Pediatric Asthma Readmission: Asthma Knowledge Is Not Enough?

Katherine A. Auger, MD, MSc[1,2], Robert S. Kahn, MD, MPH[2,3], Matthew M. Davis, MD, MAPP[4,5,6,7,8], and Jeffrey M. Simmons, MD, MSc[1,2]

Objective To characterize factors associated with readmission for acute asthma exacerbation, particularly around caregiver asthma knowledge, beliefs, and reported adherence to prescribed medication regimens.

Study design We enrolled 601 children (aged 1-16 years) who had been hospitalized for asthma. Caregivers completed a face-to-face survey regarding their asthma knowledge, beliefs, and medication adherence. Caregivers also reported demographic data, child's asthma severity, exposure to triggers, access to primary care, and financial strains. We prospectively identified asthma readmission events via billing data over a 1-year minimum follow-up period. We examined time to readmission with Cox proportional hazards.

Results The study cohort's median age was 5 years, 53% were African American, and 57% were covered by Medicaid. At 1 year, 22% had been readmitted for asthma. In the multivariate analysis, a caregiver's demonstration of increased asthma knowledge was associated with increased readmission risk. In addition, children whose caregivers reported less-than-perfect adherence to daily medication regimens had increased readmission risk. Likewise, having previously been admitted for asthma, decreased medical home access, and black race were associated with increased readmission risk.

Conclusion In a multifactorial assessment of risk factors for asthma readmission, greater asthma knowledge and decreased medication adherence were associated with readmission. Inpatient efforts to prevent readmission might best target medication adherence rather than continuing to primarily provide asthma education. *(J Pediatr 2015;166:101-8)*.

See editorial, p 10

Children hospitalized for asthma are at increased risk for rehospitalization within 1 year, with readmissions rates between 15% and 30%.[1-3] Multiple risk factors have been identified for hospitalization for asthma, including age,[4,5] black race,[1,6-9] living in a low-income neighborhood,[7,10] exposure to smoke[11,12] and cockroaches,[13] low caregiver literacy/education,[14] increased financial strain,[1] and decreased primary care access.[15] Readmissions are stressful for patients and their families[16]; in addition, hospital readmission has been proposed as a marker of hospital quality and plays a role in Medicaid reimbursement for some states.[17-19]

During hospitalization, a key aspect of asthma management is caregiver participation in asthma education.[20] Yet inpatient interventions with significant asthma education components are mixed in regard to postdischarge emergent reutilization (ie, readmission/return to emergency department [ED]). Some discharge interventions that include education have been shown to decrease subsequent utilization[21-23]; however, 2 of these studies also provided rescue oral steroids to some participants in the intervention group, obscuring data on whether the effect was related to education or to differences in medical management. Three other interventions that included asthma education had no effect on readmission or ED utilization after discharge.[24,25] In contrast, an intervention to increase asthma caregiver knowledge actually resulted in an increase in ED visits after hospital discharge.[26]

Caregivers' beliefs and attitudes are associated with children's adherence to medication regimens for treating chronic disease.[27] For children with asthma, a caregiver who demonstrates beliefs more congruent with health care professionals' teachings have improved medication adherence[28] and fewer acute asthma visits.[29] Thus, a caregiver's beliefs regarding asthma may be instrumental in preventing hospitalization.

AHR	Adjusted hazard ratio
ED	Emergency department
HR	Hazard ratio
ICD-9-CM	*International Classification of Diseases, Ninth Revision, Clinical Modification*

From the [1]Division of Hospital Medicine, Department of Pediatrics; [2]James M Anderson Center for Health Systems Excellence; [3]Division of General Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH; [4]Department of Pediatrics and Communicable Diseases; [5]Department of Internal Medicine; [6]Robert Wood Johnson Foundation Clinical Scholars Program; [7]Institute for Healthcare Policy and Innovation; and [8]Gerald R Ford School of Public Policy, University of Michigan, Ann Arbor, MI

Supported by Thrasher Foundation (New Investigator award, grant NR-0048), Cincinnati Children's Hospital Medical Center (CCHMC; Outcomes Research Award to J.S.), the Bureau of Health Professions (BHPr; to J.S.), Health Resources and Services Administration (HRSA; to J.S.), Department of Health and Human Services (DHHS) (under CCHMC NRSA Primary Care Research Fellowship in Child and Adolescent Health T32HP10027; to J.S.). K.A. received salary support from the Robert Wood Johnson Foundation (Clinical Scholars Program). The information or content and conclusions are those of the authors and should not be construed as the official position or policy of, nor should any endorsements be inferred by the BHPr, HRSA, DHHS, or the US Government. The authors declare no conflicts of interest.

http://dx.doi.org/10.1016/j.jpeds.2014.07.046

We sought to assess the relationship of the caregiver's knowledge and beliefs about asthma and the child's readmission risk. We hypothesized that the caregiver's belief about his or her ability to control the child's asthma, along with reported medication adherence, would have a stronger association with readmission compared with the caregiver's knowledge of asthma.

