOR 2.4, 95% CI 1.3, 4.4) and the child not having a chronic disease (AOR 2.9, 95% CI 1.7, 5.1) were significantly associated with higher odds of a non-urgent ED visit. Weighting did not change the level of statistical significance and minor effects on the strength of the relationship.

We found a significant interaction between caregiver health literacy and child chronic illness (Table 3). In children without a chronic illness, significantly more children had non-urgent ED visits if caregivers had low health literacy (48%) as compared to adequate health literacy (22%; OR 3.2, 95% CI 1.8, 5.7). For children with a chronic illness, there was no significant association between caregiver low health literacy and non-urgent ED use (21% vs. 15% non-urgent; OR 1.6, 95% CI 0.7, 4.0).

DISCUSSION

We found that caregivers presenting with their child to the ED have a high prevalence of low healthy literacy, and that caregiver low health literacy is associated with both a higher rate of prior ED visits and greater odds of a non-urgent index ED visit. These novel findings are important to consider in future work surrounding pediatric ED utilization. ED use for acute illness is not ideal for child health as it detracts from use of the medical home which, when appropriately used, can improve child health, decrease health expenditures, and is essential for appropriate care of chronic conditions, such as asthma.^{24,25}

Low Health Literacy is Associated with a Higher Rate of ED Visits

We have shown that children of caregivers with low health literacy have more ED visits in the previous year, a novel finding in the investigation of pediatric healthcare utilization. Caregivers with low health literacy have difficulty with health system navigation, information seeking, health decisions, and administering medications, all of which may lead to care sought in the ED.^{1,29,30} Prior studies of ED utilization have focused on non-modifiable socioeconomic variables.^{9,10,31} Even after adjusting for these potential covariates, we found that low health literacy remains an independent predictor of ED utilization with a 50% increase in rate of ED visits. To date, only two studies, both focused exclusively on children with asthma, found that low health literacy was associated with a higher number of ED visits in children.^{32,33} Prior research focusing on general ED populations has shown a relationship between low health literacy and increased ED use in adult populations,^{13,14,34} but not in a general pediatric population.³⁵ This is the first study to show the association between low caregiver health literacy and higher ED utilization in a population of children with chronic illness along with otherwise healthy children in the ED for an acute illness.

Low Health Literacy is Associated with Increased Odds of a Non-urgent ED visit

We also found that the index ED visit was more likely to be non-urgent in children of caregivers with low health literacy. Due to poor understanding of pediatric illness, parents with low health literacy may inaccurately assess their child's illness as serious, misunderstanding of severity and lead to non-urgent utilization. Also, lower perceived access to the medical home leads to non-urgent ED use²¹ and is related to the poor navigational skills possessed by caregivers with low health literacy.

While increased ED use related to low caregiver health literacy may be expected in children with chronic illness, it is not expected that children with chronic illness will have higher non-urgent ED use due to low caregiver health literacy. Children with a chronic illness more

typically require treatments or interventions that lead to classification of the ED visit as urgent. Not surprisingly, we did not find differences in visit urgency based on caregiver health literacy in children with a chronic illness. However, otherwise healthy children that present for non-urgent illnesses such as fever, cough, or vomiting are more likely to have a caregiver with low health literacy. The acute illness likely challenged the caregiver skills in caring for their child during the illness or caregivers may have interpreted the child's symptoms as serious and brought them to the ED for immediate treatment. Further evaluation of the mechanisms behind low health literacy and ED care-seeking behavior is warranted. Future interventions to reduce both overall ED use and non-urgent ED use should be targeted at caregivers with low health literacy.

Prevalence of Low Health Literacy

Over half (55%) of the caregivers in this study had low health literacy. The prevalence is higher than the overall estimate in parents in the U.S. (26%)¹¹ and prior studies of parents in the ED using a convenience sample (30%),² but similar to adults seeking care in the ED (48%).¹³ These differences may simply reflect differences in the measurement tools used in these studies as compared to this study. However, the NVS may provide a more sensitive estimate of low health literacy in caregivers of young children as compared to previously used measures. Others have suggested that a ceiling effect exists with the aforementioned measures,¹⁷ and the NVS may alleviate this measurement issue.

Importantly, this is a notable portion of the ED population, underscoring the importance of appropriate communication when educating patients. Clinicians should consider using a "universal precautions" approach to improve care of patients with low health literacy.³⁸ Universal precautions includes improved communication from all participants in the health care environment, educational materials written in a way to maximize understanding, and use of the teach-back method, an interactive communication process, as strategies to ensure understanding of medications and critical procedures.

Limitations

Caregivers with low health literacy may have been reluctant to consent for participation in a study of health literacy. We attempted to mitigate this limitation by shortening the consent procedure and using verbal consent written at a fifth grade level. Importantly, any enrollment bias due to this limitation would have only led us to underestimate the prevalence of low health literacy. Additionally, triage levels within the study population differed from overall triage levels in the ED during the study period, the weighting procedure helped address this limitation. Another limitation, the missing data for prior ED use for 25% of the patients, occurred due to technological issues and should have not systematically biased the results. Being single center potentially limits generalizability to other centers; however, all attempts were made to make it a representative ED population that may be generalizable elsewhere.

