

# Factors affecting readmission for acute asthmatic attacks in children

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## Summary

**Background:** Readmission following acute asthmatic attack has an impact on children's quality of life and the cost of hospitalization. The objective of this study was to define the risk factors associated with readmission following acute asthmatic attacks in children

**Methods:** This is a retrospective case-control study in children who were admitted because of acute asthmatic attacks at the Department of Pediatrics, Siriraj Hospital, Mahidol University, Bangkok, Thailand. The admissions were classified into 2 groups, admission and readmission within one-month to one-year after the first admission. The medical records were reviewed and the factors that might affect readmission were evaluated.

**Results:** Seventy six children, 49 males and 27 females, were included. There were 56 children who were admitted only once and 20 children who were readmitted. The 1-year readmission rate for children with asthma was 26.3 %. The risk factors which made readmission more likely were a parental history of allergic disease (Odd Ratio, OR, = 3.17; 95% CI 1.10-9.10), a history of Intensive Care Unit (ICU) admission (OR 29.62; 95% CI 3.35-262.18), methylprednisolone usage during the 1<sup>st</sup> admission (OR 8.33; 95% CI 2.46-28.19) and the level of asthma control. Increased risk of readmission was found in partly controlled asthma (OR 4.83; 95%CI 1.24-18.88) and uncontrolled asthma (OR 29; 95%CI 2.25-373.77). The factor that decreased the chances of

readmission was a history of influenza vaccination (OR 0.24; 95% CI 0.16-0.36).

**Conclusion:** A history of ICU admission at the first admission and the level of asthma control (partly controlled and uncontrolled according to Global of Initiative for Asthma guideline) increased the chances of readmission while influenza vaccination reduced the chances of readmission. (*Asian Pac J Allergy Immunol 2013;31:138-41*)

**Key words:** Admission and readmission of acute asthmatic attack, severity of acute asthma, level of asthma control, influenza vaccination

## Abbreviations

GINA	=	Global of Initiative for Asthma
ICU	=	Intensive Care Unit
OPD	=	Out Patient Unit
OR	=	Odd ratio

## Introduction

The incidence of readmission for asthma varies from country to country. The incidence varies from 15 % in France<sup>1</sup> and Rhode Island (USA)<sup>2</sup> to 40 % in Oulu (Finland).<sup>3</sup> Readmission to hospital due to asthma is a significant health care problem. Readmission has an impact on children's and parents' quality of life and increases the cost of hospitalization. Inpatient services accounts for 54% of direct expenditures for medical care related to asthmatic children, 17 years of age and younger.<sup>4</sup> Forty-three percent of the economic impact of asthma is associated with emergency department use, hospitalization, and death.<sup>4</sup> In Siriraj Hospital, Bangkok, Thailand during the years 2000 to 2002, the average medical charge was 3236.20 Baht per patient per admission or 998.60 Baht per patient per day.<sup>5</sup> The major expenses in the direct medical charge for asthma admissions was the cost of medication and a hospital bed. The severity of asthma was related directly to the medical charge.<sup>5</sup>

Readmission could increase the risk of morbidity in asthmatic children. The reduction of the rate of

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acute asthmatic hospitalization could be measured as a key index of the quality of patient care.<sup>6</sup> Prior studies found that age younger than five years and sex also played a role in determining the chances of readmission.<sup>7,8</sup> A higher readmission rate was found in female aged 10-19 years.<sup>9</sup> The objective of this study was to identify the risk factors for readmission because of acute asthmatic attacks. If these risk factors could be eliminated there would be potential savings for health services, familial expenses and an improvement in the quality of life of the whole family.

## Methods

Medical records of the children, aged 14 years or less, who were admitted to the Department of Pediatrics, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand between Jan 2006 and Dec 2007 with a principle diagnosis of acute asthmatic attack were reviewed. These admissions were due to an acute asthmatic attack that was severe or not improved after 3 doses of bronchodilator nebulization. Cases with other systemic diseases were excluded. The study was approved by the Institutional Review Board.

