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ORIGINAL ARTICLE

Risk factors of asthma exacerbations in children and its effect on their school absence and performance

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ABSTRACT

Keywords: Exacerbations of asthma, Children, School absence and performance.

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Background: Asthma-related school absenteeism affects 59% children with asthma and is linked to lower academic performance, especially among urban minority youth. **Objective:** To determine risk factors of bronchial asthma and its exacerbation in children attending Aswan University Hospital. **Patients and methods:** The present study was a prospective cross-sectional study that included 90 known asthmatics patients selected from Pulmonology Clinic and pediatrics department and reception units at Aswan University Hospital through the period from January to June 2020. **Results:** Patients with asthma exacerbation were older, had longer disease duration and more likely to be males. Likewise, there was statistically significant difference between studied groups regarding family history of asthma. There was statistically significant difference between controlled and uncontrolled asthma as regard Stayed home from school due to respiratory symptoms/asthma, do not taking full part in physical education in school and have respiratory symptoms/asthma associated with physical education or sports. **Conclusion:** These findings suggest opportunities to improve asthma control. Asthma management at schools is important for pediatric pulmonologists and allergists, primary care providers, and the whole interdisciplinary team working alongside them to provide quality asthma care.

INTRODUCTION

Asthma is defined as a chronic inflammatory disease of the airways associated with variable outflow obstruction in the respiratory tract, and manifested with wheezing, frequent coughing, difficulty in breathing and chest tightness (1)**.** Asthma exacerbation is known as severe deterioration in the control of symptoms that may force you to visit a doctor or treatment with corticosteroids becomes a must (2)**.** Airway obstruction associated with acute exacerbation may be reversed either spontaneously or with medication. However, chronic inflammation is still the universal basis for an excessive airway response to various stimuli (3)**.**

With an estimated 300 million patients of all ages, asthma stills a main cause of chronic respiratory morbidity in the West African subregion**.** In addition, the disease imposes a heavy burden on individuals and even the entire community, which increase the costs on the economy of peoples (4). The life quality decreases when asthma develops. Severe exacerbations negatively affect the quality of life of the children. In addition, acute exacerbations are signs of risk for subsequent deaths from asthma. Therefore, it is ideal to prevent the development of bronchial asthma is to prevent the predictive factors (5)**.**

Thus, development of new ways to prevent severe exacerbations is a high priority in pediatric asthma and to prevent exacerbations requires identifying patients at high risk so they develop personal care protocols that may prevent such exacerbations. So far, the best indicator of future severe exacerbations of asthma remains high. For example, children with persistent asthma and at least one severe exacerbation in the previous year have a 2–2.5 times the risk of subsequent acute exacerbations despite use of control drugs, supporting a strong role for individual susceptibility (6)**.**

This study aims to determine risk factors of bronchial asthma and its exacerbation in children attending Aswan University Hospital and the effect of on school absence and performance from January to June 2020 to predict the incidence of asthma.

PATIENTS AND METHODS

The present study was a cross-sectional, prospective, study that was conducted at Aswan University Hospital. We included 90 participants aged from 2 - 16 years, who presented with asthma. The patients with controlled asthma had no symptoms of the following in last 4 weeks, while uncontrolled have 2 or all the following symptoms in the last 4 weeks: (1) Has the patient had daytime symptoms more than twice per week? (2) Any night waking due to asthma? (3) Did SABA reliever need more than twice per week? (4) Is there Any activity limitation due to asthma?

We excluded patients with an underlying other respiratory disease, or an underlying congenital heart disease either by history or echocardiography. Also, we exclude other causes of absenteeism from school as fear or hate school or trauma.

Studied populations were divided into two groups according to presence of asthma exacerbation: Group I (56 Patients): Which included children with controlled asthma, and Group II (34 Patients): which included children with uncontrolled asthma. We differentiated between the asthmatic patients into controlled and uncontrolled according to GINA 2019 assessment of symptoms control and risk factors.

