

Childhood asthma admissions: Determinants of short stay

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The objective of this study was to identify the determinants of short hospital stay (<24 h) among children admitted because of an acute asthma exacerbation. Computerized health records were used to identify children with a discharge diagnosis of asthma (ICD code 493.0) at the Hospital for Sick Children, Toronto, during the period October 1994 to October 1995. Cases were children with a length of hospital stay of <24 h (short-stay group) and controls were children with a length of stay of >24 h (long-stay group). Clinical and demographic data were extracted from the medical record. Over the 12-month period, 485 children were hospitalized because of asthma. Of these, 121 (25%) had short-stay admissions (<24 h), whereas 364 (75%) had long-stay admissions (>24 h). Simple random sampling was used to select 85 children from each of the two groups. There were no differences between the two groups regarding language, primary care physician, asthma history, management prior to emergency department (ED) presentation, respiratory rate on presentation, use of the observation unit, and time in the ED. Logistic regression analyses identified three variables associated with short hospital stay: milder asthma (adjusted odds ratio [OR] 4.9), male gender (adjusted OR 2.4), and availability of a delivery device at home (adjusted OR 2.0). In conclusion, many children admitted to hospital because of an asthma exacerbation have short, yet expensive, hospital stays. The results of this study highlight the importance of developing alternative models of health care delivery for asthmatic children requiring short hospital contact.

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Asthma is the most common chronic disease of childhood (1). Based on national survey data, the prevalence of asthma in Canadian children (0–18 years of age) is approximately 11% (2). Asthma is also a leading cause of hospitalization in childhood, particularly among preschool children (3). The economic costs of childhood asthma care are substantial, with hospital costs accounting for the greatest proportion of these costs (4).

Several studies have examined the factors associated with prolonged hospital stay in children admitted because of an acute exacerbation of asthma (5,6). Children with more severe asthma exacerbations (as measured by longer symptom duration, lower forced expiratory volume in 1 s, and lower baseline O₂ saturation) were more likely

to have a prolonged hospital stay. Up to one-third of childhood asthma admissions, however, are of a duration shorter than 24 h (5). The objective of this study was to identify the determinants of short stay among children admitted to hospital because of an acute asthma exacerbation.

Subjects and methods

The sampling frame for the study was children (1–18 years of age) admitted to the Hospital for Sick Children, Toronto, because of asthma. Computerized health records were used to identify children with a discharge diagnosis of asthma (ICD code 493.0) during the period October 1994 to

Table 1. Comparison of short stay (<24 h) with long stay (>24 h) asthma admissions

Independent variables	Short stay (≤ 24 h)		Long stay (≥ 24 h)		p-value	(%)
	n	(%)	n			
Demographic factors						
Male gender	56	(66%)	40	(47%)		0.01
Primary language English	71	(84%)	62	(73%)		0.09
Primary care physician:						
Pediatrician	35	(41%)	35	(41%)		
Family physician	48	(57%)	48	(57%)		
None	2	(2%)	2	(2%)		1.00
Age in years, median (range)	3	(1–16%)	4	(1–17%)		0.01
Asthma history						
First ever diagnosis	21	(25%)	20	(24%)		0.86
Previous hospitalization	42	(49%)	49	(58%)		0.28
Previous ICU admission	10	(12%)	8	(9%)		0.62
Management prepresentation						
Oral bronchodilator use	8	(9%)	8	(9%)		1.00
Inhaled bronchodilator use	66	(78%)	60	(71%)		0.29
Oral steroid use	8	(9%)	14	(17%)		0.17
Inhaled steroid use	51	(60%)	44	(52%)		0.28
Visit to physician in the 72 h prior to ED presentation	28	(33%)	29	(34%)		0.87
Inhalant delivery device at home	63	(76%)	51	(60%)		0.03
Asthma severity on presentation						
Symptom duration <48 h	73	(86%)	57	(68%)		0.01
Oxygen saturation >90%	77	(93%)	64	(79%)		0.01
Respiratory rate, mean (SD)	46	(13.0%)	43	(11.6%)		0.11
Management in the ED						
Salbutamol masks/h, median (range)	1.1	(0.5–2.7%)	1.5	(0.5–3.5%)		0.01
Ipratropium bromide masks/h, median (range)	0.8	(0.1–2.3%)	0.9	(0.0–3.3%)		0.18
Systemic steroid use	80	(94%)	80	(98%)		0.27
Admission to observation unit	25	(29%)	19	(22%)		0.29
Oxygen therapy	9	(11%)	28	(33%)		0.01
Time in ED (h), mean (SD)	7	(3.3%)	7	(3.0%)		0.79
Management in the in-patient unit (first 6 h)						
Salbutamol masks/h, median (range)	0.3	(0.0–1.0%)	0.5	(0.0–3.0%)		0.01
Ipratropium bromide masks/h, median (range)	0.2	(0.0–0.7%)	0.2	(0.0–0.7%)		0.04

ED, emergency department; ICU intensive care unit; SD, standard deviation.

October 1995. (For children with repeat admissions during the study period, only the first admission was included.) Cases were defined as children with a length of hospital stay of <24 h (short-stay group) and controls were children with a length of stay of >24 h (long-stay group). Length of stay was defined as the time from admission to the ward until ready for discharge. Using a random numbers table, simple random sampling was used to select 85 children from each of the two groups (short stay and long stay). Children with co-morbid conditions (chronic heart, lung, or neurological disease), co-existing pneumonia, or who had been discharged from hospital in the previous 72 h, were excluded. Ethical approval for the study was received from the Research Ethics Board at the hospital.

