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Beyond Reading Alone: The Relationship Between Aural Literacy And Asthma Management

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Abstract

Objectives—To examine the relationship between literacy and asthma management with a focus on the oral exchange.

Methods—Study participants, all of whom reported asthma, were drawn from the New England Family Study (NEFS), an examination of links between education and health. NEFS data included reading, oral (speaking), and aural (listening) literacy measures. An additional survey was conducted with this group of study participants related to asthma issues, particularly asthma management. Data analysis focused on bivariate and multivariable logistic regression.

Results—In bivariate logistic regression models exploring aural literacy, there was a statistically significant association between those participants with lower aural literacy skills and less successful asthma management (OR:4.37, 95%CI:1.11, 17.32). In multivariable logistic regression analyses, controlling for gender, income, and race in separate models (one-at-a-time), there remained a statistically significant association between those participants with lower aural literacy skills and less successful asthma management.

Conclusion—Lower aural literacy skills seem to complicate asthma management capabilities.

Practice Implications—Greater attention to the oral exchange, in particular the listening skills highlighted by aural literacy, as well as other related literacy skills may help us develop strategies for clear communication related to asthma management.

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Statement of No Conflict of Interest: I, and my co-authors, attest to the fact that we do not have any actual or potential conflict of interest including any financial, personal or other relationship with other people or organizations within three (3) years of beginning the work submitted that could inappropriately influence or bias this work.

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Keywords

literacy; aural literacy; asthma; asthma management; health communications; provider-patient communication; oral exchange

1. Introduction

In 2000, chronic conditions, such as asthma, affected approximately 125 million (45%) people in the United States and about 61 million (21%) of these people had multiple chronic conditions. [1] Studies indicate that the ability to manage a chronic condition, such as asthma, varies by education level. [2-4] Adults with less than a high school education are more likely to die of a chronic disease than are those with higher levels of education. [5] Indeed links between education and health in general are well-established. [2-8] Explanations for this association have included improved work and economic conditions associated with higher educational attainment, broader social psychological resources, and healthier lifestyle choices among those with more education. [8] Most recently, with the publication of findings from the educational field's assessments of adult literacy skills, attention has been focused on literacy – a core component of education, as a possible explanatory pathway. [9-10]

The field of health literacy emerged from an interest in exploring links between people's literacy skills and their health outcomes – and was spurred by the publication of findings from the first national survey of adults' literacy skills in 1993. [11-12] Building on the findings from the national and international adult literacy surveys conducted in the 1990's and again in 2003, health researchers began to measure patients' literacy skills and compare health outcomes amongst those with weak and with strong literacy skills. [11,13-14] Even working with approximations of reading skills, researchers developed a substantial body of literature demonstrating that literacy skills are related to healthy action and to health outcomes. Findings indicate that literacy, measured as approximations of reading skills, are related to greater difficulty in managing a chronic disease [15-18], obtaining health knowledge [19-20], accessing care [14,18] and adhering to a medication regimen. [19,21] Schillinger and colleagues have found that the ability to manage a chronic disease such as diabetes varies by literacy skills – with lower literacy skills being related to higher chronic disease problems. [17,22-25] DeWalt and colleagues found similar patterns for heart disease and asthma care. [26-27] Studies by Williams and colleagues indicate similar links between asthma management and literacy measures. [19] Gazmarian and colleagues for example, note that compared to adults with higher reading skills, adults with lower skills ask fewer questions about medical care issues, are more likely to ask the physician to repeat something, and are less likely to use medical terminology, refer to medications by name, request additional services, or seek new information. [28]

Literacy skills, as measured by approximations of reading assessments, have proven to be robust predictors of health outcomes. The analytic reports on health literacy from the Agency of Healthcare Research and Quality (AHRQ) and from the Institute of Medicine (IOM) both note the strength of findings related to links between reading skills and health outcomes. [29-30] Yet, the health activities and tasks needed for disease management require a variety of strong literacy skills that include but go beyond reading skills. [29-33] The IOM report highlights the importance of broader measures of literacy because reading skills alone would not offer a logical explanation of differential health outcomes. Consequently, the IOM report called for attention to the full array of literacy skills. [30] Literacy, considered the cornerstone of education, consists of five interrelated skills: reading, writing, speaking, listening, and calculating (numeracy). [30,34] Early schooling,

and literacy instruction for adults, are focused on the development of these critical skills so that learners may apply them to the various educational activities and tasks involved in knowledge acquisition, critical thinking, and further skill development.

