

# Decline In Outpatient Management Of Severe Asthma Patients Admitted To A State Hospital

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## Abstract

The purpose of the study was to assess the outpatient management of adult patients admitted with asthma and compare the results obtained to a similar series studied five years earlier. A cross-sectional survey of 211 consecutive patients admitted to a hospital specialising in lung diseases during a 12 month period was conducted. Patients were surveyed using a previously validated questionnaire and the results compared to those of the previous survey. The current survey showed under-utilisation of inhaled corticosteroids, poor MDI inhalation technique, low use of PFM and under-utilisation of MDI beta2 use during asthma exacerbations. Compared to the previous study, the number of admissions doubled and the severity of asthma at the time of admission was worse. These changes may be ascribed in part to domestic social, economic and political instability in Argentina.

## INTRODUCTION

The prevalence of asthma is increasing in several countries <sup>1</sup>. Asthma morbidity and mortality is associated with under-diagnosis and under-treatment, non-compliance with prescribed medication, improper use of medication particularly inhaled drugs, under-treatment with anti-inflammatory agents and over-utilisation of beta adrenergic bronchodilators. <sup>1,2,3</sup> In addition, poor understanding of the disease process, lack of adequate medical management, and dependence on crisis oriented or emergency department (ED) care, have been identified as major problems in patients with moderate or severe asthma <sup>1,2,3</sup>.

Many countries, including Argentina <sup>4</sup>, have developed asthma management guidelines. The Global Initiative for Asthma, has established a comprehensive asthma management programme, with the goal of reducing chronic disability and premature deaths, while allowing asthmatic patients to lead productive and fulfilling lives. Although these guidelines have existed for over ten years, several studies have shown a low level of uptake <sup>5,6,7</sup>.

This study assessed the level of agreement between the clinical management of asthma patients and the asthma management guidelines, and compared current asthma management strategies to those recorded in a similar study conducted at the same hospital 5 years earlier, using the same questionnaire <sup>8</sup>. Some of the results of this study have been previously reported in the form of a short

communication <sup>9</sup>.

## METHODS

A cross-sectional survey of adult patients admitted to a state hospital between November 2002 and October 2003 was conducted, and the results compared to those of a similar study conducted five years earlier <sup>8</sup>. All patients recruited met the diagnostic criteria for asthma. <sup>3</sup> Patients were surveyed within 48 hours of admission.

The questionnaire was based on a modified translated version of one originally used by Hartert et al. <sup>6</sup>, and was designed to explore the outpatient management of asthma. The questionnaire collected information on treatments prescribed and measures taken by patients or physicians to treat the asthma exacerbation leading to hospitalisation. Demographic data including patient gender, age and smoking habits was collected. Asthma severity was estimated according to the number of asthma related ED visits and admissions during the past five years, and on the need for intubation. Questions on asthma management included information on the treatment given during the acute exacerbation leading to admission and on maintenance therapy. A brief description of the current exacerbation was requested, including duration of the attack, symptoms experienced, whether a physician had been contacted, use of beta agonists, including number of inhalation treatments or metered dose inhaler (MDI) use during the 24 hours prior to ED visit, and use of additional medication. Patients were

asked about their treating physician (whether a general practitioner or a specialist had indicated treatment), type of health insurance coverage, use of chronic medication, use of spacers and peak flow meters (PFM), and whether an action plan for asthma exacerbation management had been recommended. During the interview, patients were asked to demonstrate their MDI inhaler technique. This was scored according to five criteria: single actuation, inhalation technique, slow breathing, breath withholding and open mouth technique.

FEV<sub>1</sub> and arterial blood gases while breathing room air were measured on arrival in the ED. Predicted values were calculated from normal values previously published by Knudson et al.<sup>10</sup> Patients were interviewed by one of the authors. The study was approved by the Hospital Ethics Committee.

Data were analysed as in the study of Hartert et al.<sup>6</sup> Asthma severity was assessed as the sum of the number of visits to the ED not leading to hospitalisation plus hospitalisations during the previous year. Physician involvement was categorised as (i) if it had occurred during the two days prior to admission; (ii) if it had been between three and seven days; (iii) if it has been between one and four weeks; (iv) if it had been between one and 12 months; and (v) if it had been more than a year prior to admission. Beta-agonist use was measured as a self-reported number of MDI actuations or number of nebulisations over the 24-hour period prior to arriving at the ED. Subgroup analysis was performed for asthma severity indices and for beta-agonist usage prior to admission. Comparisons were between males and females, smokers and nonsmokers, patients with no medical coverage versus those with medical coverage. Patients receiving treatment for asthma from general practitioners were compared with those treated by specialists. Comparisons were also made between patients older than 40 years of age and patients who were younger, as well as those whose asthma developed before 30 years of age versus those with onset after 30 years of age.