Data were extracted from the medical record. Demographic data included age, gender, language spoken at home, and primary care physician. Data were also gathered on asthma history (timing of initial diagnosis, and prior admissions

to hospital or to the intensive care unit). For the index asthma exacerbation, information was collected on attendance at a physician's office or Emergency Department (ED), asthma management in the 72 h prior to ED presentation, and availability of an inhalation device at home (a spacer or a nebuliser). Information was also collected on asthma severity on presentation to the ED (based on symptom duration, oxygen saturation level, and respiratory rate). Data were also collected on asthma management in the ED, including time in the ED, use of the clinical observation unit, and therapeutic management (salbutamol, ipratropium bromide, steroids, and oxygen therapy). Last, data were collected on salbutamol and ipratropium bromide use during the first 6 h in the in-patient unit. Outcome measures included length of hospital stay and re-admission to hospital within 72 h.

Bivariate analyses (*t*-test, Mann–Whitney *U*-test, chi-square test, and Fisher's exact test, where appropriate) were used to compare the two groups

(short stay and long stay), with logistic regression analysis used to determine the relative contribution of independent variables.

Results

Over the 12-month study period, 485 children were hospitalized because of asthma. Of these, 121 (25%) had short-stay admissions (<24 h), whereas 364 (75%) had long-stay admissions (>24 h). The median length of stay for the short-stay group was 18 h (range: 6–24 h), compared with a median length of stay of 47 h (range: 26–137 h) for the long-stay group. Bivariate analyses showed no differences between the two groups regarding language, primary care physician, asthma history, management prior to ED presentation, respiratory rate on presentation, use of the observation unit, and time in the ED (see Table 1). Children in the short-stay group, however, were more likely to be younger, male, have a delivery device at home, and have milder asthma (shorter duration of symptoms and higher oxygen saturation level). The medical management of children in the short-stay group was less intensive, both in the ED and during the first 6 h in the in-patient unit. The final logistic regression model identified three variables independently associated with short hospital stay: asthma severity (based on oxygen saturation level), gender, and availability of a delivery device at home. Children with milder asthma (oxygen saturation level >90%) were more likely to have a short stay (adjusted odds ratio [OR] 4.9, 95% confidence interval [CI]: 1.6–14.6). Males were also more likely to have a short stay (adjusted OR 2.4, 95% CI: 1.2–4.7). Children with a delivery device at home were more likely to have a short stay (adjusted OR 2.0, 95% CI: 1.0–4.0). Only four patients were re-admitted within 72 h of discharge – one in the short-stay group and three in the long-stay group.

Discussion

This study found that 25% of children admitted to hospital because of asthma had a short hospital stay (<24 h). Mild disease, male gender, and the availability of a delivery device at home were independently associated with a short hospital stay.

Sampling bias was minimized by random sampling of subjects, while information bias was reduced by using the same data source for all subjects. The effects of confounding were addressed using logistic regression analysis.

Limitations of the study include the small sample size (particularly for rare ‘exposures’) and the retrospective nature of data collection. In other words, important factors may not have been recorded in the medical chart. For example, prepresentation asthma management appeared to be similar for the two groups. There was insufficient information in the chart, however, to identify subtle differences between groups on management issues such as effectiveness of inhaler use by the children or parental management of acute exacerbations.

Only one-third of children visited a physician in the 72 h prior to presentation to the ED. This may reflect parental concern about the severity of the acute asthma exacerbation and the perceived necessity of a visit to the ED. In addition, this may also reflect the unavailability of primary caregivers for acute problems (particularly outside office hours) in urban areas (7).

In our institution, the ED management of children with asthma generally follows an asthma pathway, based on the National Heart, Lung and Blood Institute (NHLBI) Asthma Guidelines. The high use of systemic steroids in the ED (in most cases within 1 h) along with ipratropium bromide use, suggests that management was optimized. The asthma pathway also has guidelines for discharge from the ED, and this includes providing appropriate delivery devices for inhaled medications and written instructions on management and follow-up.

The finding that milder disease (based on symptom duration and oxygen saturation level) was associated with a short hospital stay is intuitive. Prolonged symptomatology may reflect prolonged airway inflammation that can be more difficult to reverse. The less intensive medical management of children in the short-stay group (both in the ED and the in-patient unit) probably reflects a difference in baseline asthma severity between the two groups.

Independent of severity, however, two other factors were significantly associated with a short hospital stay. First, children with a delivery device at home had shorter hospital stays. This finding may reflect a willingness of physicians to discharge early if they know that a delivery device is available at home.

A more surprising finding was the association between male gender and short hospital stay. Although previous epidemiologic studies have demonstrated gender differences in asthma prevalence and utilization of health care, these studies did not examine differences in symptom duration (3,8). While the association between gender and length of hospital stay in our study may be a

chance finding, a recent study showed a similar result (9). In this prospective multi-centre study of 606 children (2–16 years of age), females had slightly longer hospital stays compared with males, despite similar baseline asthma severity. Possible explanations for this association include gender differences in the disease process, response to therapy, or management in hospital.

Alternative models of health care delivery for children with acute asthma exacerbations include short stay/observation units attached to EDs and formal discharge planning to caregivers in the community. Subsequent to our study, many children with asthma are now managed (to discharge) in an observation unit in the ED. In addition, a discharge planner dedicated to the ED ensures that the children and families have adequate resources and the necessary education prior to going home.

In conclusion, many children admitted to hospital because of an asthma exacerbation have short, yet expensive, hospital stays. The results of this study highlight the importance of developing alternative models of health care delivery for asthmatic children requiring short hospital contact. The relationship between male gender and symptom duration also needs further exploration to improve our understanding of the patterns of

recovery from acute asthma exacerbations in children.

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