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Triggers of Acute Asthma in Patients Attending Emergency Centre in a Peri-urban District Hospital, Johannesburg, South Africa

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Abstract

Introduction: Many avoidable triggers lead to acute asthma attack and subsequent visit to the emergency centre. The aim of the study was to determine triggers of acute asthma in order to target prevention efforts in patients attending emergency centre in a district hospital, Johannesburg, South Africa. Objectives were to describe acute asthma patients, identify triggers and severity at presentation. Methods involved a prospective descriptive cross-sectional study conducted from April to August 2015, in consenting adult participants. A researcher or trained assistant completed the semi-structured questionnaire in English. Results: Overall, 239 patients enrolled (139 males, 100 females with the median age 31 years). Majority presented with moderate acute asthma (52.72%). Active cigarette smoking (p-value<0.001) and/or passive cigarette smoking (p-value=0.004) were identified potential triggers for acute asthma attack. Chi-square or Fisher Exact test analysis were used for associations between variables and severity. Bivariate logistic regression was used to ascertain triggers associated with acute asthma attack. P-value < 0.05 was statistically significant. Confidence interval was 95%. There were no significant associations between the severity of acute asthma attack and acute respiratory infection (p-value=0.818), use of medication-related asthma triggers (p-value=0.942) and knowledge of asthma allergens (p-value =0.086). Conclusion: The majority patients presented in moderate acute asthma attack which was most probably triggered by active and/ or passive cigarette smoking. Hence, frequent visits to hospital in acute asthma attack could be minimized by removing avoidable triggers from households.

Keyswords: *Acute asthma attack, Emergency centre, Severity of asthma, Triggers of asthma, Peri-urban district hospital.*

Introduction

Asthma is a major public health problem worldwide, generates significant healthcare costs and high morbidity and mortality. The World Health Organization (WHO) estimates that about 235 million people worldwide suffer from asthma, and over 180 000 deaths occur annually.[1,2] South Africa with an asthma prevalence of 8.1% over all ages is ranked the 25th worldwide, and the asthma case fatality rate is reported to be the fourth highest in the world at 1.5% deaths annually.[1,2,3].

Adeloye et al[3] conducted a systematic review to ascertain the prevalence of asthma in Africa in which they included 45 studies covering most parts of Africa (South Africa 11 studies, Nigeria eight (8) studies, Ethiopia 6 studies, Kenya five (5) studies, and four (4) studies in each of Algeria, Morocco and Tunisia). They found that cumulative prevalence of asthma was the highest in South Africa. Asthma morbidity and mortality were potentially preventable with optimal control of chronic asthma and appropriate management of acute exacerbation.[3].

Many triggers have been reported to cause patients with poor asthma control to increasingly frequent visits to emergency centres.[4] These triggers include active and/or passive cigarette smoking, acute respiratory infection, asthma allergens, and medication-related asthma triggers such as non-steroid anti-inflammatory drugs (NSAIDs) and beta-blockers. Asthma triggers can induce a functional state of airway

narrowing and bronchospasm with subsequent wheezing and dyspnoea or chest tightness in patients.[5] Most experts agree that reducing the need for the use of emergency centres for acute asthma treatment remains an important goal of the overall management of the disease.[4,5]

The aim was to determine triggers of acute asthma attack in patients attending emergency centre in a peri-urban district hospital, Johannesburg, South Africa. Objectives were to describe the proportion of acute asthma patients, identify triggers, describe the severity in patients attending the emergence centre at the peri-urban district hospital and associations between severity and other variables. Researchers believed that by proactively identifying avoidable triggers among asthma sufferers in the community, the frequency of visits to hospital could be minimized and save health costs, indirectly. Further, it was hoped that the study would provide a better understanding of asthma among health professionals to advance opportunistic health promotion for patients.

Materials and Methods

The Study design

This was a prospective, descriptive, cross-sectional study.

Study site

The study was conducted at Bertha Gxowa District Hospital emergency centre located in Germiston, a peri-urban of Johannesburg, South Africa. It was a level-one generalist hospital with 258 inpatient beds catering across all major clinical disciplines. The hospital had a catchment area of 34 satellite primary care clinics (PHC) and some community health centres (CHC). It had outpatient, operating theatres, and a 24-hours emergency centre.

Study population and sampling approach

We took all patients who presented with acute asthma episode, met the study criteria and consented to participate in the study. Data collection period was from April to June 2015.