All included patients were interviewed, and data were collected in the form of structured questionnaire which includes 1) Full history taking (Family history, Socio-economic status, poor symptoms control, future risk factors for poor outcome of uncontrolled asthma and prior used of systemic corticosteroids in last year. 2) Full physical examination. 3) Absenteeism.

Absenteeism was assessed from the self-reported number of work or school days missed due to asthma during the previous 6 months. And having the same physical fitness as school mates Adults with asthma reported the number of workdays missed due to asthma. Caregivers of children with asthma reported the number of workdays missed due to the child's asthma. Caregivers also reported the number of school days missed by their child due to asthma. According to **Stridsman et al.** (7)**.**

Ethical consideration:

The study Protocol was submitted for approval from ethics committee and institutional review board of Aswan faculty of Medicine.

Statistical Analysis:

We utilized non-probability consecutive sampling Technique. A total of 90 asthmatic children were determined to be included in the present study. The analyses were carried with SPSS version 24. A p-value < 0.05 is considered statistically significant.

RESULTS

We included 90 participants of them 56 controlled asthma with average age 5.2±1.4 and 34 uncontrolled asthma with average age 6.9±1.4. demographic data of the included participants presented in (Table 1).

There were statistically significant differences between studied groups regarding age (p <0.001), gender (p =0.015) and residency (p= 0.032). While the weight was not statistically significant (p= 0.92). Patients with uncontrolled asthma were older and more likely to be males.

There were no statistically significant differences between studied groups regarding animal contact (p =0.65), smoking exposure (p =0.08), and history of URTI (p =0.12). On the other hand, there was statistically significant difference between studied groups regarding family history of asthma (p =0.001); patients with asthma uncontrolled were older and more likely to have family history of asthma (Table 2).

There were no statistically significant differences between studied groups regarding fathers' education (p =0.64), mothers' education (p =0.61), socioeconomic status (p =0.34), fathers' employment (p =0.22), and mothers' employment (p =0.32). On the other hand, there was statistically significant difference between studied groups regarding no. of siblings (p=0.015); patients with uncontrolled asthma were older and more likely to have more siblings (Table 3).

There was no statistically significant difference **(p-value > 0.05)** between controlled and uncontrolled asthma as regard Current wheeze, Speech-limiting wheeze, Number of wheezing episodes & Respiratory symptoms/asthma interfering with daily life. There was statistically significant difference **(p-value < 0.05)** between controlled and uncontrolled asthma as regard Number of nights with disturbed sleep & troublesome asthma (Table 4).

There were statistically significant differences between studied groups regarding all studied parameters (p <0.001); patients with asthma exacerbation were more likely to have chronic steroid-dependent asthma, prior intensive care admission, prior mechanical ventilation for asthma, recurrent visits to emergency unit in last 48 hrs, sudden onset of severe respiratory distress, poor compliance with therapy, poor recognition of severity of attack, prior use of systemic corticosteroid in last year, respiratory arrest, and over-reliance on rapid & short acting β2 agonist, inhaler therapy (Table 5).

There was highly statistically significant difference **(p-value < 0.001)** between controlled and uncontrolled asthma as regard of not having the same physical fitness as Schoolmates. There was statistically significant difference **(p-value < 0.05)** between controlled5541 and uncontrolled asthma as regard Stayed home from school due to respiratory symptoms/asthma, do not taking full part in physical education in School & Have respiratory symptoms/asthma associated with physical education, running or other sports.

DISCUSSION

Asthma is one of the most common chronic inflammatory diseases of the airways and potentially life-threatening one, with different phenotypes, characterized by variable airflow obstruction and recurrent episodes of worsening symptoms. Typical symptoms include wheeze, cough, shortness of breath and chest tightness that can vary in intensity over time, spontaneously or with pharmacological treatment (1)**.**

Asthma exacerbation is known as severe deterioration in the control of symptoms that may force the patient to visit the doctor (2). Exacerbations are caused by an accentuation of existing inflammatory processes and a loss of disease control. They are also are a major cause of disease morbidity, increases in health care costs, and, in some patients, a greater progressive loss of lung function (8).

