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Health Literacy and Asthma Among Hispanic and African American Urban Adolescents with Undiagnosed Asthma

Melissa A. Valerio, PhD, MPH¹, Maureen George, PhD, RN, AE-C, FAAN², Jianfang Liu, PhD², Zainab T. Osakwe, MSN, WHNP, MPhil, PhD^{3,a}, and Jean-Marie Bruzzese, PhD²

¹Health Promotion and Behavioral Science, University of Texas Health Science Center in Houston, School of Public Health in San Antonio San Antonio, TX, USA

²School of Nursing, Columbia University, New York, NY, USA

³College of Nursing and Public Health, Adelphi University, Garden City, NY, USA

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Asthma has high prevalence among adolescents, urban youth, and Hispanic and African American youth.^{1, 2} A large proportion of youth experience asthma symptoms, but are not diagnosed.³ Understanding more about undiagnosed asthma is an essential first step in increasing the likelihood of adolescents obtaining a diagnosis and treatment, and in preventing detrimental outcomes.

The association of adolescent health literacy to health outcomes needs further examination. Hispanic and African American adolescents have higher rates of low health literacy compared to their white counterparts.⁴ Limited health literacy in adolescents with diagnosed asthma is associated with poor asthma outcomes.⁵ Adolescence is an important transition

Address Correspondence to: Jean-Marie Bruzzese, Ph.D., Office of Scholarship and Research; Columbia University School of Nursing; 617 West 168th Street, Mail Code 6 New York, NY 10021, jb3958@cumc.columbia.edu.

^aDr. Osakwe was a PhD candidate at the Columbia University School of Nursing when she contributed to this manuscript.

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period for self-care;⁶ consequently inadequate health literacy during adolescence may impede adequate asthma self-care.

This exploratory study aims: (1) to characterize health-related literacy among urban Hispanic and African American/Black/Caribbean Black adolescents with undiagnosed asthma, including evaluating the association of health-related literacy to demographics (i.e., age, sex, race/ethnicity, being born in the United States [U.S.]); and (2) to examine the associations of health-related literacy to asthma self-care (i.e., knowledge and self-efficacy to care for symptoms) and morbidity (i.e., symptom days, night awakenings, asthma-related limitations, and being bothered by symptoms).

This cross-sectional study utilizes baseline data from a study examining the efficacy of an intervention for adolescents with undiagnosed asthma.⁷ Participants were 327 Hispanic and African American/Black/Caribbean Black adolescents aged 13 to 18 years (mean age=15.8) from 44 New York City (NYC) public high schools; 84.7% were female and 72.8% were U.S. born. Study eligibility was adolescent report of (1) never being diagnosed with asthma, reactive airway disease, or wheezy bronchitis, (2) at least three of seven asthma markers (wheezy/noise breathing; difficulty breathing deep; cough; chest tightness with exercise, night wakening due to cough or to breathing problems; cough with physical activity),⁸ and (3) symptoms of moderate to severe persistent asthma based on NAEPP guidelines, and (4) speaking English. Based on the risk of asthma disparities, we included only adolescents who self-identified as Hispanic and African American/Black/Caribbean Black to explore racial/ethnic differences. The institutional review boards of the Columbia University Medical Center, New York University School of Medicine, and NYC Department of Education approved study procedures.

Adolescents reported demographics (date of birth, sex, race/ethnicity, if U.S. born). They answered 40 true/false questions regarding asthma knowledge and 14 questions regarding self-efficacy to care for symptoms (e.g., take medication daily, take medication before exercise, avoid triggers) the investigators used previously. Adolescents reported the prior two-week frequency of (1) symptom days, (2) symptom-related nights woken and (3) days with symptom-related limitations, as well as (4) how bothered they were by symptoms during the prior two weeks.⁹ We administered the Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen), a brief health-related screening instrument for adolescent reading below grade level.¹⁰ We tested bivariable associations of each predictor to the REALM-Teen through mixed effect regression models. We assessed multivariable associations of predictors to the REALM-Teen exploring three multivariable models – demographic factors, asthma self-care, and morbidity – using mixed effect models controlling for asthma severity (i.e., moderate versus severe persistent) with school cohort as a random effect. Because this was an exploratory study, we included in multivariable models predictors with $p < .10$ in the bivariable models. Table 1 presents the results.