Sample size

This was predetermined in consultation with a statistician. The emergency centre had unpredictable number of patients presenting with acute asthma per month owing to seasonal variations. Hence, there would be between 180-210 acute asthma episodes in the emergency centre per month and 540 to 630 per three (3) months or quarterly, depending on the time of the year. With population size of 630, a 5.0% margin of error, p-value of 0.05, confidence interval (CI) 95% and a response distribution rate of 50%, the minimum sample size required was 247 using a Raosoft Sample Size Calculator.

Data collection tool

A semi-structured questionnaire which addressed socio-demographics, concurrent respiratory infections, current medications, adherence to treatment and possible triggers of asthma was developed by researchers according to standard asthma guidelines from literature.[4] Further, The acute asthma severity was assessed using validated guidelines from the Working Group for South African Thoracic Society (WGSATS).[4]

Data collection process

After initial emergency treatment and stabilization, patients who presented with acute asthma episode, met the criteria and consented to participate in the study were enrolled for three months from April to June 2015. The semi-structured questionnaire was administered by the researcher or two trained assistants who collected data from 239 adult asthma patients. Excluded were patients who declined to participate in the study and patients who were unable to perform peak exploratory flow (PEF) assessment correctly even after stabilisation. Research was approved by the Human Research Ethics Committee (HREC) of the University of the Witwatersrand (approval number M141115) and Ekurhuleni District Ethics Committee.

Data capture and analysis

The collected data was captured on Excel spread sheet and analysed using Stata version 12 software. Participant characteristics and variables such as concurrent acute respiratory infection, asthma triggers, knowledge of asthma allergens and active and/or passive cigarette smoking were collected. These variables were cross tabulated with the severity of asthma (mild, moderate and severe) to determine statistical significance. Descriptive statistics for non-normal distributed continuous variables, such as median and their associated ranges were

used to summarize quantitative characteristics. Frequencies and percentages were used to summarize the above participant categorical characteristics.

The Chi-square test or Fisher exact test were used to test the associations between different variables (acute respiratory infection, medication-related asthma triggers, knowledge of asthma allergens, active and passive cigarette smoking) across acute asthma attack severity. The Fisher exact test was used when the expected numbers of subjects in the cells were less than five. Bivariate logistic regression was used to ascertain triggers associated with acute asthma attack presentation in the emergency centre. Odds ratios (OR) with 95% CI and p-values were tabulated. P-value of less than 0.05 was statistically significant.

Results

We enrolled 239 participants in the study. The sample included 139 males (58.18%) and 100 females (41.82%), age range 18 - 75 years (median age was 31 years). Eight (8) out of 247 patients with acute asthma (3.20%) were not able to perform a Peak Exploratory Flow (PEF) assessment because of their clinical conditions at the time of presentation to the emergency centre. Hence, they were excluded from the study.

Medication-related acute asthma triggers

Table 1. Distribution between medication-related asthma triggers and severity of acute asthma

Medication used	Frequency of treatment	Mild	Moderate	Severe	Total
None	97.91%	33.76%	52.99%	13.25%	100.00
NSAIDs	2.09%	60.00%	40.00%	- -	100.00
Total	100.00%	34.31%	52.72%	12.97%	100.00

--: zero percent

The majority of participants were not exposed to medication-related asthma triggers and presented in moderate asthma attack. Chi^2 =1.8015, degree of freedom= 2, p-value =0.432

Severity assessment of acute asthma attack

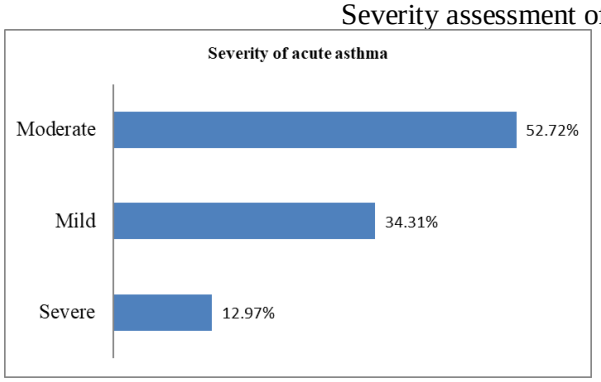

Figure 1. Severity assessment of acute asthma attacks of patients who presented in the emergency centre. Majority of patirnts presented in moderate acute asthma attack. (52.72%)

Acute respiratory infection and severity of acute asthma attack

Table 2. Distribution of acute respiratory infection and severity of acute asthma attack

Acute infection	Frequency of acute infection	Mild attack	Moderate attack	Severe attack	Total
None	89.12%	33.33%	53.52%	13.15%	100.00
Upper Respiratory Tract Infection (URTI)	10.05%	41.67%	45.83%	12.50%	100.00
Lower Respiratory Tract Infection (LRTI)	0.84%	50.00%	50.00%	- -	100.00
Total	100.00%	34.31%	52.72%	12.97%	100.00

--: zero percent

The majority of patients had no acute infection and suffered from moderate asthma attack. Chi^2 =1.0945, degree of freedom=4 and p-value=0.873.

