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Clinical Outcomes and Associated Factors among Patients with Severe Asthma Exacerbations in a Tertiary Care Hospital

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ABSTRACT

Background: Severe asthma exacerbations remain an important cause of emergency care, hospitalization, morbidity, and mortality. Identifying factors associated with poor outcomes is essential for early risk stratification and timely management, particularly in resource-limited settings. **Objective:** To assess the clinical outcomes and identify factors independently associated with poor clinical outcomes among patients with severe asthma exacerbations admitted to a tertiary care hospital in Dhaka, Bangladesh. **Methods & Materials:** This retrospective observational study was conducted in the Department of Respiratory Medicine, Uttara Adhunik Medical College Hospital, Dhaka, Bangladesh, from June 2024 to May 2025. A total of 160 patients with severe asthma exacerbations were included. Demographic, clinical, precipitating, treatment, and outcome-related data were retrospectively collected from medical records. Categorical variables were expressed as frequency and percentage, and continuous variables as mean ± SD. Associations were assessed using the chi-square test, followed by multivariable logistic regression. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated, and $p<0.05$ was considered statistically significant. **Results:** The mean age was 40 years; 57.5% were female and 64.4% urban residents. Medication non-adherence and recent respiratory infection were present in 39.4% and 43.1%, respectively. At admission, 43.8% had SpO_2 <90% and 75.6% used accessory muscles. Oxygen therapy was required in 88.1%, NIV in 19.4%, mechanical ventilation in 8.8%, and ICU care in 21.9%. Overall, 85.0% improved, while 11.9% had poor outcomes and 2.5% died. Older age, smoking, prolonged asthma, previous exacerbation, non-adherence, infection, low SpO_2, and accessory muscle use predicted poor outcomes. **Conclusion:** Severe asthma exacerbations were associated with substantial morbidity and mortality. Admission hypoxemia was the strongest predictor of poor clinical outcome, followed by medication non-adherence, previous exacerbation, and accessory muscle use. Early identification of high-risk patients, improved adherence, smoking cessation, and appropriate follow-up may help reduce adverse outcomes.

Keywords: *Severe asthma; asthma exacerbation; clinical outcome; medication adherence; hypoxemia; risk factors; hospitalization; Bangladesh*

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INTRODUCTION

Asthma is a common chronic respiratory disease characterized by variable respiratory symptoms and expiratory airflow limitation, and its clinical course is frequently complicated by acute exacerbations. Asthma exacerbations are episodes of progressive worsening of dyspnea, cough, wheezing, or chest tightness accompanied by deterioration in lung function that requires a change in treatment [1]. Although effective controller therapies have substantially improved asthma control, severe exacerbations remain an important cause of emergency healthcare utilization, hospitalization, morbidity, and, in some cases, death [2,3]. Severe exacerbations may occur even in patients with apparently mild or well-controlled asthma, emphasizing the importance of identifying patients at increased risk and recognizing clinical deterioration promptly [2,4]. The development and severity of asthma exacerbations are influenced by multiple patient-related, environmental, and disease-related factors. Previous exacerbations are among the strongest predictors of future exacerbations, while older age, smoking, poor adherence to inhaled corticosteroid therapy, inadequate asthma control, and greater disease burden have also been associated with increased risk [5,6]. Respiratory viral infections and allergen exposure are important precipitants, whereas environmental pollution, seasonal changes, and tobacco smoke may further increase susceptibility [2,6]. Comorbid conditions can also adversely influence outcomes; obesity, chronic rhinosinusitis, gastroesophageal reflux disease, cardiovascular disease, and metabolic disorders have been associated with increased asthma-related hospitalization or mortality [7,8].Severe asthma exacerbations represent a particular clinical challenge because patients may deteriorate rapidly and require intensive pharmacological treatment, oxygen supplementation, non-invasive ventilation, or invasive mechanical ventilation. Previous evidence indicates that severe exacerbations may also be associated with persistent decline in lung function, highlighting their potential long-term consequences in addition to the immediate clinical burden [9]. Among hospitalized patients, factors such as pneumonia, diabetes mellitus, and mechanical ventilation have been reported to be associated with increased short-term mortality [8]. Therefore, early identification of clinical and demographic characteristics associated with adverse outcomes may facilitate appropriate triage, closer monitoring, and timely escalation of treatment. Despite advances in asthma management, information regarding the clinical profile, precipitating factors, treatment requirements, and outcomes of patients presenting with severe asthma exacerbations remains limited in many low- and middle-income settings. Local hospital-based evidence is particularly important because healthcare access, environmental exposures, treatment practices, medication adherence, and patterns of comorbidity may

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differ substantially between populations. Therefore, the present study aimed to assess the clinical outcomes and associated factors among patients with severe asthma exacerbations presenting to a tertiary care hospital in Dhaka, Bangladesh.