Health researchers have only recently begun to consider literacy skills beyond reading, such as speaking and listening skills. [35-36] Roter and colleagues have measured various aspects of the oral exchange, which primarily addresses provider and patient talk. They note that providers must pay attention to multiple components of communication and interaction such as openings for interruptions, the easy flow of exchange and question asking in order to shape an encounter that does not presuppose advanced literacy skills [35-36] The patient-provider interaction is also under study in new ways - with a focus on literacy skills of patients, communication skills of providers, and on the assumptions and misperceptions that may color the exchanges. [35] Although studies of listening related issues may well be underway, no published health studies to date have reported measures of listening skills. [30]

This exploratory study was designed to focus on the oral exchange (speaking and listening) because of its importance in chronic disease management. It is during this interpersonal communication that patients are expected to apply their literacy skills and forge a partnership with a health provider to effectively manage a chronic disease. Patients engaged in such an exchange with health providers are expected to present as well as to listen. Patients must find the words to describe feelings, experiences, and concerns. They are expected to follow and understand explanations and directions. Consequently, measures of oral and aural literacy skills may offer insight into communication patterns and into the exchange of information so critical for the development of patient specific plans and for the ultimate management of a chronic disease.

The focus on the oral exchange (speaking and listening) presupposes that successful communication is a prerequisite for any other change. Consequently, we draw on McGuire's communication model [37] and on the Diffusion of Innovation Model [38] with an emphasis on the interpersonal channels of communication so important for outreach, awareness building, and action/adoption. These models, often drawn on for mass communication planning and analyses, are applicable to the interpersonal exchange needed for chronic disease management.

Almost 23 million people in the United States have asthma, characterized by an irritant or event that triggers the airways of the lungs to become narrow or blocked. [39-41] Patients with asthma engage in a variety of critical activities; all of which involve application of literacy skills. These activities include measuring and monitoring symptoms, avoiding triggers, taking medicines, and deciding on (preventive) actions. Few studies have investigated the relationship between literacy and adult asthma, especially exploring multiple components of literacy. [42-45] Therefore, we examined the relationship between asthma management and educational attainment as well as asthma management and reading, speaking, and listening to explore why participants might or might not successfully manage asthma. We use the term 'oral exchange' to refer to the speaking and listening activities involved in communication. We hereafter refer to speaking skills as 'oral literacy' and listening skills as 'aural literacy', terms that are beginning to appear in discussions and presentation in the health literacy field.

2. Methods

2.1 Data

Data for the Asthma Health Literacy Study (AHLS) come from the New England Family Study (NEFS) [46], which comprises a series of adult follow-up assessments of the offspring of mothers enrolled during pregnancy in the Boston and Providence sites of the National Collaborative Perinatal Project (NCPP). The original aims and study design of the NCPP have been described previously. [47-49] Briefly, the NCPP study involved systematic examinations and interviews of mothers during the prenatal period, and their offspring's health and development through age 7. A multi-stage sampling design was used to enroll participants into the current AHLS study. This began with a sample of 1674 adults who were interviewed as part of a multi-project investigation on tobacco use. [46,50] A sample of 915 adults (part of a cohort because of their mothers' earlier study participation) were selected from this sample of 1674 adults, for participation in a study on the pathways linking education and health, beginning in November, 2004 and ending in December, 2007. Of these 915 individuals, 16 were determined to have died or were otherwise ineligible for follow-up assessment (e.g. incarcerated), yielding a pool of 899 individuals eligible for participation. Of these, 618 interviews were completed (68.7%) for the pathways study. For this AHLS study of associations among education, literacy and asthma management, we recruited individuals with asthma from the cohort sample of 618 individuals who completed the interviews.

We selected 101 participants who reported having ever been diagnosed with asthma by a physician, either as a child or an adult. This was reported in the original NEFS interview. Of these, 74 were reached, 4 refused, 1 completed a partial interview, and 69 completed full interviews (93.2%). Twenty-nine participants were interviewed in-person and 40 participants were interviewed by phone. In these analyses, a final sample of 68 was used since one participant did not have any data on literacy measures. There were no statistically significant differences between those who did and did not participate in the AHLS by gender, race, income, education or literacy skills. All participants were in their early 40's. Our data are comprised of assessments given only during the NEFS and the AHLS.