Patients treated by an asthma specialist were compared with patients treated in the ED with respect to maintenance

medication usage, severity of asthma, gender, smoking status, age ( $\leq 40$  vs.  $>40$  years) and age of asthma onset ( $\leq 30$  vs.  $>30$  years).

### ANALYSIS

A two-tailed Student's test was used to compare continuous variables; contingency tables and Fischer's exact test or  $\chi^2$  statistic were used for dichotomous variables. Exploratory analysis was performed to determine the features predictive of asthma severity, beta-agonist use, arterial blood gas levels or spirometric changes. Stepwise multiple regression was employed using different models, the dependent variables analysed included: (i) asthma severity measured as the sum ED visits plus hospital admissions during the previous year; (ii) number of beta-agonist MDI actuations administered during the 24 hours prior to admission; (iii) FEV<sub>1</sub>; (iv) PaO<sub>2</sub> and (v) PaCO<sub>2</sub> on arrival at the ED. Independent variables were: gender, age, age of asthma onset, health insurance coverage, type of attending physician, smoking status and total number of asthma medications prescribed per patient. All results are presented as means  $\pm$  standard deviations.  $P < 0.05$  was considered evidence of statistical significance.

### RESULTS

During the first survey, 98 patients had been hospitalized.<sup>8</sup> During the second survey 232 patients were hospitalised. Of these, six were not recruited, either because their hospital stay lasted only a few hours ( $n=2$ ), or because intubation was required ( $n=4$ ). An additional fifteen patients were surveyed only in his or her first admission. Therefore, a total 211 patients completed the second survey.

Demographic and clinical characteristics of the two populations are shown in Table 1. The lower spirometric values recorded by patients in the present survey, in combination with the higher PaCO<sub>2</sub> concentrations, indicate more severely ill patients (Table 2). Of the other indices of asthma severity such as prior hospital admission for asthma, mean number of admissions during the last year, mean ED visits during the previous year, or the need for intubation during admission, only the mean number of admissions during the last year was significantly higher in the present survey (Table 1).

**Figure 1**

Table 1: Clinical and demographic characteristics of the study population compared to that of Raimondi

	Previous study <sup>8</sup>	Present study	P-value
<b>Number of patients</b>	98	211	
<b>Mean age (years)</b>	39±15	42±16	0.11
<b>Gender %</b>			
Male	24.6	29.4	0.37
Female	75.4	70.6	
<b>Smoking status %</b>			
Current	13.7	8.5	0.27
Past	17.8	23.2	
Never	69.5	68.3	
<b>Asthma care provider %</b>			
General practitioner	5.1	3.8	0.64
Specialist	69.5	64.9	
ED only	26.4	31.3	
<b>Health coverage %</b>			
Medical assistance	8.2	4.7	0.30
Third party payer	1.0	1.0	
HMO	15.3	12.8	
No coverage	75.5	81.5	
<b>Hospitalised at any time (%)</b>	65.3	74.4	0.10
<b>Mean admissions (past year)</b>	0.7±1.2	1.3±0.7	0.0001
<b>Mean ED visits (past year)</b>	4.6±5.1	5.5±6.8	0.13
<b>Intubated during this admission (%)</b>	9.2	4.3	0.08
<b>Have an action plan (%)</b>	43.4	92.9	0.0001
<b>Own a PFM (%)</b>	3.1	4.7	0.51
<b>Correct use of MDI (%)</b>	11.2	14.7	0.34
<b>Spacing device prescribed (%)</b>	14.2	16.3	0.62
<b>β<sub>2</sub> MDI (%)‡</b>	68.4	62.6	0.32
<b>β<sub>2</sub> nebulised (%)‡</b>	37.8	65.4	0.01
<b>Oral corticosteroids (%)‡</b>	10.2	13.3	0.40
<b>Inhaled corticosteroids (%)‡</b>	62.2	53.6	0.15
<b>Inhaled corticosteroids, mean dose (µg) §</b>	737±454	831±414	0.14
<b>Oral theophylline (%)‡</b>	21.4	4.3	0.01

† Data compared to results from the study by Raimondi et al.<sup>8</sup>; both studies used the same data collection methods.

‡ Percentage of patients with prescribed medication for chronic care.