Our study agreed with **Abd Elmoneim et al.** (9) and **Ahmed et al.** (10), whom studies showed that uncontrolled asthma was statistically significant in older children, in males, and in children living in urban areas more than rural ones. **Vink et al. (11),** also reported in their tracking adolescents' individual lives survey which included 2,230 subjects, that before puberty, the prevalence and severity of asthma was higher in boys than in girls. By adulthood, a gender switch in the prevalence of asthma had occurred, with female subjects having a higher prevalence than males

Our explanation for the higher prevalence of asthma and atopy in urban than rural areas is the environmental exposures, such as air pollution from traffic and industrial activity, home heating, and allergens, such as cockroaches, and house dust mites which are more prevalent in urban than rural areas.

The weight of asthmatic children in our study showed no statistically significant difference between patients with uncontrolled asthma and those with controlled disease. This is in agreement with **Ross et al.** (12) who reported that obese participants had similar rates of atopy as non-obese peers. In contrast to our results, **Michelson et al.** (13) reported that higher BMI and CRP are associated with increased asthma severity.

Moreover, we found that patients with uncontrolled asthma had statistically significant more siblings than those with controlled asthma. This agrees with **Al-Zalabani et al.** (14), who declared that family size was larger in patients with uncontrolled asthma than those with controlled disease.

This can be explained by the lack of parental care, lower education, increased infection risk, inadequate treatment provided, or poor supervision and follow up in patients living with larger family size that contributes to poor asthma control in asthmatic patients.

Having a positive family history of asthma was more evident in children with uncontrolled than those controlled asthma in our study. Our results agree with **Banjari et al.** (15), whom study on 107 asthmatic children showed that large percent of children with uncontrolled asthma had family history of asthma and other allergies in comparison to those with controlled asthma.

Also, our study showed that having previous history of exposure to smoke was more in children with uncontrolled than those controlled asthma. This agrees with **Castro-Rodriguez et al.** (16) and **Hallit et al.** (17), who found that smoking during breastfeeding were significantly associated with uncontrolled asthma. Their study also clarified that Parental asthma and prenatal environmental tobacco smoke are well-established risk factors for childhood asthma. However, our study disagrees with **Andersson et al.** (12), whom study concluded that parents' smoking and having cat or dog did not significantly impact asthma severity and control.

In our study, there was no statistically significant increase in Current wheeze, Speech-limiting wheeze, Number of wheezing episodes & Respiratory symptoms/asthma interfering with daily life in patients with uncontrolled asthma than those with controlled disease. While there was statistically significant increase in number of nights with disturbed sleep & troublesome asthma in uncontrolled asthmatics. This in agreement with the **NAEPP** guidelines of the criteria of uncontrolled asthma.

Patients with uncontrolled asthma had more chronic steroid- dependent asthma, prior intensive care admissions, prior mechanical ventilation for asthma, recurrent visits to emergency unit in last 48 hours, sudden onset of severe respiratory distress, poor compliance with therapy, poor recognition of severity of attack, prior use of systemic corticosteroid in last year, respiratory arrest, and over-reliance on rapid & short acting β2 agonist, inhaler therapy than those with controlled asthma. Also, we found that patients with uncontrolled asthma were more likely to have poor compliance with therapy and poor recognition of severity of attack.

Our study agrees with **Fuhrman et al**. (19), whom study included 498 asthmatic children, revealed that two-thirds of the children hospitalized for asthma, had been consistently poorly controlled during the previous year of hospitalization. They were frequently undertreated and insufficiently educated about asthma. **American Lung Association** (20) also stated that asthma is the third most common cause of hospitalization in children younger than 15 years old.