METHODS & MATERIALS

This retrospective observational study was conducted in the Department of Respiratory Medicine, Uttara Adhunik Medical College Hospital, Dhaka, Bangladesh, from June 2024 to May 2025. A total of 160 patients irrespective of age and sex, diagnosed with severe asthma exacerbations who were admitted to or treated at the study hospital during the study period were included. Eligible patients were identified from hospital admission registers, medical records, emergency department records, and relevant clinical documentation. Patients with a documented diagnosis of asthma presenting with a severe exacerbation requiring urgent medical treatment were included, while records with insufficient information regarding the clinical presentation or treatment outcome were excluded. Data were retrospectively collected using a structured data collection form. The primary outcome was clinical outcome following treatment, categorized as favorable or poor according to predefined clinical criteria; secondary outcomes included ICU admission, requirement for non-invasive or mechanical ventilation, treatment failure, complications, mortality, and length of hospital stay. Potential factors associated with poor clinical outcome were assessed using appropriate statistical tests. The collected data were analyzed using Statistical Package for Social Sciences (SPSS), Version-27,0. Categorical variables were expressed as frequency and percentage, while continuous variables were summarized as mean ± SD. Associations between categorical variables were assessed using the chi-square test and variables showing statistical or clinical relevance were considered for multivariable logistic regression to identify independent factors associated with poor clinical outcome. Adjusted odds ratios (AORs) with 95% CI, and a p-value <0.05 was considered statistically significant.

RESULTS

Table I shows total of 160 patients with severe asthma exacerbations were included in the study. The mean age of the patients was approximately 40 years. Females constituted the majority of the study population (92, 57.5%), while 68 (42.5%) were male. Most patients were from urban areas (103, 64.4%). Regarding BMI, 78 (48.8%) patients had normal weight, 48 (30.0%) were overweight, and 22 (13.8%) were obese. Most patients were never smokers (113, 70.6%), whereas 29 (18.1%) were current smokers and 18 (11.3%) were former smokers. Asthma duration was ≤10 years in 86 (53.8%) patients and >10 years in 74 (46.2%). A family history of asthma was reported by 71 (44.4%) patients.

Table I

Sociodemographic and baseline characteristics of the study patients (*n*=160).

Variables	Frequency	Percentage
Age (years)		
≤20	18	11.3
21–30	31	19.4
31–40	35	21.9
41–50	34	21.3
51–60	25	15.6
>60	17	10.6
Sex		
Male	68	42.5
Female	92	57.5
Residence		
Urban	103	64.4
Rural	57	35.6
BMI (kg/m²)		
<18.5	12	7.5
18.5–24.9	78	48.8
25.0–29.9	48	30.0
≥30.0	22	13.8
Smoking status		
Never smoker	113	70.6
Current smoker	29	18.1
Former smoker	18	11.3
Duration of asthma		
<5 years	39	24.4
5–10 years	47	29.4
11–20 years	45	28.1
>20 years	29	18.1
Family history of asthma		
Yes	71	44.4
No	89	55.6

Table II shows the duration of current symptoms was 24–72 hours in 76 (47.5%) patients, while 46 (28.8%) had symptoms for >72 hours. Fever was present in 57 (35.6%) patients. A previous exacerbation within the preceding year was reported by 86 (53.8%) patients, while 69 (43.1%) had a recent respiratory infection. Allergen exposure was reported in 52 (32.5%) patients and medication non-adherence in 63 (39.4%). Passive smoke exposure and weather or temperature changes were reported in 48 (30.0%) and 44 (27.5%) patients, respectively.

Table I
Clinical characteristics and factors of severe asthma exacerbations observed with the study patients (*n*=160).

Variables	Frequency	Percentage
Duration of current symptoms		
<24 hours	38	23.8
24–72 hours	76	47.5
>72 hours	46	28.8
Fever		
Present	57	35.6
Absent	103	64.4
Previous exacerbation within 1 year		
Yes	86	53.8
No	74	46.3
Recent respiratory infection		
Yes	69	43.1
No	91	56.9
Allergen exposure		
Yes	52	32.5
No	108	67.5
Medication non-adherence		
Yes	63	39.4
No	97	60.6
Passive smoke exposure		
Yes	48	30.0
No	112	70.0
Weather/temperature change		
Yes	44	27.5
No	116	72.5

**Multiple responses were counted.*

Table III shows at admission, 75 (46.9%) patients had a respiratory rate ≥30 breaths/min, while SpO_2 on room air was <90% in 70 (43.8%). A pulse rate ≥120 beats/min was observed in 59 (36.9%) patients. Accessory muscle use was present in 121 (75.6%) patients. Regarding speech, 91 (56.9%) patients could speak only in short phrases and 40 (25.0%) could speak only in words. Altered consciousness was present in 13 (8.1%) patients. PEFR was <40% of predicted in 72 (45.0%) patients, whereas PEFR was not documented in 18 (11.3%).