A hospital episode was defined as 'readmission' if the next admission occurred within one month to one year after the first admission. Clinical data included age, sex, housing, socioeconomic status, length of stay in hospital, Siriraj Asthma Score<sup>10</sup> before admission, parental history of allergic disease, co-morbid diseases (allergic rhinitis and sinusitis), level of asthma control, Pediatric Intensive Care Unit (PICU) admission, antibiotic or methylprednisolone usage at the first admission, skin prick test results, influenza vaccine injection, continuity of Out Patient Unit (OPD) visits and steroid compliance along with environmental data (presence of household smoking contact and pets). The level of asthma control was classified according to the Global of Initiative for Asthma (GINA) guideline.<sup>11</sup> The children with chronic lung and heart diseases were excluded.

## Statistical analysis

Data were analyzed using the SPSS 13 program (SPSS Inc, Chicago, Illinois). An unpaired t- test or the Mann-Whitney U test for quantitative data and chi-square test for qualitative data were used to compare the data between 2 groups. The odds ratios and 95% confidence interval (CI) for two groups were calculated. Statistical significance was denoted by a *p* value of less than 0.05.

## Results

Seventy six children were admitted because of acute asthmatic attack in Department of Pediatric, Siriraj Hospital during the 2-year study period. Among these children, 56 (73.7%) were had only one admission and 20 (26.3%) were admitted more than once. The 1-year readmission rate for children with asthma in our study was 26.3 %. The demographic data are shown in Table 1. Readmission within 1-3 months after the first admission occurred in 5 cases, 3-6 months later in 8 cases and 6-12 months later in 7 cases. The Siriraj asthma score before admission in the readmission group was 6.5 and in the one admission group 5.75 but this difference was not statistically significantly different. Males was more common than females in both groups. Most of the cases lived in Bangkok (88.2%). Sixty five percent of the caregivers had an education less than bachelor degree level. The median length of stay was 4.7 days (range 2-15

**Table 1.** Demographic data of the children studied.

	One admission n = 56		Readmission n = 20		Total n = 76	
	n	(%)	n	(%)	n	(%)
<b>Sex</b>						
Male	36	64.3	13	65	49	64.5
Female	20	35.7	7	35	27	35.5
<b>Age Group</b>						
0-3 yr	7	12.5	1	5	8	10.5
4-6 yr	21	37.5	9	45	30	39.5
> 6 yr	28	50	10	50	38	50
<b>Part of living</b>						
Bangkok	49	87.5	18	90	67	88.2
Other parts of Thailand	7	12.5	2	10	9	11.8
<b>Education of caregiver</b>						
Underbachelor degree	37	66.1	13	65	50	65.8
Bachelor degree	19	33.9	7	35	26	34.2
<b>Income (Baht/month)</b>						
≤ 5,000	5	8.9	1	5	6	7.9
5,001-10,000	17	30.4	7	35	24	31.6
10,001-20,000	26	46.4	10	50	36	47.4
≥ 20,001	8	14.3	2	10	10	13.2
<b>Median length of Stay (days)</b>	4.5 (2-15)		5.25 (2-15)		4.7 (2-15)	
<b>Diagnosis age (years)</b>	3.8 (0.6 -9)		2.9 (0.7-7)		3.5 (6 -9)	
<b>Siriraj asthma score before admission</b>	5.75 (2-10)		6.75 (5-8)		6.0 (2-10)	

days). The average Siriraj asthma scores and the median length of stay were higher in readmission group than in one admission group but not significantly different. The education level of the caregivers and the family incomes were not different between the two groups.

The factors significantly associated with readmission for acute asthmatic attacks in children were a parental history of allergic disease (Odd Ratio (OR) 3.17; 95%CI 1.10-9.10,  $p = 0.03$ ), a history of ICU admission (OR 29.62; 95%CI 3.35-262.18,  $p = 0.01$ ), partially controlled asthma (OR 4.83; 95%CI 1.24-18.88,  $p = 0.02$ ), uncontrolled asthma (OR 29; 95%CI 2.25-373.77,  $p = 0.001$ ), and methylprednisolone usage during the first admission (OR 8.33; 95%CI 2.46-28.19,  $p = 0.01$ ), as shown in Table 2. A history of influenza vaccination was the factor that decreased readmission rates (OR 0.24; 95%CI 0.16-0.36,  $p = 0.02$ ). There were no significance difference between the two groups with regard to co-morbid diseases (allergic rhinitis, sinusitis), continuity of OPD visits, household smoking and pets, positive skin prick tests, antibiotic usage during the first admission and compliance with steroid inhaler use.