§ expressed in Beclometasone potency

ED, emergency department, HMO, Health Maintenance Organization; MDI, metered dose inhaler; PFM, peak flow meter

**Figure 2**

Table 2: Spirometric and arterial gases values of the present study population compared to that of Raimondi

	Previous study <sup>8</sup> (n)	Present study (n)	p
<b>FEV<sub>1</sub></b> (%predicted)	30.2±11.1 (82)	23.9±8.9 (182)	0.00001
<b>PaCO<sub>2</sub></b> (Kpa)	4.4±1.2 (93)	5.2±0.3 (221)	0.00003
<b>PaO<sub>2</sub></b> (Kpa)†	9.2±2.1 (82)	9.3±2.2 (184)	NS
<b>pH</b> (units)	7.43±0.09 (93)	7.40±0.22 (221)	NS
<b>BE</b> (mEq/L)	-1.9±3.9 (93)	0.3±3.5 (212)	0.00001
<b>Bic</b> (mEq/L)	21.3±3.5 (93)	24.3±3.3 (218)	0.00001
<b>AG</b> (mEq/L)	16.0±5.5 (34)	13.7±2.7 (201)	0.0001

†Only PaO<sub>2</sub> values of patients breathing air are shown.  
BE, base excess; Bic, bicarbonate; AG, anion gap (Na – Cl – bicarbonate)

Comparison of maintenance medication use by the two survey populations showed no difference for MDI beta-agonists (MDI<sub>2</sub>), oral corticosteroids or inhaled corticosteroids (IC). Use of nebulised beta-agonists (NB<sub>2</sub>) increased, while oral theophylline use was significantly reduced in the present study (Table 1). Beta-agonist usage 24 hours preceding admission are shown in Table 3. Changes made in the treatment regimen are shown in Table 4.

**Figure 3**

Table 3: Beta-agonist usage 24 hours preceding admission

	Previous study <sup>8</sup> n (%)	Present study n (%)	p
<b>Number of patients using β<sub>2</sub></b>	91 (92.8)	196 (92.9)	1.0
<b>Nβ<sub>2</sub> only</b>	44 (45.0)	110 (52.2)	0.43
<b>MDIβ<sub>2</sub> only</b>	23 (23.5)	53 (25.2)	0.85
<b>Nβ<sub>2</sub> and MDIβ<sub>2</sub></b>	24 (24.5)	33 (15.6)	0.46
<b>MDIβ<sub>2</sub> only</b> (puffs/24 h)	14.4±7.4	16.6±13.8	0.48
<b>Nβ<sub>2</sub> only</b> (nebulizations/24 h)	8.6±5.4	9.0±5.5	0.65

**Figure 4**

Table 4: Changes made in the treatment regimen of the study population compared to that of Raimondi

	Previous study <sup>8</sup> n (%)	Present study n (%)	p
<b>Contacted with their physician:</b>	12 (12.2)	41 (19.3)	0.12
<b>Made changes themselves:</b>	57 (58.2)	159(75.4)	0.02
<b>Medication changes:</b>			
- increase β <sub>2</sub> NBZ	59 (60.2)	145 (68.8)	0.14
- increase β <sub>2</sub> MDI	22 (22.4)	89 (42.2)	<0.01
- add or increase corticosteroids p.o.	24 (24.4)	17 (8.1)	<0.01
- add or increase inhaled corticosteroids	11 (11.2)	3 (1.4)	<0.01
- add theophylline	9 (9.2)	5 (2.4)	<0.01

As in the previous survey<sup>8</sup>, no statistically significant differences were recorded for subgroup analysis of asthma severity as measured by the number of ED visits and hospital admissions within the previous year, and by beta-agonist use during the 24 hours prior to admission. More patients treated by specialists had been prescribed inhaled corticosteroids than those followed exclusively through the ED for routine care (65.9% vs. 33.8% p<0.001)

No relationship was found between the number of ED visits

in the year prior to the survey and the IC doses prescribed ( $r = 0.02$ ). No differences were found between the mean number of ED visits during the year prior to the survey for the patients prescribed vs not prescribed IC ( $5.5 \pm 6.1$  vs.  $4.1 \pm 4.8$  visits,  $p < 0.12$ ). The mean number of admissions during the year prior to the survey for patients prescribed IC was higher than that for patients not prescribed IC ( $1.5 \pm 1.6$  vs.  $0.6 \pm 0.9$  admissions,  $p < 0.0001$ ), with a significant correlation between the number of admissions during the last year and the number of IC doses prescribed ( $r = 0.23$ ,  $p < 0.002$ ).

