

## Original Research Article

# Factors influencing bronchial asthma exacerbations with special emphasis on inhaler usage

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**Received:** 21 January 2019

**Accepted:** 01 March 2019

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### ABSTRACT

**Background:** Study of risk factors help make patients aware about them and they can be taught to take proper precautions to prevent the exacerbation of asthma. Objective was to study factors influencing bronchial asthma exacerbations with special emphasis on inhaler usage.

**Methods:** A hospital based cross sectional study was carried out over a period of three months among 218 eligible patients with asthma who could give written informed consent and willing to participate in the present study and the data was recorded in a pre tested, semi structured study questionnaire. The data was recorded in the Microsoft Excel Worksheet and analyzed using proportions and mean $\pm$ 2SD.

**Results:** We found that advanced age, exposure to dust, fumes and allergens, lower social class, presence of other co-morbidities, irregular use of inhalers, and not demonstrated the technique of proper inhaler use were significantly associated with exacerbation of bronchial asthma. Other factors like mean duration of illness, mean duration of use of inhalers, gender, presence of allergic rhinitis, type of device used for inhalation and taking consultation from pulmonologist were not significantly associated with exacerbations of asthma.

**Conclusions:** Demonstrating and teaching the patient on how to use the device of inhaler plays a significant role in reducing the risk of exacerbation of bronchial asthma.

**Keywords:** Asthma, Demonstration, Exacerbation, Inhaler, Technique

### INTRODUCTION

It has been estimated that around 300 million people are affected with asthma globally. The worldwide prevalence of asthma ranges from 1-18%. It has been stated that the prevalence is increasing.<sup>1</sup>

Exacerbation of asthma has many risk factors including exposure to dusts, fumes, smoke, allergens, house dust mites, irregular management, increasing age, certain drugs, and weather conditions. Study of risk factors help make patients aware about them and they can be taught to

take proper precautions to prevent the exacerbation of asthma.<sup>2</sup>

In a South African hospital based study it has been found that poor adherence to asthma treatment was a strong predictor of exacerbation of asthma. Western Cape Province, South Africa study was carried out in the university hospital observed that residing in rural areas, not using corticosteroid inhalers and poverty were significantly associated with the exacerbation of asthma. Study from Ethiopia studied risk factors of wheeze among the children from urban areas and found that exposure to tobacco smoke, prolonged breast feeding and

kerosene use in the kitchen as cooking fuel were the significant risk factors for exacerbation of asthma.<sup>3</sup>

The mainstay of management of asthma is to prescribe the inhalers using some device. The minimum dose of inhaler must be inhaled by the patient for proper control of asthma. These devices must use with appropriately and a correct technique must be followed to ensure optimal dose delivery. Asthma patients should be taught and given demonstration on how to use these devices. They should be taught the importance of proper use. This increases the adherence of the patient as the correct dose is delivered as the patient gets prompt relief.<sup>4</sup>

Present study focuses along with other risk factors, on the importance of demonstration of inhaler device use in reducing the incidence of the exacerbation of asthma.

## METHODS

This was a hospital based cross sectional study. This study was conducted at Department of Pulmonary Medicine, Apollo Institute of Medical Sciences and Research, Jubilee Hills, Hyderabad, Telangana, India. This study was conducted from June 2016 to August 2016.

During the study period, it was possible to study 218 study subjects who were eligible to be included in the present study and who consented. A total of 240 patients with asthma were seen. Out of which 5 were excluded as they were not eligible as per the eligibility criteria of the study. Out of remaining 235 patients, 11 did not consent. Thus, data was collected from 224 patients. But during final analysis, it was found that 6 patient's data was not complete and thus they were excluded. Hence final sample size included was 218. Approval from Institutional Ethics Committee was sought. Written informed consent was taken from those eligible patients who were willing to participate in the study.

### Inclusion criteria

- Patients aged 15-75 years,
- Patients with asthma,

### Exclusion criteria

- Patients not fitting in inclusion criteria,
- Having acute attacks of asthma at the time of study,
- Seriously ill,
- Final data not found to be complete.

### Methodology

A hospital based cross sectional study was carried out over a period of three months among 218 eligible patients with asthma who could give written informed consent

and willing to participate in the present study and the data was recorded in a pre tested, semi structured study questionnaire.