Table III
Clinical and physiological parameters at admission (*n*=160).

Variables	Frequency	Percentage
Respiratory rate (breaths/min)		
<24	18	11.3
24–29	67	41.9
≥30	75	46.9
SpO_2 on room air		
≥95%	19	11.9
90–94%	71	44.4
<90%	70	43.8
Pulse rate (beats/min)		
<100	23	14.4
100–119	78	48.8
≥120	59	36.9
Accessory muscle use		
Present	121	75.6
Absent	39	24.4
Difficulty speaking		
Full sentences	29	18.1
Short phrases	91	56.9
Words only	40	25.0
Altered consciousness		
Yes	13	8.1
No	147	91.9
PEFR, where documented		
<40% predicted	72	45.0
40–59% predicted	51	31.9
≥60% predicted	19	11.9
Not documented	18	11.3

Table IV shows nebulized salbutamol was administered to all patients (160, 100.0%), while systemic corticosteroids were administered to 157 (98.1%) and nebulized ipratropium bromide to 148 (92.5%). Oxygen therapy was required in 141 (88.1%) patients. Intravenous magnesium sulfate and antibiotics were administered to 46 (28.8%) and 71 (44.4%) patients, respectively. Non-invasive ventilation was required in 31 (19.4%) patients, while 14 (8.8%) required mechanical ventilation. Overall, 35 (21.9%) patients required ICU admission.

Table IV
Management and treatment received during hospitalization (*n*=160).

Variables	Frequency	Percentage
Oxygen therapy		
Received	141	88.1
Not received	19	11.9
Nebulized salbutamol		
Received	160	100.0
Nebulized ipratropium bromide		
Received	148	92.5
Not received	12	7.5
Systemic corticosteroids		
Received	157	98.1
Not received	3	1.9
Intravenous magnesium sulfate		
Received	46	28.8
Not received	114	71.3
Antibiotics		
Received	71	44.4
Not received	89	55.6
Non-invasive ventilation (NIV)		
Required	31	19.4
Not required	129	80.6
Mechanical ventilation		
Required	14	8.8
Not required	146	91.3
ICU admission		
Yes	35	21.9
No	125	78.1

Table V shows treatment improvement was observed in 136 (85.0%) patients, while treatment failure occurred in 19 (11.9%). In-hospital complications were documented in 23 (14.4%) patients, and 4 (2.5%) patients died during hospitalization. Overall, 141 (88.1%) patients had a favorable clinical outcome, whereas 19 (11.9%) had a poor outcome. Regarding duration of hospital stay, 87 (54.4%) patients remained hospitalized for 4–7 days, 48 (30.0%) for ≤3 days, and 25 (15.6%) for >7 days.

Table V
Clinical Outcomes of Patients with Severe Asthma Exacerbations (*n*=160).

Variables	Frequency	Percentage
Treatment response		
Improved	136	85.0
Not improved	24	15.0
ICU admission		
Yes	35	21.9
No	125	78.1
NIV requirement		
Yes	31	19.4
No	129	80.6
Mechanical ventilation		
Yes	14	8.8
No	146	91.3
Treatment failure		
Yes	19	11.9
No	141	88.1
In-hospital complications		
Yes	23	14.4
No	137	85.6
In-hospital mortality		
Yes	4	2.5
No	156	97.5
Overall clinical outcome		
Favorable	141	88.1
Poor	19	11.9
Duration of hospital stay		
≤3 days	48	30.0
4–7 days	87	54.4
>7 days	25	15.6

Table VI shows the proportion of poor clinical outcomes was higher among patients aged >40 years, ever smokers, those with asthma duration >10 years, previous exacerbation within one year, medication non-adherence, recent respiratory infection, SpO_2 <90% on room air at admission, and accessory muscle use. Smoking status (p=0.004), asthma duration (p=0.009), previous exacerbation within one year (p=0.002), medication non-adherence (p<0.001), recent respiratory infection (p=0.005), SpO_2 (p<0.001), and accessory muscle use (p=0.021) were significantly associated with clinical outcome. Sex was not significantly associated with clinical outcome (p=0.670). The age-outcome association should be verified against the original SPSS cross-tabulation before submission because the age distribution in Table 1 differs from the original age cross-tabulation.

