

# Factors affecting compliance and control of asthma in patients attending the Respiratory Outpatient Department, Chris Hani Baragwanath Academic Hospital

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**Background.** There is a sense among respiratory physicians that asthma is poorly controlled in public sector hospitals, possibly due to poor adherence and lack of knowledge regarding inhaler technique.

**Objective.** To describe the status of asthma control in patients attending the Respiratory Outpatient Department at Chris Hani Baragwanath Academic Hospital.

**Methods.** A retrospective record review was conducted on outpatient files of asthmatics known to the Respiratory Department. Data obtained included demographics, level of control and number of admissions and exacerbations.

**Results.** A total of 519 patient files were reviewed, 74.2% of whom were female. The mean (standard deviation) age was 47 (16.5) years. We found 47.2% of patients were controlled, 30.4% partially controlled and 22.4% uncontrolled. Most patients (88%) had no admissions in the previous year. About 60% had not experienced exacerbations in the previous year. There were significant differences between the three groups for number of exacerbations, both per year and per lifetime, and type of steroid prescribed. For a number of significant areas, such as forced expiratory volume in one second (FEV<sub>1</sub>%) predicted and competency of inhaler technique, a large proportion of the data (>30%) had not been documented by the attending doctor in the patient files.

**Conclusion.** In this population of mostly middle-aged female asthmatics, less than half the patients were well-controlled despite very few admissions or exacerbations in the previous year. Documentation by clinicians of aspects indicative of asthma control was generally poor, and better documentation should be encouraged in order to improve knowledge and highlight awareness of best practice in the management of asthma.

*S Afr Respir J* 2015;21(4):91-95. DOI:10.7196/SARJ.2015.v21i4.43



Asthma is a chronic, inflammatory airway disease involving airway hyper-responsiveness and intermittent airflow obstruction. Although potentially under-reported, asthma affects 20% of people in sub-Saharan Africa.<sup>[1]</sup> There is a wide range in prevalence among different geographic locations, owing in part to poverty, climate, and allergen exposure.<sup>[1]</sup> There appears to be a racial discrepancy in prevalence of asthma, with Asians being less affected than Native Americans, and a gender discrepancy, with a female preponderance among adult asthmatics.<sup>[2]</sup> Patients with asthma over the age of 65 years tend to fare worse than younger patients.<sup>[3]</sup>

Identification of the level of severity of asthma and determination of the factors affecting asthma control are crucial to the design and implementation of strategies to reduce the number of exacerbations and hospital admissions, thus improving outcomes. Of vital importance is the documentation of important parameters in the management of asthma, particularly in a public hospital where patients often see different doctors at each visit. These include inhaler technique, frequency of exacerbations and number of admissions to hospital.

Our impression is that the control of asthma in patients attending the Respiratory Outpatient Department (ROPD) at Chris Hani

Baragwanath Academic Hospital (CHBAH), Johannesburg, is suboptimal. However, no study has been performed at our hospital to interrogate this hypothesis, or to quantify the proportion of our patients with severe disease and/or poor control. We are of the opinion that these data will provide important information on asthma management relevant to the South African (SA) healthcare system.

## Methods

We undertook a retrospective analysis of scheduled visits by patients with asthma attending the ROPD at CHBAH. Data collected included demographics, symptoms, disease severity, medication prescription and usage, control of asthma, inhaler technique competency and spirometry. This information was captured by the investigator using a data collection sheet that is routinely completed as part of our patients' clinic records. The sources of information were the patients' files, held at ROPD.