Demographic details like age, sex, social class and occupation was enquired into. Weight was measured using standard guidelines and standardized weighing machine. History was recorded pertaining to duration of asthma and duration of inhaler use. Past history of allergic rhinitis and other associated co-morbidities was taken. All patients were using the inhaler and hence they were asked whether they used the inhaler regularly or not. Also, the type of device used for inhalation was also enquired into. A note was made on usually whom the patients consults most and that was recorded e.g. whether he consults pulmonologist or someone else. They were specifically asked on whether they were demonstrated the technique on how to correctly use the inhaler device.

### Statistical analysis

The data was recorded in the Microsoft Excel Worksheet and analyzed using proportions and mean $\pm$ 2SD. For mean values student's t test was calculated using the "Graph Pad" statistical software which is available free online. For 2x2 tables using proportion, Yates corrected chi square with one tailed p value and odds ratio with 95% confidence interval was calculated using "Open Epi" statistical software which is also available free online. For all tests, probability value was considered as significant if it was less than 0.05.

## RESULTS

Mean age was significantly more among those with exacerbation of asthma than those without exacerbation of asthma. But the factors like mean weight in kg, duration of illness in years and duration of inhaler use in months were not found to be significantly associated with exacerbation of asthma ( $p>0.05$ ) (Table 1).

The incidence of exacerbation of asthma was more in males i.e. 44.9% compared to females i.e. 41.8%. But this difference was not found to be statistically significant ( $p>0.05$ ) (Table 2).

The incidence of exacerbation of asthma was significantly more (67.9%) among those who were exposed to dust, fumes and allergens at their workplace than those not (35.2%). Those exposed were 3.889 times more (95% CI = 2.037-7.426) at risk of exacerbation of asthma (Table 3).

The association between lower social class and exacerbation of asthma was found to be statistically significant. The odds were 2.482 (95% CI = 1.388-4.247) i.e. people from lower class were 2.428 times more at risk of exacerbation of asthma than those from upper classes (Table 4).

**Table 1: Association between factors and exacerbation of asthma.**

Factors	Exacerbation of asthma		T value	P value
	Yes (N = 95)	No (N = 123)		
Age (years)	49.42±16.77	44.32±16.38	2.2560	0.0251
Weight (kg)	58.84±11.75	59.25±13.74	0.2325	0.8164
Duration of illness (years)	7.6±8.6	6.6±6.8	0.8513	0.3955
Duration of inhaler use (months)	34.11±47.9	30.45±48.06	0.5584	0.5772

**Table 2: Association between sex and exacerbation of asthma.**

Sex	Exacerbation of asthma		Chi square	P value
	Yes	No		
Male	57 (44.9%)	70 (55.1%)	0.1025	0.3744
Female	38 (41.8%)	53 (58.2%)		
Total	95 (43.6%)	123 (56.4%)		

**Table 3: Association between occupation and exacerbation of asthma.**

Occupation	Exacerbation of asthma		Chi square	P value	OR (95% CI)
	Yes	No			
Exposed to dust, fumes and allergens	38 (67.9%)	18 (32.1%)	16.76	0.0001	3.889 (2.037-7.426)
Not Exposed to dust, fumes and allergens	57 (35.2%)	105 (64.8%)			
Total	95 (43.6%)	123 (56.4%)			

**Table 4: Association between social class and exacerbation of asthma.**

Social class	Exacerbation of asthma		Chi square	P value	OR (95% CI)
	Yes	No			
Lower	65 (52.8%)	58 (47.2%)	9.013	0.001340	2.428 (1.388-4.247)
Middle and upper	30 (31.6%)	65 (68.4%)			
Total	95 (43.6%)	123 (56.4%)			

**Table 5: Association between presence of allergic rhinitis and exacerbation of asthma.**

Presence of allergic rhinitis	Exacerbation of asthma		Chi square	P value
	Yes	No		
Yes	38 (42.7%)	51 (57.3%)	0.006	0.4685
No	57 (44.2%)	72 (55.8%)		
Total	95 (43.6%)	123 (56.4%)		

**Table 6: Association between presence of other co-morbidities and exacerbation of asthma.**

presence of other co-morbidities	Exacerbation of asthma		Chi square	P value	OR (95% CI)
	Yes	No			
Yes	62 (52.5%)	56 (47.5%)	7.631	0.002868	2.248 (1.295-3.902)
No	33 (33%)	67 (67%)			
Total	95 (43.6%)	123 (56.4%)			

Then the association between presence of allergic rhinitis and exacerbation of asthma was studied, it was not found to be statistically significant ( $p>0.05$ ). The incidence of exacerbation of asthma among those with allergic rhinitis was 42.7% compared to 44.2% without allergic rhinitis (Table 5).