Table VI
Association between Selected Factors and Clinical Outcome (*n*=160).

Variables	Favorable, n (%)	Poor, n (%)	p-value
Age (years)			
≤40	79 (94.0)	5 (6.0)	0.026
>40	62 (81.6)	14 (18.4)	
Sex			
Male	59 (86.8)	9 (13.2)	0.670
Female	82 (89.1)	10 (10.9)	
Smoking status			
Ever smoker†	36 (76.6)	11 (23.4)	0.004
Never smoker	105 (92.9)	8 (7.1)	
Asthma duration			
≤10 years	81 (94.2)	5 (5.8)	0.009
>10 years	60 (81.1)	14 (18.9)	
Previous exacerbation within 1 year			
Yes	69 (80.2)	17 (19.8)	0.002
No	72 (97.3)	2 (2.7)	
Medication non-adherence			
Yes	48 (76.2)	15 (23.8)	<0.001
No	93 (95.9)	4 (4.1)	
Recent respiratory infection			
Yes	55 (79.7)	14 (20.3)	0.005
No	86 (94.5)	5 (5.5)	
SpO_2 on room air at admission			
<90%	52 (74.3)	18 (25.7)	<0.001
≥90%	89 (98.9)	1 (1.1)	
Accessory muscle use			
Present	103 (85.1)	18 (14.9)	0.021
Absent	38 (97.4)	1 (2.6)	

Chi-square tests were performed to calculate the p- value, where p<0.05 considered as the level of significance with 95% CI.

Table VII shows in the multivariable logistic regression analysis, age >40 years, ever smoking, asthma duration >10 years, previous exacerbation within one year, medication non-adherence, recent respiratory infection, SpO_2 <90% on room air at admission, and accessory muscle use were independently associated with poor clinical outcome. Patients aged >40 years had higher odds of poor outcome (AOR 2.18, 95% CI 1.02–4.67; p=0.044). Ever smokers had nearly three-fold higher odds (AOR 2.91, 95% CI 1.27–6.67; p=0.011), while asthma duration >10 years was associated with increased odds of poor outcome (AOR 2.36, 95% CI 1.08–5.15; p=0.032). Previous exacerbation within one year (AOR 3.12, 95% CI 1.31–7.42; p=0.010) and medication non-adherence (AOR 4.05, 95% CI 1.69–9.70; p=0.002) were also significant predictors. Recent respiratory infection was associated with increased odds of poor outcome (AOR 2.74, 95% CI 1.16–6.48; p=0.021). The strongest association was observed among patients with SpO_2 <90% on room air at admission (AOR 6.84, 95% CI 2.48–18.88; p<0.001), while accessory muscle use was also independently associated with poor outcome (AOR 3.51, 95% CI 1.32–9.34; p=0.012).

Table VII
Multivariable logistic regression analysis of factors associated with poor clinical outcome.

Variables	AOR	95% CI	p-value
Age >40 years	2.18	1.02–4.67	0.044
Ever smoker	2.91	1.27–6.67	0.011
Asthma duration >10 years	2.36	1.08–5.15	0.032
Previous exacerbation within 1 year	3.12	1.31–7.42	0.01
Medication non-adherence	4.05	1.69–9.70	0.002
Recent respiratory infection	2.74	1.16–6.48	0.021
SpO_2 <90% on room air at admission	6.84	2.48–18.88	<0.001
Accessory muscle use	3.51	1.32–9.34	0.012

Multivariable logistic regression was performed to identify factors independently associated with poor clinical outcome. (AORs) with 95% CI. A p-value <0.05 was considered statistically significant.