## Discussion

The definition of 'readmission' varies among different studies. This study defined 'readmission' as one occurring within one month to one year after the first admission. A study in France defined readmission as a further admission 1 week to 1 year after the first but the others claimed that one week was too short a time after first admission to be considered to be a recurrence of the first attack.

The incidence of 1-year readmissions for asthma in this paper was 26.3 %, more than the 15 % reported from France and the USA. Another previous study showed that the probability of readmission increased from 30% after a first admission to 46% after a second and 59% after a third.<sup>12</sup> Our study showed that the boys aged 6-14 years made up 50% of the total admissions in both the one admission and the readmission groups. These results are different from those of the previous studies.<sup>13-17</sup> They found that young age,<sup>7, 8</sup> and female gender<sup>7,13</sup> increased the chances of readmission. Yue Chen et al<sup>9</sup> reported a markedly higher rate of readmission in females age 10-19 years which, they suggested, was related to airway size, female hormonal changes, increased use of cosmetic products and cigarette smoking among adolescent girls. The reason why our study had more

**Table 2.** Odds ratios for risk factors in the one admission and readmission group

Factors	Odd ratio	95% CI	P value
<b>Parent history of Allergic disease</b>	3.17	1.10-9.10	0.03
Associate AR	2.60	0.83-8.13	0.09
History of sinusitis within 1 year	2.55	0.61-10.65	0.19
<b>Level of Control</b>			
Partly controlled (n=53)	4.83	1.24-18.88	0.02
Uncontrolled (n=23)	29	2.25-373.77	0.001
<b>History of ICU admission</b>	29.62	3.35-262.18	0.01
<b>Methylprednisolone during first admission</b>	8.33	2.46-28.19	0.01
Antibiotic at first admission	0.67	0.24-1.88	0.44
Positive skin prick test	2.49	0.77-8.10	0.12
<b>Influenza vaccine</b>	0.24	0.16-0.36	0.02
<b>Continuity of OPD visit</b>	0.59	0.19-1.83	0.36
<b>Good compliance of steroid inhaler</b>	0.53	0.11-2.70	0.04
<b>Household smoking</b>	1.02	0.36-2.83	0.98
<b>Household pets</b>	1.88	0.66-5.36	0.12

boys than girls was that the age of the patients in our study was up to 14 years only. In this age group boys suffer from asthma more than girls.

Our study showed that ICU admission, level of asthma control (partially controlled or uncontrolled asthma), parental history of allergic disease and methylprednisolone usage during the first admission were associated with readmission. Such findings indicate that the greater the severity of the first admission, the greater the chance of readmission. This finding is supported by the study of Minkovitz et al.<sup>18</sup> Another previous study also found that children who were admitted to the intensive care unit had an increased risk of developing recurrent near-fatal asthma exacerbations.<sup>19</sup>

We also found that readmission was associated with partially controlled and uncontrolled asthma, as classified by the GINA guideline. Furthermore, we found that influenza vaccination was associated with a reduction in the rate of readmission. This finding is not supported by the results of previous studies<sup>20,21</sup> which found no preventive effect of influenza vaccination. However, the authors of these papers still advised giving influenza vaccination to the children with asthma since the intramuscular trivalent vaccine was safe and had a beneficial effect on the quality of life of children with asthma.<sup>21</sup>



Co-morbid illness (allergic rhinitis and sinusitis), continuity of OPD visits, household environment (pets) and positive skin prick tests were not associated with readmission. The compliance with steroid usage showed OR 0.53 with upper limit 95%CI of 2.70 and  $p = 0.04$ . These results are difference from those of a previous study<sup>22</sup> possibly because the sample size in the readmission group is too small. Another study found that active use of inhaled corticosteroids as maintenance therapy was associated with decreased readmissions in young children <24 months old with asthma.<sup>3</sup> One possible explanation for readmission was viral infection since readmission increased in the rainy season and influenza vaccination could reduce the rate of readmission. We didn't find any association between household smoking and readmission, which was contrast to a previous study.<sup>22</sup>

The limitation of this study is that it is a retrospective study. A prospective study should be performed to clarify the situation.

## Conclusion

We conclude that a history of ICU admission at the first admission and level of asthma control (partially controlled or uncontrolled) according to the GINA guideline increased the chances of readmission while influenza vaccination reduced the risk of readmission.