Other co-morbidities like diabetes, hypertension etc was included along with presence of allergic rhinitis and its association with exacerbation of asthma was found to be statistically significant ( $p<0.05$ ). Those with these co-morbidities were found to be 2.248 times more at risk of exacerbation of asthma (Table 6).

**Table 7: Association between regular use of inhaler and exacerbation of asthma.**

Regular use of inhaler	Exacerbation of asthma		Chi square	P value	OR (95% CI)
	Yes	No			
No	43 (58.1%)	31 (41.9%)	8.746	0.001552	2.454 (1.383-4.354)
Yes	52 (36.1%)	92 (63.9%)			
Total	95 (43.6%)	123 (56.4%)			

**Table 8: Association between type of device used and exacerbation of asthma.**

Type of device used for inhalation	Exacerbation of asthma		Chi square	P value
	Yes	No		
Metered Dose Inhaler (MDI)	74 (45.9%)	87 (54.1%)	1.077	0.1505
Dry powder inhaler (DPI)	21 (36.8%)	36 (63.2%)		
Total	95 (43.6%)	123 (56.4%)		

The incidence of exacerbation of asthma was very low (36.1%) who used the inhalers regularly and this association was statistically significant. Those who did not use the inhaler regularly were found to be 2.454 times more at risk of exacerbation of asthma (Table 7).

The association between the type of device used and the exacerbation of asthma was not found to be statistically

significant. Though the incidence of exacerbation of asthma was more among those who used MDI compared to those who used DPI, the difference was not significant.

It did not make much difference whether the patient consulted pulmonologist or other doctors in reducing the exacerbation of asthma episodes. Though majority consulted the pulmonologist overall the association was statistically not significant (Table 9).

**Table 9: Association between consultation with pulmonologist and exacerbation of asthma.**

Consultation with pulmonologist	Exacerbation of asthma		Chi square	P value
	Yes	No		
No	24 (52.2%)	22 (43.8%)	1.337	0.08103
Yes	71 (41.3%)	101 (58.7%)		
Total	95 (43.6%)	123 (56.4%)		

**Table 10: Association between demonstrated technique of use of device and exacerbation of asthma.**

Demonstrated technique of use of device	Exacerbation of asthma		Chi square	P value
	Yes	No		
No	24 (55.8%)	19 (44.2%)	3.247	0.03579
Yes	71 (40.6%)	104 (59.4%)		
Total	95 (43.6%)	123 (56.4%)		

We asked the patients whether they were demonstrated the correct use of inhaler or not at the time of prescription by the doctor. We noticed that not getting proper demonstration was associated with exacerbation of asthma and incidence of exacerbation of asthma among them was high i.e. 55.8% (Table 10).

## DISCUSSION

We studied various factors which were likely to be associated with exacerbations of bronchial asthma. We

found that advanced age, exposure to dust, fumes and allergens, lower social class, presence of other comorbidities, irregular use of inhalers, and not demonstrated the technique of proper inhaler use were significantly associated with exacerbation of bronchial asthma. Other factors like mean duration of illness, mean duration of use of inhalers, gender, presence of allergic rhinitis, type of device used for inhalation and taking consultation from pulmonologist were not significantly associated with exacerbations of asthma.

We observed that patients with exacerbations of bronchial asthma were significantly older (mean age 49.42 years) than those without exacerbations of bronchial asthma (mean age 44.32 years) and this difference was found to be statistically significant ( $p < 0.05$ ). Tomita K et al, found in their study that the odds of exacerbations of bronchial asthma were 1.57 for the elderly people.<sup>5</sup> Razzaq S et al, found that the risk of exacerbations of bronchial asthma was 1.9 times more among those aged  $>38$  years of age.<sup>6</sup> Kang HR et al, also observed similar finding that exacerbations of bronchial asthma episodes were significantly more among those aged more than 45 years.<sup>7</sup> Smith K et al, also noted in their study that elderly were at more risk of exacerbations of bronchial asthma.<sup>8</sup> Thus, all studies confirm that advanced age is associated more attacks of exacerbations of bronchial asthma. This can be attributed to decreasing lung capacity as the age advances.