Methods

Children hospitalized for an acute asthma exacerbation at a single institution between April 2008 and May 2009 (n = 601) were enrolled in a prospective observational cohort study[15] and followed throughout the duration of the study for a minimum of 1 year, or until readmission. Eligible patients were aged 1-16 years and resided in the institution's 8-county primary service area. The institution is a large, freestanding, tertiary care children's hospital in a Midwest urban area. It is the primary site of inpatient pediatric care in the service area, managing approximately 85% of all asthma admissions among children aged <18 years.[30]

Potential subjects were identified based on admission diagnosis (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] code 493.XX) and initiation of the evidence-based clinical pathway for acute asthma care by the admitting physician. The pathway includes orders for education, a standardized bronchodilator weaning protocol, oxygen administration protocol, and steroids. Institutional quality assurance data indicate that the pathway is used for >98% of all admissions for acute asthma exacerbations. Patients were excluded if after the initial assessment, the attending physician removed the patient from the asthma pathway because of an alternative diagnosis (eg, bronchiolitis). Children with a comorbid condition, including cystic fibrosis or congenital heart disease, were excluded as well. Caregivers must have been able to participate in written or oral English (**Figure**). The study was approved by the hospital's Institutional Review Board.

Measures

Outcome. Children were followed prospectively for a minimum of 1 year. Readmission events were captured with hospital billing data. Readmission hospitalizations had either a primary discharge diagnosis for asthma (ICD-9-CM code 493.XX) or a primary ICD-9-CM discharge code for a respiratory complaint with asthma code in the second position. We verified fidelity in readmission event capture through phone calls to a randomly selected 25% of patients, as described previously.[15] Time to readmission was calculated as the interval between the index admission and the first asthma-related hospital readmission. Censoring occurred at the end of the follow-up period (June 2010).

Predictors of Readmission. Research personnel administered a 134-question face-to-face interview with the child's caregiver, typically on the morning after admission.

Asthma Knowledge. A total of 13 statements regarding asthma adapted from the "Facts About Asthma" portion of the Asthma Illness Representation Scale[28] and the Asthma Information Quiz for Children[31] were included (**Appendix**; available at www.jpeds.com). Caregivers rated their agreement on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." We scored each question by assigning to each correct statement a score of −2 for strongly disagree, −1 for disagree, 0 for unsure, +1 for agree, and +2 for strongly agree (with reverse coding as appropriate). We then summed each subject's total score on the 13 knowledge assessment items, yielding a 53-point scale with a possible score range of −26 to 26.

Asthma Beliefs and Adherence. We included 3 belief questions in our analyses, selected a priori, adapted from the asthma literature regarding a caregiver's beliefs about his or her ability to control the child's asthma. These measures included the caregiver's expectation that the patient "will have no [further] emergency room visits or hospitalizations due to asthma,"[28] belief that the patient "can be symptom-free most of the time,"[28] and belief that the patient has asthma all of the time (as opposed to asthma present only during symptoms).[32] We used 2 existing measures of adherence,[33] including rating the patient's "experience with taking his/her medications exactly on schedule" and whether the patient had "run out of medicines" for asthma "and not had any on hand." The belief and adherence questions were analyzed as individual questions.

Environmental Exposures. Caregivers reported on seeing any roaches and on their child's indoor smoke exposure. A patient was categorized as having one of these exposures if the caregiver reported the exposure at either the primary residence or at a secondary residence when applicable.

Medical Home Access. Medical home access was measured through the access subscale of the Parent's Perceptions of Pediatric Primary Care[34] as described previously.[15] This scale includes the caregiver's assessment of ease of scheduling well-child checks, ill visits, receiving advice on weekends and evenings, and travel to appointments.

Financial Strain. Financial strain was assessed using a financial strain index developed previously in this cohort of patients. We included all patients whose caregiver responded to at least 6 of the possible 7 strain items. We coded patients as having 0 strain items, 1-2 positive strain items, 3-4 strain items, or more than 5 strain items. These 4 financial strain levels were treated as a continuous variable as described previously.[35]

Asthma Severity and Other Predictors. Covariates included child's age, race, and insurance, as well as the