Cigarette smoking and severity of acute asthma attack

Table 3. Distribution between cigarette smoking status and severity of acute asthma attack

Cigarette smoking	Frequency of cigarette smoking	Mild attack	Moderate attack	Severe attack	Total
Yes	15.06%	22.22%	30.56%	47.22%	100.00%
No	84.96%	36.45%	56.65%	6.90%	100.00%
Total	100.00%	34.31%	52.72%	12.97%	100.00%

The majority of participants did not smoke and presented in moderate asthma attack. Chi^2 = 44.0897, degree of freedom=2, $p < 0.001$.

Passive cigarette smoking and severity of acute asthma attack.

Table 4. Distribution between passive cigarette smoking and severity of acute asthma attack

Passive cigarette smoking	Frequency of passive cigarette smoking	Mild	Moderate	Severe	Total
Yes	22.19%	28.57%	42.86%	28.57%	100.00%
No	77.82%	35.29%	54.41%	10.29%	100.00%
Total	100.00%	34.31%	52.72%	12.97%	100.00%

The majority did not experience passive cigarette smoking yet presented with more moderate episodes than those who were exposed to smoke. Chi^2 =8.8442, degree of freedom=2 and p-value=0.012

Bivariate logistic regression of variables

Table 5. Bivariate logistic regression results between variables and severity of acute asthma attack

Variables	OR	95%CI	p-value
Acute respiratory infection	-		
None	0.86	-	-
URTI		0.24 to 3.06	0.818
Medication-related asthma triggers	0.95	0.27 to 3.41	0.942
Asthma allergens knowledge score	0.79	0.60 to 1.03	0.086
Smoking	12.08	5.16 to 28.27	<0.001
Passive cigarette smoking	3.49	1.47 to 8.25	0.476

The above table shows active cigarette smoking (OR 12.08, 95% CI: 5.16 to 28.27; p-value < 0.001) and passive cigarette smoking (OR 3.49, 95% CI: 1.47 to 8.25; p-value = 0.004) were statistically significant factors

Summary of main study findings

The proportion of patients presenting with acute asthma episode was 4.77%. Majority of them had moderate acute asthma (52.72%), were black (63.18%), young adults (83.68%), males (58.18%), completed secondary school (77.82%), employed (83.26%), had an occupation (83.63%), lived in modern or urban type of house (96.65%), and were adherent to asthma treatment (58.00%).

Statistically significant findings were low level of education ($p < 0.001$) which was associated with acute asthma attack presentation. Active cigarette smoking ($p < 0.001$) and/or passive cigarette smoking ($p = 0.004$) were identified triggers associated with acute asthma attacks and more than usual hospital visits.

Not statistically significant findings were associations between acute asthma severity and age ($p = 0.592$), gender ($p = 0.240$), race ($p = 0.759$), occupation status ($p = 0.291$),

employment status (p = 0.268), numbers of cigarette smoked per day (p = 0.059), type of housing (p = 0,982), acute respiratory tract infection (p = 0.818), use of medication-related asthma triggers (p = 0.942), knowledge of asthma allergens (p = 0.086), and stress or anxiety (p = 0.475).

Discussion

The majority patients had moderate acute asthma attack (52.72%). This was in line with studies by Dankner et al[6] in Israel and by Westerman et al. in Cape Town et al[7]. Active cigarette smoking and/or passive cigarette smoking were identified potential triggers associated with acute asthma attack. However, there were no significant associations between the severity of acute asthma attack and the number of cigarettes smoked per day (p-value = 0.059), acute respiratory tract infection (p-value = 0.818) and knowledge of asthma allergens (p-value= 0.086) because there were possibly other environmental factors which influenced this finding..