We found that the mean duration of illness among those with exacerbations of bronchial asthma was 7.6 years compared to 6.6 years among those without exacerbations of bronchial asthma. But this difference was not statistically significant. Xing B et al, in their study observed that exacerbations of bronchial asthma were more among those with disease duration of more than 10 years.<sup>9</sup>

We noted that the incidence of exacerbations of bronchial asthma was more in males (44.9%) compared to females (41.8%) but statistically not significant. Sanya RE et al, had a contrary finding as they stated that risk of exacerbations of bronchial asthma was 1.58 times more for females.<sup>10</sup> Xing B et al, had on the other hand observed that exacerbations of bronchial asthma were more among males.<sup>9</sup> But again Kang HR et al, found that it was more in females.<sup>7</sup> Anto JM et al, stated that the risk of exacerbations of bronchial asthma was 1.97 times more in females.<sup>11</sup> Thus, there is no coherence between the studies as to whether gender can be a risk factor for exacerbations of bronchial asthma.

We studied the association between those who were exposed to various dusts, fumes or allergens during their occupation and exacerbations of bronchial asthma and found that the incidence of exacerbations of bronchial asthma was 67.9% among exposed compared to 35.2% among those who were not exposed. The exposed were 3.88 times (95% CI = 2.037-7.426) more at risk of exacerbations of bronchial asthma. Anto JM et al, also noted similar observations that the incidence of exacerbations of bronchial asthma was more among those who were engaged in high risk occupation.<sup>11</sup>

After studying the association between social class and exacerbations of bronchial asthma we found that the incidence of exacerbations of bronchial asthma was more among lower class (52.8%) compared to upper class (31.6%). The odds were 2.424 (95% CI = 1.388-4.247). Eisner MD et al, also observed similar association and the

odds in their study for lower income group was 1.1 which increased the asthma related hospitalization.<sup>12</sup>

We noted that the incidence of exacerbations of bronchial asthma was 42.7% among those with presence of allergic rhinitis and 44.2% among those without allergic rhinitis. This marginal difference was obviously not significant. Sanya RE et al, found that those with upper respiratory tract infection were 4.5 times more at risk of exacerbations of bronchial asthma than those without upper respiratory tract infections.<sup>10</sup> Razzaq S et al, this risk was 1.9 times more among those with history of allergies.<sup>6</sup> Anto JM et al, this risk was 1.98 times more among those having nasal allergy.<sup>11</sup> But we did not find this association as significant.

But after including other co-morbidities like hypertension etc along with allergic rhinitis we found that the odd ratio for this was 2.248 (95% CI = 1.295-3.902). Xing B et al, also found that the incidence of exacerbations of bronchial asthma was 42.9% among those who had respiratory tract infection.<sup>9</sup>

We found that irregular use of inhalers was significantly associated with exacerbations of bronchial asthma (OR = 2.454; 95% CI = 1.383-4.354). Sanya RE et al, observed that this risk was 22 times more among those who were not using steroids.<sup>10</sup> Tomita K et al, disuse of inhaled steroids was associated with 2.63 times risk of exacerbations of bronchial asthma.<sup>5</sup> Stem L et al, noted that the odds ratio for compliant patients was 0.94 (95% CI = 0.91-.097).<sup>13</sup> Williams LK et al, stated from the observations of their study that adherence was associated with decreased exacerbations of bronchial asthma.<sup>14</sup> Engelkes M et al, also supported this observation that good adherence decreased the risk of exacerbations of bronchial asthma.<sup>15</sup> Thus, all studies agree that regular use of prescribed inhaler either non-steroidal or steroidal decrease the risk of exacerbations of bronchial asthma.

We found that the incidence of exacerbation of bronchial asthma was significantly less among those patients who were taught and demonstrated on how to use the device (40.6%) compared to 55.8% among those who were not demonstrated so ( $p < 0.05$ ).

## CONCLUSION

Thus, we conclude that advanced age, exposure to dust, fumes and allergens, lower social class, presence of other co-morbidities, irregular use of inhalers, and not demonstrated the technique of proper inhaler use were significantly associated with exacerbation of bronchial asthma. Motivating patients to use the inhalers regularly as per the prescription is key in reducing the risk of exacerbation of bronchial asthma. Demonstrating and teaching the patient on how to use the device of inhaler plays a significant role in reducing the risk of exacerbation of bronchial asthma.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Gali JH, Varma HV. Factors influencing bronchial asthma exacerbations with special emphasis on inhaler usage. *Int J Adv Med* 2019;6:365-70.