The mean REALM-Teen score was 55.93 (SD=9.17) with 69% (227/327) scoring below grade level. Specifically, 4% were at the 3rd grade or lower level, 6% at the 4th – 5th grade level, 43% at the 6th – 7th grade level, 24% at the 8th – 9th grade level, and 23% at the 10th grade or higher.

In demographic bivariable models, REALM-Teen scores were significantly associated with race/ethnicity and being US born; sex had a p value $<.10$ and was included in the multivariable model. In the multivariable model, the REALM-Teen score was significantly associated with being U.S. born such that U.S. born adolescents had higher health literacy scores. There was a trend towards females having higher REALM-Teen scores.

REALM-Teen scores were significantly associated to both greater asthma knowledge and higher asthma self-efficacy to care for their asthma in the self-care bivariable models. Both remained significant in the multivariable model.

In the morbidity bivariable models higher REALM-Teen scores were significantly associated with more symptom days and increased symptom bother. Days with limitations had p value $<.10$ and was included in the multivariable model, which revealed a trend towards the REALM-Teen score being associated with symptom bother.

In sum, low REALM-Teen scores were evident in adolescents with undiagnosed asthma, and were associated with being male and foreign-born. It may be that females are better readers and/or engage in household care-related tasks, and therefore are more likely to recognize health-related words including in the REALM-Teen than males. Foreign-born adolescents may be at greater risk for poorer reading skills given their possible lack of recognizing key health-related words due to limited English language proficiency. Greater REALM-Teen scores were associated with better asthma knowledge and self-care. Strategies for improving adolescent's health literacy and recognition of asthma care needs are key to promoting self-efficacy in acquiring symptom information. In contrast to findings with those with diagnosed asthma where greater health literacy is associated with better asthma outcomes,⁵ we found better REALM-Teen scores were associated with worse morbidity in an undiagnosed sample. It may be that undiagnosed adolescents with greater health-related reading skills were able to recognize symptoms as indicated by an increase in symptom frequency reporting and how much the symptoms bothered the adolescents. Of note, in the morbidity multivariable model predictors were not significant – the variables assessing morbidity were correlated to each other and are likely to be assessing highly related constructs.

The most notable study limitation is our use of the REALM-Teen, which assesses health-related word recognition and pronunciation, and not functional health literacy. However, the REALM-Teen among the few validated health literacy screeners for adolescents. Further prospective work to examine mechanisms driving associations found in this study is warranted, as is validating findings in other samples with asthma using a comprehensive assessment of health literacy, including caregiver health literacy, which may influence adolescents' health literacy.

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Table 1**Bivariable and Multivariable Associations To Health Literacy**

	Bivariable Models[¶] β (95% CI); p value	Multivariable Models^{¶,†} β (95% CI); p value
Demographic Factors		
Age (mean ± SD, years)	−0.63 (−1.57, 0.31); p=0.19	—
Sex (Reference = Male)	2.66 (−0.09, 5.40); p=0.06	2.65 (−0.02, 5.33); p=0.05
Race/ethnicity (Reference = Hispanic/Latino)	−2.04 (−4.04, −0.06); p=0.04	−1.40 (−3.45, 0.62); p=.17
Born in the US (Reference = No)	3.21 (1.01, 5.41); p=.004	3.34 (1.14, 5.54); p=.003
Asthma Self-care		
Asthma Knowledge	0.72 (0.45, 1.00); p<.001	0.68 (0.41, 0.96); p<.001
Asthma Self-efficacy	1.44 (0.35, 2.53); p=0.009	1.28 (0.23, 2.32); p=.02
Asthma Morbidity in Prior 2 Weeks		
# Days with asthma-like symptoms	0.33 (0.03, 0.63); p=0.03	0.23 (−0.09, 0.55); p=.16
# Nights woken with asthma-like symptoms	−0.094 (−0.38, 0.20); p=0.53	—
# Days activity limitations due to asthma-like symptoms	0.40 (−0.02, 0.83); p=0.06	0.25 (−0.20, 0.69); p=.28
How much bothered by symptoms	1.23 (0.36, 2.11); p=0.006	0.95 (.005, 1.89); p=.05

Abbreviations = CI: Confidence Interval; SD: Standard Deviation

[¶] = Models include each predictor as fixed effect only.

[†] = Models include predictor variables with p<.10 in bivariable analyses and cohort as a random effect, and control for asthma severity.