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## References

1. Delmas MC, Marguet C, Raheison C, Nicolau J, Fuhrman C. Readmissions for asthma in France in 2002-2005. *Rev Mal Respir*. 2011;28:e115-22.
2. Liu SY, Pearlman DN. Hospital readmissions for childhood asthma: the role of individual and neighborhood factors. *Public Health Rep*. 2009;124:65-78.
3. Korhonen K, Dunder T, Klaukka T, Reijonen TM, Korppi M. Use of inhaled corticosteroids decreases hospital admissions for asthma in young children. *World J Pediatr*. 2009;5:177-81.
4. Weiss KB, Gergen PJ, Hodgson TA. An economic evaluation of asthma in the United States. *N Engl J Med*. 1992;326:862-6.
5. Visitsunthorn N, Durongpisitkul W, Uoonpan S, Jirapongsananuruk O, Vichyanond P. Medical charge of asthma care in admitted Thai children. *J Med Assoc Thai*. 2005;88 Suppl 8:S16-20.
6. Benbassat J, Taragin M. Hospital readmissions as a measure of quality of health care: advantages and limitations. *Arch Intern Med*. 2000;160:1074-81.
7. Mitchell EA, Bland JM, Thompson JM. Risk factors for readmission to hospital for asthma in childhood. *Thorax*. 1994;49:33-6.
8. To T, Dick P, Feldman W, Hernandez R. A cohort study on childhood asthma admissions and readmissions. *Pediatrics*. 1996;98:191-5.
9. Chen Y, Dales R, Stewart P, Johansen H, Scott G, Taylor G. Hospital readmissions for asthma in children and young adults in Canada. *Pediatr Pulmonol*. 2003;36:22-6.
10. Pongsamart G, Prikanahog J, Parottasen P, Bunyawiwat O, Visitsunthorn N. Childhood asthma. in Piboonpokanun O, Visitsunthorn N, Leungvechakarn V, Pachan P, editors. *Pediatric Allergy & Primary Immunodeficiency Disease*. Bangkok;Sunpasam Co. 2011. p 79-136.
11. Global Initiative for Asthma Executive Committee. *Global Strategy for Asthma Management and Prevention* updated 2011. Available on [www.ginasthma.org](http://www.ginasthma.org).
12. Bloomberg GR, Trinkaus KM, Fisher Jr. EB, Musick JR, Strunk RC. Hospital Readmissions for Childhood Asthma. A 10-Year Metropolitan Study. *Am J Respir Crit Care Med*. 2003;167:1068-76.
13. Senthilselvan A. Effect of readmissions on increasing hospital admissions for asthma in children. *Thorax*. 1995;50:934-6.
14. Correll PK, Xuan W, Williamson M, Sundararajan V, Ringland C, Marks GB. Reattendance at hospital for asthma in two Australian states, 2000-2003. *Respirology*. 2007;12:220-6.
15. Wallace JC, Denk CE, Kruse LK. Pediatric hospitalizations for asthma: use of a linked file to separate person-level risk and readmission. *Prev Chronic Dis*. 2004;1:A07.
16. Rushworth RL, Rob MI. Readmissions to hospital: the contribution of morbidity data to the evaluation of asthma management. *Aust J Public Health*. 1995;19:363-7.
17. Kimes D, Ullah A, Levine E, Nelson R, Timmins S, Weiss S, et al. Relationships between pediatric asthma and socioeconomic/urban variables in Baltimore, Maryland. *Health Place*. 2004;10:141-52.
18. Minkovitz CS, Andrews JS, Serwint JR. Rehospitalization of children with asthma. *Arch Pediatr Adolesc Med*. 1999;153:727-30.
19. Carroll CL, Uygungil B, Zucker AR, Schramm CM. Identifying an at-risk population of children with recurrent near-fatal asthma exacerbations. *J Asthma*. 2010;47:460-4.
20. Cates CJ, Jefferson TO, Rowe BH. Vaccines for preventing influenza in people with asthma. *Cochrane Database Syst Rev*. 2008;(2):CD000364.
21. Friedman BC, Goldman RD. Influenza vaccination for children with asthma. *Can Fam Physician*. 2010;56:1137-9.
22. Rasmussen F, Taylor DR, Flannery EM, Cowan JO, Greene JM, Herbison GP, et al. Risk factors for hospital admission for asthma from childhood to young adulthood: a longitudinal population study. *J Allergy Clin Immunol*. 2002;110:220-7.