A statistically significant relationship was found between the time elapsing between admission and the latest physician visit vs. asthma severity (defined as the sum of the number of visits to the ED plus hospital admissions during the previous year), suggesting that the patients with more severe disease obtain more frequent medical care. ( $r = -0.29$ ,  $p < 0.001$ ).

No association was found between FEV<sub>1</sub> % predicted or arterial gases and other variables, such as the type of physician or asthma severity. Multiple regression analysis using asthma severity, the number of MDI actuations over the 24 hours prior to admission, FEV<sub>1</sub> % predicted, PaO<sub>2</sub>, PaCO<sub>2</sub> on arrival as dependent variables and gender, duration of asthma attack, age of asthma onset, health coverage, type of attending physician, smoking status and the total number of asthma medications that each patient was prescribed as independent variables, found no significant associations.

### DISCUSSION

Demographic characteristics of age, gender, smoking habits and health coverage were similar in both series. The average number of admissions in the year prior to the present survey was nearly double that found in the survey conducted 5 years earlier<sup>8</sup>. Asthma severity observed in the present study was also greater than in the previous survey, as reflected by lower FEV<sub>1</sub>%, higher PaCO<sub>2</sub> and higher mean number of admissions in the year prior to the survey. FEV<sub>1</sub>% levels at admission were 24% of the expected values, demonstrating not only the significant degree of breathing obstruction present in this population, but also a more severely affected group of patients, compared to those reported in other series admitted after ED treatment<sup>11,12,13</sup>. Although these were severely affected asthmatics, fewer required intubation compared to the previous survey, suggesting stable institutional care between surveys.

The population surveyed and treated at this hospital is mainly a low-income group, less likely to have access to health insurance, which in turn may limit the quality of medical care they receive. Nearly 82% of patients had no health insurance, and 31% were followed only through ED visits. Hospitalisation for asthma is associated with low household income levels<sup>14</sup>, and more ED use<sup>15</sup>. Also, those without access to primary care due to cost or insurance status are more likely to use ED services<sup>16</sup>. Low income is associated with increased prevalence of asthma, and with increased hospitalisation and mortality rates<sup>14,17,18,19</sup>. It has also been suggested that the higher rate of ED and hospital use in this population, may be related to inadequate use of maintenance medication<sup>5</sup>.

Potential reasons underlying the greater number of hospital admissions prior to the survey and more severely ill patients recorded during the present survey, could be ascribed to significant economic hardships imposed by social, economic and political instability beginning in Argentina at the end of 2001, with large numbers of low income level groups losing health insurance coverage, significantly increasing public hospital attendance and restricting access to prescribed medication<sup>20,21</sup>. A significant drop in units of drug dispensed for chronic airflow limitation was also observed<sup>22</sup>, this may have resulted in a large proportion of untreated patients visiting the ED and increasing the need for admission. Shortage of beds produced changes in admission criteria explaining the greater symptom severity present in patients admitted in the current study.

Current guidelines recommended the use of IC in mild, moderate and severe persistent asthma, and in patients with intermittent asthma subject to severe exacerbations<sup>3</sup>. Most of the patients surveyed in this study met these criteria and should have received IC. Fewer patients were being treated with IC (54%) in the present survey than in the survey five years previously (62%, despite the changes in treatment recommendations. Taking into account that IC are expensive in Argentina, the relative decrease in IC use could be ascribed to the economic problems of the country. In fact, the number of prescription and over-the-counter IC units dispensed in 1998 compared to 2003 (data collected from wholesalers and pharmacies obtained from IMS MIDAS, IMS Health and analysed on a quarterly basis) dropped 25%<sup>22</sup>. These values represent annual sales for the country at large, but in this particular population, the drop was probably even greater. The observation that patients prescribed IC had a higher average number of admissions

during the year prior to the study compared to patients not prescribed IC, together with the significant relationship found between admissions during the year prior to the study and prescribed doses of IC, reflects asthma severity, with the more severe asthmatics being prescribed more IC at higher doses. As in other studies <sup>5</sup> and the previous study <sup>8</sup> patients treated by asthma specialists were more likely to receive a prescription for IC than those treated in the ED.

Rapid-acting inhaled beta-agonists are the most effective bronchodilators available, and are the preferred treatment for acute asthma. Although similar results are achieved using different routes of administration for inhaled beta-agonists <sup>23,24</sup>, a great proportion of these patients were treated with nebulised  $\beta_2$  agonists. This is not in agreement with current recommendations favoring MDI administration <sup>3</sup>. In Argentina, nebulised beta-agonists continue to be preferred over MDI. On an equivalent weight basis, nebulised Salbutamol sales (prescriptions) are double MDI sales in this country <sup>25</sup>.