Definitions of asthma control and indicators of asthma severity were based on those advocated by local SA Thoracic Society guidelines.<sup>[4]</sup> Acute exacerbations and severity were determined by the need for oral steroid use, days off work, antibiotic use, number of Emergency Department visits (exacerbations), intensive care unit admissions and general ward

admissions due to asthma in the prior 12 months. Examination findings and spirometry results were also captured. Age, gender and comorbidities were noted in an attempt to identify any factors that were associated with poor control or severity of asthma. Treatment prescriptions were documented, as well as any comments regarding use of medication in the previous month. The diagnosis of asthma was based on clinical assessment. The diagnosis of gastro-oesophageal reflux was based on either reporting of symptoms, barium swallow or gastroscopy. Any patient  $\geq 18$  years known to have asthma who presented for a scheduled visit to ROPD within the defined period was included.

Patient demographics and clinical characteristics of the cohort group were summarised using descriptive statistics. All categorical data were analysed using the  $\chi^2$ -test, unless the frequency was  $\leq 5$ , in which case Fisher's exact test (two-tailed) was used. Student's *t*-test was used for numerical variables when comparing well-controlled asthmatics with poorly controlled asthmatics.

Ethical approval was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (M150458), and from the CHBAH Medical Advisory Committee.

## Results

A total of 586 patient files were reviewed. Sixty patients were younger than 18 years of age, leaving 526 eligible for analysis. Of these, a further 7 were excluded as their level of control was not determined. Of the study population, 74.2% were female. The median (standard deviation (SD)) age was 46 (16.5) years. With regard to levels of asthma control, 47.2% (245/519) were controlled, 30.4% were partially controlled (158/519), and 22.4% were uncontrolled (116/519). There was no significant difference in terms of age and median forced expiratory volume in one second (FEV<sub>1</sub>)/forced expiratory vital capacity (FVC) between the controlled, partially controlled and uncontrolled groups (Table 1). The controlled group, however, had statistically significantly higher percent predicted and median FEV<sub>1</sub>% than the partially controlled and uncontrolled groups ( $p < 0.05$ ).

The risk posed to asthma control by hospital admissions is shown by the fact that the number of admissions per year was lowest in the controlled group, compared with the uncontrolled (odds ratio (OR) 8.14,  $p < 0.0001$ ), and the partially controlled groups (OR 3.99,  $p < 0.0001$ ) (Table 2). Only the uncontrolled group had significantly more admissions per lifetime than the controlled group (OR 2.4,  $p = 0.0025$ ). There were similar differences in the acute exacerbations whether determined per week or per year between the controlled, partially controlled and uncontrolled groups of patients.

In almost half the cases, doctors did not document the patients' inhaler technique (Table 2). Doctors assessed patients' inhaler technique as 'fair to good' in only 59 partially controlled and 31 uncontrolled asthmatics v. the controlled group, which was significantly different from the uncontrolled group (Table 2).

The uncontrolled patients were also statistically more likely to be prescribed both inhaled and oral corticosteroids (CSs) than the controlled group (Table 2).

In all three groups of asthma control there was a median of one comorbidity. Fig. 1 illustrates the variety of comorbidities found in the cohort, and the numbers found within the levels of asthma control.

There were no significant differences between levels of asthma control for patients with co-existent gastro-oesophageal reflux disease

(GERD), eczema, hypertension, diabetes mellitus, HIV infection, heart disease, depression and other psychiatric disorders, and obesity. There was a significant difference in asthma control in patients with co-existent rheumatoid arthritis, allergic rhinitis and previous tuberculosis. Rheumatoid arthritis was more frequent in those patients with controlled asthma compared with uncontrolled ( $p = 0.018$ ) and partially controlled asthma ( $p = 0.032$ ). Allergic rhinitis was also more commonly diagnosed in the controlled group compared with the partially controlled group ( $p = 0.023$ ). Previous tuberculosis was more common in the partially controlled group than the controlled group ( $p = 0.020$ ) (Table 3).

## Discussion

Our data show that a large number of adult asthmatic patients attending the ROPD at CHBAH hospital remain either partially controlled or uncontrolled. Our patients were mainly middle-aged women with one comorbidity. The level of asthma control is associated with %-predicted and median FEV<sub>1</sub>, number of admissions and exacerbations and steroid use.