Health literacy measurement remains one of the continued challenges to the field of health literacy research. Numerous measures have been validated and are in common use with no measure clearly superior in parents.³⁹ We used a threshold for the NVS that differs from the

original threshold. We found that the threshold distinguished important differences in care-seeking behavior and we believe is a more appropriate threshold for this age population with the outcomes we were assessing. Additionally, this is the first study to measure health literacy using the NVS in the pediatric ED, and any comparison of prevalence with other measures must be interpreted with caution.

Future Directions

Given the findings from this study, health literacy is a potentially mutable factor in understanding non-urgent ED use. Future research on non-urgent ED use and ED use in children should incorporate health literacy principles to allow for full benefit. Interventions targeting specific acute illnesses or general health information about acute illness have the potential to impact care-seeking behavior, reduce non-urgent ED use, improve the connection with medical home, and empower caregivers to seek care for acute illnesses of childhood at the primary care office or treat at home.

CONCLUSIONS

Over half of caregivers seeking care in the ED for their child have low health literacy. Low caregiver health literacy is associated with both a higher rate of prior ED visits and a greater proportion of non-urgent ED visits in children. Clinicians caring for children should be aware of the challenges raised by low health literacy and consequently adjust communication strategies and educational materials to reflect caregivers' needs.

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Abbreviations

CSHCN	Children with Special Health Care Needs
ED	Emergency department
NVS	Newest Vital Sign
OR	Odds Ratio
AOR	Adjusted Odds Ratio
IRR	Incidence Rate Ratio
aIRR	Adjusted Incidence Rate Ratio

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What's New

Over half of caregivers with their child in the emergency department have low health literacy and seek care more often and for non-urgent conditions. Caregiver health literacy may serve as a potential target for future interventions targeting non-urgent ED utilization.

Figure 1.
Study Subject Flow Diagram

*Refused subjects did not differ from study subjects in age ($p=0.09$), triage level ($p=0.36$), or month of recruitment (0.39).

Table 1Caregiver and Child Characteristics^a

	%
Caregiver (n=495)	
Age, y, median (range)	(30.1; 18–69)
Female gender	86.1
Foreign born	16.0
Ethnicity/race	
White	42.5
Black	41.3
Hispanic	10.6
Other	5.6
Education	
Less than HS	12.6
Graduated HS	25.7
1–4 years college	31.3
College degree	30.4
Child	
Age, y, median (range)	(2.7; 0.1–12)
Insurance	
Private	29.2
Public	68.9
None	1.8
Child has Chronic Illness^b	38.9

^a All values in table are weighted by triage level to reflect the entire ED population (59,185 patients during study period).

^b Children with Special Health Care Needs Screener for chronic illness.

Table 2Caregiver and Child Characteristics by Health Literacy on Newest Vital Sign^{a,b}

Variable ^c	Low Health Literacy, %	Adequate Health Literacy, %	p ^d
Caregiver	55.7	44.3	
Age			
18–24	71.8	28.2	<0.0001
25–34	63.1	36.9	
35–45	31.5	68.5	
> 45	39.6	60.4	
Gender			0.04
Male	42.6	57.4	
Female	56.9	43.1	
Foreign born			<0.001
Yes	72.7	27.3	
No	51.5	48.5	
Ethnicity/race			< 0.0001
White	25.7	74.3	
Black	77.0	23.0	
Hispanic	83.9	16.1	
Other	59.3	40.7	
Education			< 0.0001
Less than HS	80.1	19.9	
Graduated HS	72.0	28.0	
1–4 years college	56.6	43.4	
College degree	29.3	70.7	
Child			
Age			
< 1 year	36.5	63.5	0.04
1–2 years	54.4	45.6	
2–5 years	31.4	68.6	
> 5 years	30.2	69.8	
Insurance			< 0.0001
Private	20.9	79.1	
Public	67.9	32.1	
None	100	0	
Chronic Illness^e			
Yes	55.8	44.2	0.81
No	54.6	45.4	

^a All values in table are weighted by triage level to reflect the entire ED population.^b Low health literacy scored as 0–4 correct on Newest Vital Sign (NVS) and adequate health literacy scored as 5–6 correct.

^c Other than age (median, range), proportion (%) of those possessing the characteristic are presented. The weighting procedure produces partial person counts therefor the number (*n*) for each characteristic was not included.

^d P-values were generated using χ^2 for all characteristics

^e Children with Special Health Care Needs Screener for chronic illness.

Table 3

Association between low caregiver health literacy and odds of non-urgent as well as rate of prior ED utilization

	Child odds of non-urgent ED visit if caregiver has <i>low health literacy</i>^a	Child rate of prior ED visits if caregiver has <i>low health literacy</i>^a
	OR (95% CI)	IRR (95% CI)
Overall	2.4 (1.3, 4.4) ^b	1.5 (1.2, 1.8) ^b
Child with chronic illness^c		
Yes	1.6 (0.7, 4.0) ^d	
No	3.2 (1.8, 5.7) ^e	

^a As compared to a reference group of adequate health literacy (OR or RR=1.0)

^b Regression including caregiver health literacy, ethnicity/race, insurance type, chronic illness status, and child age (only for prior ED analysis)

^c Children with Special Health Care Needs Screener for chronic illness

^d Unable to analyze in multivariable analysis due to sample size

^e Regression included caregiver health literacy, ethnicity/race, and insurance type