AHLS data, including an asthma survey, were collected from December 2006 through February 2008. These interviews took place an average of 1.3 years after (median = 1.39) the original NEFS interviews. The asthma survey was adapted from the SLAITS-CDC National Asthma Survey (NAS) State Sample. [51] The NAS was developed to immediately follow the National Immunization Survey, and was widely tested before implementation. [51] We drew measures from the NAS to create an adapted, short survey focused on the following areas: history of asthma (symptoms and episodes), health care utilization, knowledge of asthma management, modifications to environment, and medications. [51] All other variables, including literacy measures, were collected during the NEFS. The Harvard University School of Public Health Human Subjects Committee approved this study.

Dependent Variable—Management of a chronic disease, specifically asthma management, was defined by nighttime asthma control as measured by the number of nights with asthma symptoms in the last 30 days. (“During the past 30 days, on how many days did symptoms of asthma make it difficult for you to stay asleep?”) Number of nights with asthma symptoms were dichotomized as none (successful asthma management), or one or more (less successful asthma management).

Asthma symptoms were defined as coughing, wheezing, shortness of breath, chest tightness or phlegm production when a cold or respiratory infection is not present. [51] Asthma management was defined by the number of nights with asthma symptoms. Asthma

management was defined by nights with symptoms because of the emphasis placed on nighttime asthma control within the asthma literature. While many other factors are indeed important, nighttime control of asthma symptoms is highlighted as a marker in asthma control questionnaires, a marker of disease severity, and as an indicator of quality of life functioning. [52-55] Successful asthma management was defined as no nights with asthma symptoms. Unsuccessful asthma management was defined by 1+ nights with asthma symptoms.

Independent Variables—Educational level was assessed by years of schooling, and was dichotomized as high school graduate or less, and some college or more. This cutpoint was chosen because of the financial and skill-level differences of those with education beyond that of the high school level compared to those with a high school education or less. [56] Literacy level was measured by the Woodcock-Johnson Achievement Tests® and reported as grade equivalents. These tests have been widely-used in psychology to measure cognition and they appear to approximate literacy skills, having the format and structure of standardized literacy assessments' focus. [57-59] Furthermore, the assessments focus on untapped literacy skills -particularly oral presentation and aural listening skills - and have been previously used to measure literacy. [60-61] The Woodcock-Johnson Achievement Tests® are standardized tests, normed against a representative U.S. population, ages 24 months to 90 years and older. [62]

The reading assessment [passage comprehension-cloze test] tests reading comprehension and verbal (printed) language comprehension, and asks participants to fill in a missing word. Reliability and validity for this test are strong; the one-year test-retest reliability was 0.92 and validation against the reading composite scores of the Kaufman Test of Educational Achievement [63] and the Wechsler Individual Achievement Test [64] show good validity with correlations of 0.81 and 0.78 respectively. [65] The oral assessment [story recall] tests language development and listening ability. It assesses verbal communication by having participants listen to a story and repeat it back. The aural assessment [understanding directions] tests listening ability and language development. It assesses speech comprehension by having participants look at a complex picture/scene while a recording tells them to do something, such as point to an object. Scores for both tests are based on correct tasks completed. Reliability and validity for these tests of achievement are strong: For “Story Recall” (oral literacy) and “Understanding Directions” (aural literacy), the one year test-retest reliability was 0.70 and 0.88, respectively. [65] These two tests were also moderately correlated with the Language Composite from the Wechsler Individual Achievement Test [64], 0.55 and 0.56, respectively. [65] The Woodcock-Johnson Achievement Tests® scores were dichotomized as equivalent to an eighth grade education level or less, or 9th grade education level or more.

Cutpoints vary between educational attainment and literacy skills in order to best represent the various skills of participants. That is, literacy skills (as grade level equivalencies) are not best represented by traditional educational attainment cutpoints since educational attainment most often does not equate to skill levels. [66]

Confounders—Race was dichotomized as White/Non-White, gender was dichotomized as male/female, and income was dichotomized as ≤\$49,999 and ≥\$50,000.

2.2 Statistical Analysis

We examined issues related to asthma management and literacy by investigating the distributions of dependent and independent variables, and confounders, as illustrated in Table 1. Next, to explore potential relationships, we used preliminary logistic regression

analyses, p value (<0.05). These were performed in SAS 9.1 to explore bivariate associations between the dependent variable (nights with asthma symptoms [asthma management]) and independent variables (education and literacy types). [67] In the first step of modeling, we explored whether there was a relationship between asthma management and each independent variable, separately. Findings are displayed in Table 2. All confounders (gender, income, and race) were then added to each bivariate model separately to explore whether these additions might change any of the relationships. (Results not shown.)