Moreover, poor asthma control can lead to severe asthma exacerbations. Comparison between our studied groups revealed higher risk for severe asthma exacerbations mainly in those who had history of sudden onset of severe respiratory distress and had chronic steroid-dependent asthma. **Antonio Corrado et al.** (21), reported also in their survey study that despite a maximal treatment of asthmatic patients with high doses of inhaled corticosteroids associated to LABA, a high rate of uncontrolled asthma and asthmatic exacerbations was found, demonstrating that real-life conditions, and epidemiological studies in the general population showed that asthma is still far from being adequately controlled.

Cyanosis, lethargy, and inability to talk were alarming signs in patients with severe asthma exacerbation when compared to those with mild asthma exacerbation at Alexandria University (22).

Childhood asthma attacks present a burden to the child in terms of quality of life and also a burden to the society in terms of lost education, parental absence from work, and direct cost to health care services. It can be difficult to tease out the burden due to attacks from asthma as a whole but there are studies that have given some insight. In a study, 388 children examined and discharged from the ED with an acute asthma attack were followed up by telephone 2 weeks after having presented; 45% had missed more than 2 days of school, while 54% of parents had missed at least 1 day of work. Thirteen percent had to revisit the ED within 2 weeks (23).

These findings suggest opportunities to improve asthma control. Further understanding of asthma- related absenteeism, including extended and repeated absence, could establish how to use absenteeism information most effectively as a health status indicator.

Limitations

The present study has some limitations, sample size is one of them. Future studies with larger sample size and more comprehensive are required to validate the findings. Nevertheless, the present study provides a basis for future studies to clarify the effect of asthma on absence and performance of children in the schools.

CONCLUSION

The uncontrolled asthma is associated with longer disease duration, female gender, family history of asthma, overcrowding, poor asthma control, and poor compliance to therapy. Moreover, Patients with asthma require greater attention to their age and comorbidities, hospitalization history, and drug adherence.

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Conflict of Interest: The Authors declare that there is no conflict of interest

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Table (1): The comparison of demographic characteristics between controlled & uncontrolled asthma.

Variables	Un controlled (N =34)	Controlled (n =56)	P-value
Age in years Mean ±SD. Median (range)	 6.9±1.4 7 (5 - 13)	 5.2±1.4 5 (1 - 10)	<0.001
Gender, No. (%) - Male - Female	 24 (70.5%) 10 (29.5%)	 27 (48.2%) 29 (51.8%)	0.015
Residency Urban Rural	 20 14	 20 36	 0.032
Weight Underweight Overweight Obese	 8 12 14	 15 20 21	 0.92

*Data are presented as mean ±SD, median (Range), or number (%)

Table1 (2): The comparison of risk factors for controlled & uncontrolled asthma.

Variables	Uncontrolled (N =34)	Controlled (n =56)	p- value
Animal Contact, No. (%) Yes No	 5 (14.7%) 29 (85.3%)	 7 (12.5%) 49 (87.5%)	0.65
Smoking Exposure, No. (%) Yes No	 21 (61.7%) 13 (38.3%)	 24 (42.9%) 32 (57.1%)	0.08
Family history, No. (%) Yes No	 24 (70.5%) 10 (29.5%)	 24 (42.8%) 32 (57.2%)	0.001
URTI, No. (%) Yes No	 19 (55.8%) 15 (44.2%)	 22 (39.2%) 34 (60.8%)	0.12

*Data are presented as number (%).

Table (3): The comparison of socioeconomic characteristics of the included patients as risk factor between controlled& uncontrolled asthma.