The overwhelming preponderance (74.2%) of female asthmatics attending our clinic was somewhat surprising. A higher incidence of asthma among females in the adult population is described,<sup>[5-7]</sup> yet our figures are higher than generally reported. We are a tertiary level facility, and preferentially follow up patients whose asthma is difficult to control. The cluster analysis study of severe asthma (Moore *et al.*<sup>[8]</sup>) also found that women constituted the majority in all five cluster phenotypes, although the proportions ranged from 53% to 80%. Females may have greater health-seeking behaviour than men.<sup>[9]</sup> This phenomenon remains an area for further study.

The median (SD) age was 47 (16.5) years, with no significant age difference between the groups stratified by the three levels of control. This is likely a reflection of the catchment population, but is also in keeping with other studies.<sup>[7]</sup>

Occupational asthma in adults, as is described by Burney *et al.*,<sup>[10]</sup> was unfortunately not examined in this study, as we did not record employment or type of occupation. We are thus unable to comment on the relative contribution that occupational asthma plays in the prevalence of asthma in our adult population.

We found that the majority of our patients were either partially controlled or uncontrolled, similar to the findings of an American study which showed that 74% of patients were partially controlled or uncontrolled (according to GINA guidelines).<sup>[11]</sup> A recent Italian study demonstrated that only 9.1% of asthmatics were controlled<sup>[7]</sup> and in an SA study, Mash *et al.*<sup>[12]</sup> reported that only 31.5% of asthmatics in the Western Cape were controlled.

The median FEV<sub>1</sub>, when expressed as a percentage of predicted, decreased with the level of control. This trend was echoed by the absolute FEV<sub>1</sub> (L). However, the FEV<sub>1</sub>/FVC ratio was not significantly different between the groups stratified by level of control. A possible explanation for this unchanged ratio could be a persistent airflow limitation. In a number of patients, the data were obtained from spirometry values documented by the attending doctor, and the flow volume curves were not examined by the investigator.

Most patients (77.2%) had had no admissions in the previous year, and 60.1% had not experienced exacerbations in the previous year. Predictably, the poorer the control, the more admissions patients were

**Table 1. Patient characteristics**

	Total group	Well-controlled (N=245)	Partially controlled (N=158)	Well-controlled v. partially controlled	Uncontrolled (N=116)	Well-controlled v. uncontrolled
Age (years), median (SD)	47 (16.5)	45 (17.9)	48 (15.6)	NS	46 (14.8)	NS
Gender (male/female), <i>n</i>	134/385	79/166	32/126	<i>p</i> =0.012; OR 0.54; 95% CI 0.33 - 0.86	23/93	<i>p</i> =0.02; OR 0.52; 95% CI 0.31 - 0.88
FEV <sub>1</sub> % predicted, median (SD)	81 (24.9)	85 (24.4)	79 (24.1)	0.015	70 (24.7)	0.000
FEV <sub>1</sub> (L), median (SD)	1.8 (1.8)	2.0 (2.4)	1.7 (0.7)	0.010	1.6 (0.7)	0.001
FEV <sub>1</sub> /FVC, median (SD)	72 (13.5)	72.5 (13.0)	72 (13.0)	NS	70.5 (15.2)	NS

CI = confidence interval; OR = odds ratio; NS = non-significant.