3. Results

3.1 Sample Demographics

In this sample of adults with asthma, about 71% successfully manages their asthma (no nighttime symptoms), and about 63% had some college education or more. About 62% of participants had aural literacy skills below the 9th grade level. Females comprised about 69% of the sample, and about 75% of the sample was White and had an income greater than or equal to \$50,000.

3.2 Literacy and Asthma Management

We performed preliminary logistic regression analyses to explore the relationship between asthma management and each of the following: education, reading, oral and aural literacy. There were no statistically significant differences between asthma management and educational attainment, reading literacy, or oral literacy in bivariate or multivariable models. However, in the bivariate model exploring aural literacy, there was a statistically significant association between those participants with lower aural literacy skills and less successful asthma management (OR:4.37, 95%CI: 1.11, 17.32). In the multivariable model adjusting for gender, the relationship between participants with lower aural literacy skills and less successful asthma management continued (OR:4.65, 95%CI: 1.15, 18.86). In the multivariable model adjusting for income, this relationship also continued (OR:6.07, 95%CI: 1.45, 25.44). Lastly, in the multivariable model adjusting for race, this relationship also continued (OR:5.36, 95%CI:1.29, 22.24).

4. Discussion and conclusion

4.1 Discussion

Previous studies have provided evidence of a relationship between literacy, as measured by reading skills, and asthma management. [19,27,43-44] In this study, we found an association between aural literacy skills and asthma management as measured by nighttime asthma symptoms. Overall, lower aural literacy skills were related to less successful asthma management. This relationship persisted when we adjusted for demographic factors such as gender, income, and race. This suggests that aural literacy affects asthma management above and beyond each of these demographic characteristics.

The aural literacy skills of patients are important considerations within this patient/provider context. In particular, this study suggests that measures of aural literacy skills may provide insight into patients' abilities to understand and follow explanations and directions offered by health care providers. [30] The Woodcock-Johnson Tests of Achievement® section called "Understanding Directions" examined aural literacy by asking participants to follow the instructions of an audio-recording while looking at an illustrated drawing. As drawings became more complex, task components and difficulty also increased. [68] This test simulates the listening comprehension, and recall and enactment activities necessary of a patient or participant. Patients and participants both need to understand what a provider is telling them to do, accomplish the task(s), and recall information for later action. For

example, a patient and provider might have a discussion about the patient's asthma condition followed by directions given to the patient by the provider. The patient is then expected to follow through on a course of action that might include medication as well as environmental adjustments such as changes to cleaning procedures in the home. Furthermore, the patient is often expected to follow an asthma plan, as discussed during the clinical encounter, when called upon to handle an unexpected asthma attack. This may involve choice of inhaler or making a judgment about whether and whom to call upon for advice or help. [69]

A measure of aural literacy may capture how well patients are able to listen during the provider-patient interaction and how well they are able to follow explanations and directions, discussed during a health encounter. Of course, the onus of responsibility does not fall totally on the patient because the oral exchange (of which aural skills are a large part) is also dependent on the clarity of presentation. As is well-documented in the health communications literature, a large part of patients' understanding and satisfaction after a medical encounter is directly affected by providers' communication styles. [70-71] However, an understanding of aural literacy may serve to inform the design of further studies and a consideration of efficacious action. The relationship between literacy type, especially aural literacy, and chronic disease management warrants further exploration. Patient-provider communication is a central component of chronic disease management and further studies are warranted.

This was an exploratory study based on cross-sectional data and focused on a small sample of individuals. The cross-sectional nature of this study and the small sample size limited our ability to explore disease management issues according to age at diagnosis. Likewise, the study did not allow for the contingency that participants may have improved their management skills between time of reporting asthma and having their literacy skills assessed (median time: 1.3 years). Such issues may be of particular interest in health literacy inquiries; for instance, participants diagnosed as children were likely aided by parents as they learned to manage their asthma. On the other hand, those who developed the disease at a later age may have had to rely on their own literacy skills and abilities alone. Literacy skills were measured by representative cognitive assessments which seem to approximate literacy; even though this is what we expect, they may not have acted in this way. In addition, an asthma survey was adapted from the Centers for Disease Control, but has not yet been validated.

While the modeled analytic approach may have been more suited for a larger sample size, logistic regression analyses did separately take into account possible confounders. However, we must keep in mind the small sample size and wide confidence intervals which resulted, and therefore, the analysis must be considered as exploratory only. Nonetheless, the main relationship between aural literacy and asthma management persists. Lastly, a full exploration of participant actions related to asthma was not feasible. Thus, it is not possible to determine whether participants who reported no nighttime symptoms were controlling their asthma because they were better skilled in their use of inhalers, because they applied some other methods for control, or because they were not experiencing active disease.