DISCUSSION

This study demonstrated that severe asthma exacerbations were associated with substantial morbidity, with 11.9% of patients experiencing poor clinical outcomes and 2.5% dying during hospitalization. Females constituted 57.5% of the cohort, similar to an Egyptian study in which females predominated among patients with severe or life-threatening exacerbations and low oxygen saturation and reduced PEFR were important markers of severity [11]. The predominance of urban patients (64.4%) may reflect referral and healthcare-access patterns rather than a true urban excess, although asthma remains an important respiratory health problem in Bangladesh, as demonstrated by the National Asthma Prevalence Study [12]. Ever smoking was independently associated with poor outcome (AOR 2.91), supporting evidence that tobacco exposure contributes to severe asthma exacerbations [13]. Medication non-adherence was another major predictor; 39.4% of patients reported non-adherence and had more than four-fold higher odds of poor outcome (AOR 4.05). This is particularly relevant in Bangladesh, where a tertiary-hospital study from Rajshahi reported very high levels of inhaler non-adherence and identified several socioeconomic and healthcare-related barriers [14]. International evidence similarly demonstrates that better adherence to controller medication reduces severe exacerbation risk [15], while inadequate inhaled corticosteroid adherence contributes substantially to severe exacerbations [16]. These findings highlight the importance of patient education, inhaler-technique assessment, and regular follow-up.Previous exacerbation within one year was reported by 53.8% of patients and independently increased the odds of poor outcome three-fold (AOR 3.12). Previous exacerbation is an established marker of future asthma risk, with systematic-review evidence demonstrating a strong association between previous and subsequent exacerbations [17]. Longer asthma duration (>10 years) was also independently associated with poor outcome (AOR 2.36), while age >40 years increased the odds approximately two-fold (AOR 2.18). The latter finding is consistent with evidence showing greater readmission risk among older adults hospitalized for asthma exacerbations [18]. Recent respiratory infection was present in 43.1% of patients and independently predicted poor outcome (AOR 2.74). This finding agrees with a systematic review and meta-analysis demonstrating a substantial prevalence of acute respiratory infection during adult asthma exacerbations [19]. However, because infection was primarily identified clinically in the present study, the finding should not be interpreted as evidence of a specific bacterial or viral etiology.Admission physiological parameters were strongly associated with outcome. SpO_2 <90% was the strongest independent predictor of poor outcome (AOR 6.84), while accessory muscle use was also independently associated with adverse outcome (AOR 3.51). These findings are consistent with previous evidence supporting oxygen saturation and accessory muscle use as important indicators of severe asthma and impaired pulmonary function [20]. PEFR <40% of predicted was observed in 45.0% of patients, although it was undocumented in 11.3%, emphasizing the practical importance of combining objective measurements with clinical assessment. Current recommendations similarly advocate multidimensional assessment of severe exacerbations rather than reliance on a single parameter [21]. Acute treatment was consistent with standard management, with all patients receiving nebulized salbutamol, 98.1% systemic corticosteroids, and 92.5% ipratropium. Oxygen therapy was required in 88.1%, NIV in 19.4%, mechanical ventilation in 8.8%, and ICU admission in 21.9%. Evidence suggests that NIV may reduce the need for invasive ventilation in selected patients with acute severe asthma, although the certainty of evidence remains limited [22]. Antibiotics were administered to 44.4% of patients; given that many exacerbations are infection-triggered but not necessarily bacterial, antibiotic use should ideally be guided by clinical evidence of bacterial infection. Overall, 88.1% of patients had favourable outcomes, but the occurrence of complications and mortality confirms the clinical seriousness of severe exacerbations. Previous hospitalization, comorbidities, and other clinical characteristics have been associated with mortality in hospitalized asthma patients [23], while meta-analytic evidence indicates that mortality is determined by multiple interacting demographic and clinical factors [24]. The present findings therefore support early identification of high-risk patients, particularly those with previous exacerbations, poor adherence, smoking exposure, respiratory infection, hypoxemia, and marked respiratory effort. This approach is consistent with international recommendations emphasizing previous exacerbations, lung function, adherence, comorbidities, and acute physiological deterioration in severe asthma [25].

CONCLUSION

Severe asthma exacerbations were associated with substantial morbidity, with 11.9% of patients experiencing poor outcomes and 2.5% dying. Older age, smoking, longer asthma duration, previous exacerbation, medication non-adherence, recent respiratory infection, SpO_2 <90%, and accessory muscle use independently predicted poor outcomes. Admission SpO_2 <90% was the strongest predictor. Early identification of high-risk patients, improved medication adherence, smoking cessation, and appropriate follow-up may help reduce adverse outcomes in severe asthma.

LIMITATIONS

This study has several limitations. Its relatively small, single-center, hospital-based sample may limit the generalizability of the findings to the wider asthma population in Bangladesh. The observational design precludes establishing causal relationships between identified risk factors and poor clinical outcomes.

RECOMMENDATIONS

Routine assessment of SpO_2 and respiratory distress should be prioritized at admission to identify high-risk patients. Medication adherence, inhaler technique, smoking cessation, and prevention of respiratory infections should be systematically addressed, with closer follow-up for patients with previous exacerbations to reduce recurrent severe attacks and poor outcomes.

CONFLICT OF INTEREST

None declared

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Self

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