**Table 2. Factors associated with levels of asthma control**

	Controlled (N=245), <i>n</i> (%)	Partially controlled (N=158), <i>n</i> (%)	Uncontrolled (N=116), <i>n</i> (%)	Controlled v. uncontrolled			Controlled v. partially controlled		
				<i>p</i> -value	OR	95% CI	<i>p</i> -value	OR	95% CI
Patients with admissions per lifetime									
None	84 (34.3)	39 (24.7)	20 (17.2)	0.0031	2.5	1.39 - 4.51	0.25	1.39	0.84 - 2.29
Any	94 (38.4)	59 (37.3)	56 (48.3)						
Unknown	67 (27.3)	60 (38)	40 (34.5)						
Patients with an admission prior year									
None	209 (85.3)	110 (69.6)	61 (52.6)	<0.0001	8.16	4.55 - 14.93	<0.0001	3.71	2.09 - 6.59
At least one	21 (8.6)	41 (25.9)	50 (43.1)						
Unknown	15 (6.1)	7 (4.4)	5 (4.3)						
Patients with AE last year									
None	173 (70.6)	58 (36.7)	13 (11.2)	<0.0001	16.79	8.50 - 33.18	<0.0001	4.73	2.90 - 7.72
One or more	45 (18.4)	57 (36.1)	60 (51.7)						
Unknown	27 (11.0)	43 (27.2)	43 (37.1)						
Patients with AE per week									
None	218 (89.0)	93 (58.9)	30 (25.9)	<0.0001	6.78	3.23 - 14.22	<0.0001	6.93	3.46 - 13.90
One or more	12 (4.9)	40 (25.3)	62 (53.4)						
Unknown	15 (6.1)	25 (10.2)	24 (20.7)						
Patient inhaler technique recorded									
Not checked	155 (63.3)	78 (49.4)	68 (58.6)		NS		0.008	1.77	1.18 - 2.65
Checked	90 (36.7)	80 (50.6)	48 (41.4)						
Quality of inhaler technique									
Fair to good	76 (31.0)	59 (37.3)	30 (25.9)	0.041	2.41	1.1 - 5.27		NS	
Poor	14 (5.7)	21 (13.3)	18 (15.5)						
Unknown	155 (63.3)	78 (49.4)	68 (58.6)						
CS use									
Inhaled plus oral CS*	54 (22.0)	50 (31.6)	51 (44.0)	<0.0001	2.83	1.76 - 4.55	0.035	1.67	1.06 - 2.62

AE = acute exacerbations.

\*Numbers in rows may not add up to totals in the first row as there were missing data points.

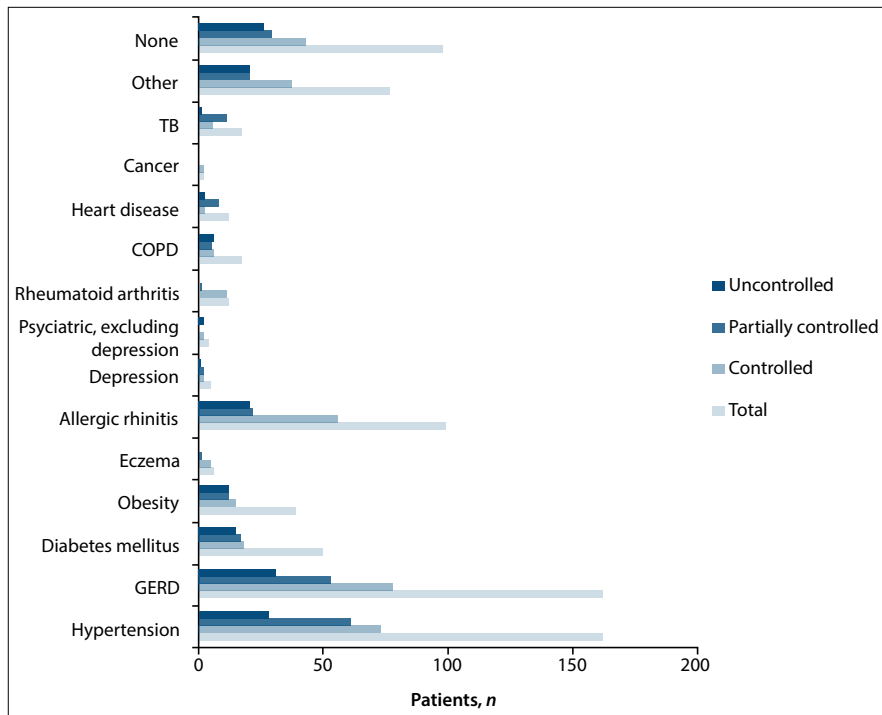


Fig. 1. Comorbidities in the cohort and in the three levels of asthma control. (TB = tuberculosis)