4.2 Conclusion

This study provides insight for future research and practice considerations. It expands the exploration of literacy skills and offers insight into the oral/aural exchange component of disease management. The 2004 Institute of Medicine report, "Health Literacy: A Prescription to End Confusion" highlights the importance of attending to the full array of literacy skills as we explore links between literacy and health outcomes. [30] Patients managing a chronic disease need to engage in a variety of activities and to apply a full range of literacy skills in order to accomplish the many tasks expected of them. They are expected

to read explanations and medicine labels, to use measurement tools, to make note of and later describe symptoms and changes, and to listen to explanations and directions and later act on them. Critical literacy skills to accomplish these tasks include reading, writing, calculating, speaking and listening. Previous studies exploring links between literacy skills and health outcomes have primarily relied on measures of reading skills alone. The Woodcock-Johnson Tests of Achievement® offer additional measures to help researchers better understand components of reading, oral, and aural literacy and their individual or shared influence on health outcomes. A standardized measure of numeracy is also needed and would allow researchers to uniformly measure the need for and contribution of math-related skills.

Future research might explore literacy as a separate and unique component of education; a distinct lens through which to examine asthma management. [9-10] Prior research demonstrates that chronic disease management relies on a partnership between a patient and health care provider. [17,22-25] Central to this relationship is the oral exchange. [72] Extensive work has explored the oral exchange in terms of communication processes and theoretical frameworks. [72-73] The exchange between patients and providers is already a substantive area of research. [71,74-75] In particular, investigations in the provider-patient communication field have explored the contributions and effects of gender [76], race [77-79], patient-provider racial concordance [80], provider sexuality [81], nonverbal communication [82-83], use of interpreters [84-85], older patients [86], internet health information [87], domestic violence [81], health disparities and asthma [88], colorectal cancer [89] and HIV [90]. However, what is notably lacking is a detailed discussion of patient skills needed to participate in this encounter and ameliorative action providers might take that do not rely on sophisticated literacy skills of patients.

4.3 Practice Implications

This study suggests that aural literacy may enhance disease management capabilities. Research exploring literacy and health has not yet fully examined these domains. Greater attention to the oral exchange and related literacy skills may help us develop better strategies for clear communication related to chronic disease management. Although there are no gold standards yet available to guide the patient provider exchange, the use of “teach back” methods has been highlighted. [91] The “teach back” is a tool that can be used after any information is presented to a patient. Using this method, health providers ask patients to summarize the information just presented. Such a method offers a needed check on communication. Instead of putting communication responsibilities on the patient, the “teach back” approach puts responsibility on the speaker, and encourages a “check-in”. [92] For these reasons, the use of the “teach back” has been highlighted as a check on the clarity of the presentation and on whether or not the patient actively followed the information provided. [92-93] Further explorations of similar efficacious action are needed. We should be able to augment the verbal and listening skills of both providers and patients, thereby enhancing patient-health system connections as well as patient-provider interactions.

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Table 1
Dependent, Independent and Confounder Variables Asthma Health Literacy Study
(n=68)

	N	%	Missing
Dependent Variable			
Asthma Management			--
Successful Asthma Management (No nighttime symptoms)	48	70.59	
Less Successful Asthma Management (One or more nighttime symptoms)	20	29.41	
Independent Variables			
Education			--
HS Grad or less	25	36.76	
Some college or more	43	63.24	
Literacy Measures			4
Reading Literacy: <9th grade equiv.	16	25.00	
Reading Literacy: 9th grade equiv. or more	48	75.00	
			5
Oral Literacy: <9th grade equiv.	46	73.02	
Oral Literacy: 9th grade equiv. or more	17	26.98	
			5
Aural Literacy: <9th grade equiv.	39	61.90	
Aural Literacy: 9th grade equiv. or more	24	38.10	
Confounders			
Gender			--
Female	47	69.12	
Male	21	30.88	
Household Income (before tax)			3
\$0-49,999	16	24.62	
>=\$50,000	49	75.38	
Race			--
White	51	75.00	
Non-White	17	25.00	

Table 2
Bivariate associations of education, literacy measures, and asthma management in the
Asthma Health Literacy Study (Odds Ratios and Confidence Intervals) (n=68)

Education	1.22 (0.42, 3.55)	--	--	--
Reading Literacy	--	1.80 (0.50, 6.01)	--	--
Oral Literacy	--	--	1.57 (0.44, 5.65)	--
Aural Literacy	--	--	--	4.37 (1.11, 17.23)