The difference in proportions of moderate and severe acute asthma could be explained by many factors. These included the wide geographical factors and guidelines used to classify asthma, social habits (such as cigarette smoking), adherence to asthma treatment, occupational status, help-seeking behaviour, the presence of acute viral respiratory infection and asthma allergens.[4,5, 6,7]

We used the WGSATS guideline to classify severity of asthma yet there were significant differences in PEF values between different guidelines.[4]

This study highlights that cigarette smoking is one of the main factors associated with severe acute asthma attack at presentation in the hospital.[8,9,10,11]

In the study by Refaat et al[12], 25.40% of patients were current smokers, whereas there were only 15.06% in our study. Hence, the higher rate of severe asthma exacerbation documented by Refaat et al[12] compared to this study could be due to significant number of current cigarette smokers in their study.

Chi-square showed no significant association between medication-related asthma triggers and severity of acute asthma attack (p-value = 0.432), which was in line with the findings of logistic regression (OR 0.95, 95% CI: 0.27 to 3.41; p-value=0.942). Medication-related asthma triggers were not associated triggers for acute asthma attack in these patients. This was similar to the conclusion reported by Geyser et al[13] (OR 1.2, 95% CI: 0.64 to 2.76; p = 0.45).

Also, Sanya et al[9] in Uganda also came to the same conclusion. Thus, the finding was not surprising because asthma triggers might vary from an individual to the other. Hence, prevention strategies of flare ups of acute asthma may also differ from one person to the other.

Further, the difference between medication-related asthma triggers and asthma exacerbation was not statistically significant in our study. This observation could be attributed to the small proportion of medication-related asthma triggers (2.09%) in our study. It could be possible that this proportion was under-represented, which affected the outcome. Therefore, the finding should be interpreted with caution.

There was no significant association between lack of knowledge on asthma allergens and acute asthma attack on Chi-square (p-value =0.462). Hoever, participants showed adequate knowledge about asthma allergens and be have benefitted from it.

A significant association between cigarette smoking and acute asthma attack was highlighted (p < 0.001). For example, patients who smoked cigarettes were more likely to suffer severe acute asthma attack compared to patients who did not smoke cigarettes. The finding was in agreement with the logistic regression findings, OR 12.08, 95% CI: 5.16 to 28.27; p-value < 0.001. This study reinforces the belief that cigarette smoking is a potential trigger associated with acute asthma attack and subsequent hospital visits.[8,9,10,11]

Asthma sufferers who smoked cigarettes were more likely to have uncontrolled asthma than non-smokers, and this could lead ultimately to an increase in the number of asthma exacerbations with subsequent hospital visits.[8,9,10] Patients who had households in which cigarettes were smoked were more likely to suffer severe acute asthma compared to patients who did not, and the finding is in line with findings of the logistic regression (OR 3.49, 95% CI: 1.47 to 8.25; p-value=0.004). Passive cigarette smoking was a potential associated trigger for acute asthma attack.

This study had some strengths. Firstly, it was a prospective study and, therefore, an opportunity to collect all the information that was required for the study analysis. Secondly, the study ensured that sufficient participants were enrolled from a study site which had 34 satellite clinics in a peri-urban area in order to allow a reliable analysis. Finally, this study has relevance to the practice of family medicine and primary health care because asthma has significant morbidity and mortality, particularly in resource-constraint countries.[3,4].

However, the study also had some limitations. The study was conducted at one site although the catchment area had a wide geography involving nearly 34 satellite clinics which referred to the district hospital. The findings might not be generalizable to other district hospitals, settings and levels of care. Nevertheless, the study highlights the important link between asthma control and smoke cessation. Acute respiratory infection was not objectively assessed because it was based on self-reporting. In the context of this study, the definition of passive cigarette smoking was limited to cigarettes smoked in the patient's household and not the public. It would seem more likely that a large proportion of passive cigarette smokers, sample size, and multiple study sites would make findings more reliable and generalizable than otherwise.

Lastly, patients who were unable to perform Peak Exploratory Flow assessment were excluded from the study. Hence, an opportunity exists that further studies could explore an observational study across all cases of asthma exacerbation presenting across the entire primary care platform including community health centres and big clinics which were not part of this study.

Conclusion

Our study reports that majority patients had moderate acute asthma attack when they presented to the peri-urban district hospital. Further, we demonstrated and reinforced the belief that active and/or passive cigarette smoking was one of the potential triggers for acute asthma attack in adults in our area. The smoking behaviour is a modifiable or avoidable trigger and warrants prompt community health interventions to enhance its cessation. The latter will mitigate for indirectly minimizing frequency of hospital visits for acute asthma attack among patients from households who smoke cigarettes.

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