likely to experience (OR 8.16 for admissions per year, and OR 2.5 for admissions in a lifetime). In keeping with a study conducted in the Western Cape,<sup>[12]</sup> about 1 in 5 patients (23%) were admitted in the prior year for asthma-related morbidity. If one examines data per lifetime, 59% (209/352) of patients had at least one admission to hospital for asthma-related morbidity. This reiterates the importance of prior hospital admission as a marker for suboptimal asthma control.

Predictably, there were significant differences in the number of exacerbations of asthma as measured by presentations to the Emergency Department, with the lowest numbers occurring in the controlled group when compared with either the partially controlled or uncontrolled groups. The statistically significantly increased likelihood for the uncontrolled group to receive both inhaled and oral CSs may be a marker for more severe asthma, or reflect a poorer inhaler technique.

Inhaler technique was documented by the attending physician in only 57.1% of patients. There was no correlation between the level of asthma control and whether the attending doctor checked inhaler technique; neither was there evidence that those patients who were poorly controlled had their inhaler technique checked more frequently

than those who were well controlled. One could argue that this may be one of the reasons why these patients were poorly controlled. The lack of documentation that the inhaler technique had been checked in these patients is a disappointing result for an aspect of management which is critical for good asthma control, and is included in recommendations to improve asthma control.<sup>[12]</sup> Attending physicians need to be fastidious about checking inhaler technique and recording it at every visit.

Although the quality of the inhaler technique was recorded in only 57% of patients, a significant difference was seen when compared with the level of asthma control. The majority (75.7%) of patients whose inhaler technique was checked had fair to good technique, with an OR of 2.41 when compared with the number in the uncontrolled group of patients.

There was a median of one comorbidity in all three groups of control. Interestingly, despite the increased use of oral CSs in the uncontrolled group, there was no significant increase in CS-associated diseases, for example diabetes, obesity and hypertension. As has been found internationally,<sup>[13]</sup> GERD was noted in our study population. However, our figure of 33% of asthmatics with GERD is relatively low and there was no observed

increase in its prevalence within either the uncontrolled or the partially controlled groups compared with the controlled group. This is difficult to interpret, as not all patients were subjected to gastroscopy or barium swallows in order to document the presence of GERD, neither were symptoms specifically recorded on our questionnaire. It may be of interest to closely interrogate and examine the patients in the two poorly controlled groups for GERD, although the contribution of concomitant GERD with asthma may vary according to the asthma phenotype, and not with the level of control.<sup>[13]</sup>

Allergic rhinitis was found in only 20.3% of the cohort, considerably lower than the 67% found in a Japanese study.<sup>[13]</sup> Allergic rhinitis was more commonly diagnosed in the controlled group compared with the uncontrolled group ( $p=0.023$ ), in conflict with the Japanese data which described allergic rhinitis as an aggravating factor for poorer control.<sup>[13]</sup> However, allergic rhinitis may be under-diagnosed in the poorly controlled groups.

Rheumatoid arthritis was more frequent in those patients with controlled asthma compared with uncontrolled ( $p=0.018$ ) and partially controlled ( $p=0.032$ ), suggesting that it may be protective in the control of asthma. Possible explanations for this include the healthy user bias, or that the immunosuppressive drugs used to treat rheumatoid arthritis, particularly methotrexate, may have a beneficial effect in asthma.

