

Brief communications

Factors associated with pediatric asthma readmissions

Colin Macarthur, MBChB, PhD, Caroline Calpin, MD, FRCPC,
Patricia C. Parkin, MD, FRCPC, and William Feldman, MD, FRCPC
Toronto, Ontario, Canada

Hospitalization rates for childhood asthma have increased steadily over the past 20 years.¹ It is unclear whether this increase represents a change in disease prevalence, severity, or health care utilization. Readmissions contribute substantially to this burden, with up to half of all admissions for treatment of asthma representing repeat admissions.² The objective of this study was to determine the factors associated with pediatric asthma readmission.

METHODS

An inception cohort consisting of all children with their first ever admission for treatment of asthma to the Hospital for Sick Children in Toronto between January 1, 1990 and July 31, 1991, and at least one readmission to the Hospital for Sick Children because of asthma within 12 months of the index admission was identified. This cohort was followed forward, with children readmitted because of asthma within 12 months of their second discharge compared with those not readmitted, on demographic and clinical factors. (Those admitted because of relapse, defined as admission within 1 week of their second discharge, were not considered readmissions.) Exclusion criteria were age younger than 6 months, history of prematurity, or a comorbid condition (bronchopulmonary dysplasia, congenital heart defect, neurologic abnormality, or other chronic pulmonary condition). Hospitalizations for treatment of asthma (ICD9 473) were identified by using the Health Records Department computerized database. The study was approved by the Hospital for Sick Children Research Ethics Board.

Patient demographic and clinical characteristics were abstracted from the medical record. Predictor variables included age, sex, disease severity (intrave-

nous glucocorticoid use or intubation/intensive care unit admission during the second hospitalization), prescription of prophylactic medication at the time of second discharge (inhaled steroid or sodium cromoglycate), exposure to environmental triggers (passive smoke, pets in the home, or day care attendance), and follow-up physician (pediatrician, pediatric pulmonologist, or family physician).

Differences between the two groups (readmitted and not readmitted) were tested by using the nonparametric Mann-Whitney U test and Fisher's exact test for continuous and categorical variables, respectively. Logistic regression analysis was used to assess the relative importance of predictor variables on the risk of readmission.

RESULTS

In all, 68 children comprised the inception cohort. Of these, 32 (47%) were readmitted because of asthma within 12 months. The risk of readmission by clinical and demographic factors is described in Table I. Age, sex, and asthma severity indicators were not associated with readmission. The median age of readmitted children was 3 years (range, 1 to 10 years) compared with a median age of 2 years (range, 1 to 13 years) for those not readmitted ($p = 0.83$). No child was intubated or admitted to the intensive care unit during his or her second admission. Exposure to environmental triggers and prophylactic sodium cromoglycate use were also not associated with readmission. However, children prescribed prophylactic inhaled steroids at the time of discharge were less likely to be readmitted compared with those not prescribed prophylactic steroids (29% vs 55%, $p = 0.04$). Children who were followed up by a primary care pediatrician or pediatric pulmonologist were also less likely to be readmitted compared with those receiving follow-up care from family physicians (34% vs 71%, $p = 0.01$). Logistic regression analysis showed that prophylactic steroid use and follow-up care were independent predictors.

From Pediatric Outcomes Research Team, Division of General Pediatrics, The Hospital for Sick Children and Department of Pediatrics, University of Toronto.

Reprint requests: Colin Macarthur, MBChB, PhD, Division of General Pediatrics, The Hospital for Sick Children, 555 University Ave., Toronto, Ontario, Canada M5G 1X8.

J Allergy Clin Immunol 1996;98:992-3.

Copyright © 1996 by Mosby-Year Book, Inc.