Inhaled  $\beta_2$  agonist use during the 24 hours preceding admission was almost the same compared to the previous study. As in the previous study, inhaled beta-agonist use during the 24 hours preceding admission was relatively low compared to the recommendations for home management of exacerbations and compared to other studies <sup>12,13</sup>. MDI use contrasts clearly with the results of the study by Hartert et al., who found a mean use of  $44.8 \pm 7.8$  puffs/day <sup>6</sup>. Current guidelines recommend repeated administration of 2-4 puffs every twenty minutes during the first hour for home management of exacerbations (up to 12), and in severe exacerbations to continue with up to ten puffs at less than hourly intervals <sup>3</sup>. The total MDI  $\beta_2$  administration of about 14 puffs during the 24 hours preceding an admission observed in this study appear inadequate.

For the adult population, MDI is preferred over the nebulised route because the latter is more expensive, cumbersome, time-consuming and drug output is device dependent. When scoring the quality of MDI technique based on the five criteria used by Hartert et al., we found that only 15% of the patients performed it properly <sup>6</sup>. This result was similar to the one observed in the previous study (11%) <sup>8</sup>. The finding that inhaler technique is generally sub-optimal has been reported by other studies <sup>7,26</sup>. Previous surveys have found that poor MDI technique increases with ageing <sup>27</sup> and that females of all ages are much more likely to have a poor MDI technique <sup>28</sup>. Poor use of MDI is associated with decreased

asthma control in asthmatics treated with IC <sup>29</sup>. Poor use of pressurised MDI is mainly due to poor coordination <sup>29</sup> thus the use of devices which alleviate coordination problems should be reinforced in MDI inhaler misusers. In spite of physicians' reliance on MDI medication, such findings suggest that health care providers have not checked patients' knowledge or inhaler technique. One of the recommendations of the current guidelines is to demonstrate the inhaler technique at every visit <sup>3</sup>. Surveys have shown that specialists generally claim to have observed MDI inhaler technique <sup>30</sup>, but this may not necessarily be so. Despite the poor MDI technique, only a minority of patients were prescribed a spacing device, similar to the finding of the previous study <sup>8</sup>.

In general, most adults can use a PFM correctly. The guidelines state that those patients with more than mild disease should receive training on how to measure and record peak flow. Only 3.1% of patients in the present study had a PFM, a figure similar to the one found previously (4.7%). The infrequent use of PFM could be due to economic restrictions and the high cost of the PFM, making it unaffordable. Patterns of PFM prescription depend on the type of medical insurance coverage <sup>31</sup>. Notwithstanding, other studies have shown higher rates of PFM use <sup>5,7,32</sup>.

The value of a written action plan for patients with a history of severe exacerbations, or with moderate to severe persistent asthma is well documented. Action plans have been demonstrated significantly reduce morbidity and the patient's need for medical services <sup>33,34</sup>. In the present survey, an action plan was given to 92% of the patients by their physicians, a significant improvement on the figure registered during the previous study (43%), however most plans consisted only of instructions to attend the ED for care in case of clinical deterioration and did not contain the level of information that would advise patients on the steps to take to self-manage an exacerbation. A minority of the patients contacted their physician during the exacerbation and 75% of the patients made changes themselves. These changes are inconsistent with the recommendations of current asthma management guidelines, which clearly indicate adding or increasing inhaled or systemic corticosteroids in case of worsening <sup>3</sup> asthma. The findings probably reflect self-medication, in lieu of a written action plan.

The correlation found between indices of asthma severity versus time elapsed between most recent interaction with any physician and hospital admission, suggests that the

patients with more severe disease obtained more frequent medical care. Nevertheless, in this particular group of patients, it is possible that what was called the last interaction with a medical doctor was in fact an unscheduled visit to the ED. The finding described by Dales et al. in patients presenting with asthma exacerbation to ED is particularly revealing, namely that the frequency of visits to a patient's regular physician was positively correlated with multiple emergency room visits, leading the authors to conclude that patients were not simply substituting the ED for an ambulatory clinical setting <sup>35</sup>.

In patients admitted to the study hospital with asthma, under-use of IC, low use of MDI<sub>2</sub> agonists in the 24 hours preceding admission and low PFM utilisation were observed, as well as more hospital admissions than in the previous survey. Modifications in the asthma management of the study patients could not be ascribed only to continuing physician education, or adherence to guidelines. Other variables may have been of greater significance, and social, economic and political instability may account for the observations made.

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