## Conclusion

In this population of mostly middle-aged female asthmatics, less than half the patients were well-controlled despite relatively few admissions or exacerbations in the previous year. Control of asthma has a significant impact on the number of exacerbations and admissions during the year, leading to higher healthcare costs in those patients who were not well-controlled. Documentation by clinicians of aspects indicative of asthma control and the routine checking of inhaler technique should be mandatory in order to improve knowledge and highlight awareness of best practice in the management of asthma.

## Study limitations

This study had several limitations, because it was a retrospective review, and as such,

**Table 3. Comorbidities in the cohort, and in levels of asthma control**

	Total cohort (N=487), n (%)	Controlled (N=224), n (%)	Partially controlled (N=150), n (%)	Uncontrolled (N=113), n (%)	Controlled v. uncontrolled			Controlled v. partially controlled		
					p-value	OR	95% CI	p-value	OR	95% CI
Hypertension	162 (33.3)	73 (32.6)	61 (40.7)	28 (24.8)	0.18	0.68	0.41 - 1.13	0.14	1.42	0.92 - 2.18
Gastro-oesophageal reflux	162 (33.3)	78 (34.8)	53 (35.3)	31 (27.4)	0.21	0.71	0.43 - 1.16	1.00	1.02	0.66 - 1.58
Diabetes mellitus	50 (10.3)	18 (8.0)	17 (11.3)	15 (13.3)	0.18	1.75	0.85 - 3.62	0.37	1.46	0.73 - 2.94
Obesity	39 (8.0)	15 (6.7)	12 (8.0)	12 (10.6)	0.30	1.66	0.74 - 3.67	0.79	1.21	0.55 - 2.67
Allergic rhinitis	99 (20.3)	56 (25.0)	22 (14.7)	21 (18.6)	0.24	0.68	0.39 - 1.20	0.023	0.52	0.30 - 0.89
Depression	5 (1.0)	2 (0.9)	2 (1.3)	1 (0.9)	1.00	0.99	0.089 - 11.05	1.00	15.00	0.21 - 10.77
Rheumatoid arthritis	12 (2.5)	11 (4.9)	1 (0.7)	0 (0)	0.018	-	-	0.032	0.13	0.017 - 1.02
COPD	17 (3.5)	6 (2.7)	5 (3.3)	6 (5.3)	0.35	2.04	0.64 - 6.47	0.76	1.25	0.38 - 4.18
Heart disease	12(2.5)	2 (0.9)	8 (5.3)	2 (1.8)	0.60	2.00	0.28 - 14.39	0.017	6.25	1.31 - 29.87
Cancer	2 (0.4)	2 (0.9)	0 (0)	0 (0)	0.55	-	-	0.52	-	-
Psychiatric disease	4 (0.8)	2 (0.9)	0 (0)	2 (1.8)	0.60	2.00	0.28 - 14.39	0.52	-	-
Previous tuberculosis	17 (3.5)	5 (2.2)	11 (7.3)	1 (0.9)	0.45	0.39	0.045 - 3.39	0.02	3.47	1.18 - 10.19
HIV	34 (7.0)	14 (6.3)	13 (8.7)	7 (6.2)	0.50	1.26	0.73 - 2.18	0.92	1.01	0.60 - 1.70
Eczema	6 (1.2)	5 (2.2)	1 (0.7)	0 (0)	-	-	-	0.50	1.42	0.65 - 3.12
Other	77 (15.8)	37 (16.5)	20 (13.3)	20 (17.7)	0.92	1.09	0.60 - 1.98	0.49	0.78	0.43 - 1.40
None	98 (20.1)	43 (19.2)	29 (19.3)	26 (23.0)	-	-	-	-	-	-

COPD = chronic obstructive pulmonary disease.

accurate record-keeping was a concern, as demonstrated by the large number of data points missing, particularly in the fields of checking the inhaler technique, and lung functions results.

There was no characterisation of the phenotype of asthma as a predictor for control.

**Acknowledgements.** Our thanks to the staff and patients at ROPD for their willingness to help, and to Leporogo Academic Services for their assistance with compiling the study.

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