0091-6749/96 \$5.00 + 0 1/54/76112

TABLE 1. Risk of readmission for treatment of asthma by clinical and demographic factors

Factor	Readmitted			RR (95% CI)
	No.	No.	%	
Age <5 yr				
Yes	52	24	46	0.87 (0.50, 1.52)
No	15	8	53	
Sex				
Male	48	21	44	0.80 (0.48, 1.34)
Female	20	11	55	
Intravenous steroid on second admission				
Yes	46	23	50	1.22 (0.70, 2.12)
No	22	9	41	
Prophylactic sodium cromoglycate use*				
Yes	24	11	46	0.94 (0.56, 1.57)
No	43	21	49	
Prophylactic steroid use*				
Yes	21	6	29	0.52 (0.28, 0.97)
No	47	26	55	
Follow-up by pediatrician/pulmonologist				
Yes	44	15	34	0.48 (0.29, 0.79)
No	24	17	71	
≥1 smoker in home				
Yes	30	17	57	1.44 (0.87, 2.37)
No	38	15	39	
≥1 pet in home				
Yes	8	3	38	0.66 (0.30, 1.47)
No	60	34	57	
Day care attendance				
Yes	18	8	44	0.72 (0.42, 1.23)
No	34	21	62	

RR, Relative risk (yes vs no); CI, confidence interval.

*Prescribed on second discharge

DISCUSSION

Because data were collected retrospectively, with the medical chart as the primary data source, the strength of inference is dependent on the quality of the chart information. For example, the decision on hospitalization involves not only an assessment of illness severity but also consideration of social and family issues. Factors such as socioeconomic status, parental education, and compliance (either with prescribed medication use or physician instruction in the outpatient setting) were not recorded in the chart and therefore could not be studied. In this respect, the results relating to medical management strategies represent "intention-to-treat" analyses.

Mitchell et al.³ conducted a retrospective study

in New Zealand involving 1034 children with at least one hospital admission for treatment of asthma who were followed up for a maximum of 2.8 years. Similar to our findings, at 1 year, 43% of subjects had been readmitted because of asthma. The risk of readmission was higher for female patients, younger children (<5 years), those who received inpatient intravenous treatment, and those who had previous admissions for treatment of asthma. Prophylactic medication use and follow-up care arrangements, however, were not associated with readmission.

The contrast in findings between the study by Mitchell et al.³ and ours may be explained by differences in the characteristics of the study populations (e.g., in ethnic composition or asthma severity). Other reasons may include different criteria for admission, different health care utilization practices, and different medical management strategies in the two countries.

There is randomized, controlled trial evidence that inhaled steroid prophylaxis is effective in controlling symptoms, preventing exacerbations, and reducing hospitalization in children with asthma.⁴ In addition, a study by Kirshner et al.⁵ showed that community pediatricians (in Ontario) were more likely to prescribe anti-asthma medications for treatment of childhood cough and wheezing compared with family physicians. This study also demonstrated a lower hospitalization rate for treatment of childhood asthma in the city with a greater concentration of community pediatricians compared with a city where primary care was provided mainly by family physicians. Although these data and the findings from our retrospective study suggest that prophylactic inhaled steroid use and follow-up by pediatricians are associated with a decreased risk of readmission for treatment of childhood asthma, prospective data are required to confirm these associations.

REFERENCES

1. Strachan DP, Anderson HR. Trends in hospital admission rates for asthma in children. *Br Med J* 1992;304:819-20.
2. Storr J, Barrell E, Lenney W. Rising asthma admissions and self referral. *Arch Dis Child* 1988;63:774-9.
3. Mitchell EA, Bland JM, Thompson JMD. Risk factors for readmission to hospital for asthma in childhood. *Thorax* 1994;49:33-6.
4. Barnes PJ. Inhaled glucocorticoids for asthma. *N Engl J Med* 1995;332:868-75.
5. Kirshner B, Gold M, Zimmerman B. Comparison between the prevalence and treatment of wheezing and coughing in Brampton and Mississauga children. *J Clin Epidemiol* 1990; 43:765-71.