Variables	Uncontrolled (N =34)	Controlled (n =56)	P-value
Fathers' Education level, No. (%) No formal education Primary education Secondary Education University Education Post-graduate degree	 4 (11.7%) 6 (17.6%) 11 (32.4%) 12 (35.3%) 1 (2.9%)	 2 (3.6%) 11 (19.6%) 20 (35.7%) 20 (35.7%) 3 (5.3%)	0.64
Mothers' Education level, No. (%) No formal education Primary education Secondary Education University Education Post-graduate degree	 5 (14.7%) 18 (52.9%) 9 (26.4%) 2 (5.8%)	 7 (12.5%) 20 (35.7%) 10 (17.8%) 8 (14.3%) 1 (1.8%)	0.61
Parents' Socioeconomic status, No. (%) Upper Middle Lower	 9 (26.4%) 18 (53%) 7 (20.6%)	 10 (17.8%) 27 (50%) 19 (33.9%)	0.34
Fathers' Employment, No. (%) Unemployed Self-employed Governmental Employment	 9 (26.4%) 18 (52.9%) 7 (20.6%)	 9 (16.1%) 24 (42.8%) 23 (41.1%)	0.22
Mothers' Employment, No. (%) Housewives Self-employed Governmental Employment	 21 (61.7%) 11 (32.4%) 2 (5.8%)	 27 (48.2%) 21 (37.5%) 8 (14.3%)	0.32
No of siblings, No. (%) - 1 - 2 - 3 - >3	 12 (35.3%) 2 (5.8%) 12 (35.3%) 8 (23.5%)	 26 (46.4%) 10 (17.8%) 17 (30.3%) 12 (5.3%)	0.015

*Data are presented as number (%).

Table (4): Comparison between controlled and uncontrolled asthma as regard respiratory symptoms and conditions. According to ISSAC questionnaire.

		Asthma				X^2	p-value
		Controlled (n = 34)		Un-controlled (n = 56)			
Current wheeze	No	21	61.8%	32	57.1%	0.18	0.665
	Yes	13	38.2%	24	42.9%		
Number of nights with disturbed sleep	Never	23	67.6%	24	42.9%	6.55	0.037
	< 1 night / week	10	29.4%	23	41.1%		
	> 1 night / week	1	2.9%	9	16.1%		
Speech-limiting wheeze	No	20	58.8%	31	55.4%	0.1	0.747
	Yes	14	41.2%	25	44.6%		
Number of wheezing episodes	0	17	50%	25	44.6%	0.4	0.939
	1 - 3	10	29.4%	20	35.7%		
	4 - 12	3	8.8%	5	8.9%		
	> 12	4	11.8%	6	10.7%		
Troublesome asthma	No	29	85.3%	29	51.8%	10.4	0.001
	Yes	5	14.7%	27	48.2%		
Respiratory symptoms/ asthma interfering with daily life	No	19	55.9%	30	53.6%	1.49	0.221
	Yes	10	29.4%	28	50%		

X^2: Chi-square test. S: p-value < 0.05 is considered significant.
NS: p-value > 0.05 is considered non-significant.

Table (5): The comparison of future risk factors of poor outcomes according to GINA 2020 between controlled and uncontrolled patients.

Variables, No. (%)	excacerbatons (N =34)	Controlled (n =56)	p-value
Chronic steroid-dependent asthma	21 (61.7%)	17 (30.6%)	0.001
Prior intensive care admission	15 (44.1%)	4 (7.1%)	0.001
Prior mechanical ventilation for asthma	13 (38.2%)	0	0.001
Recurrent visits to emergency unit in last 48 hrs.	34 (100%)	0	0.001
Sudden onset of severe respiratory distress	34 (100%)	0	0.001
Poor compliance with therapy	31 (91.7%)	11 (19.6%)	0.001
Poor recognition of severity of attack	14 (41.7%)	10 (17.8%)	0.001
Prior use of systemic corticosteroid in last year	34 (100%)	9 (16.1%)	0.001
Respiratory arrest	10 (29.4%)	0	0.001
Over-reliance on rapid & short acting β2 agonist, inhaler therapy	34 (100%)	11 (19.6%)	0.001

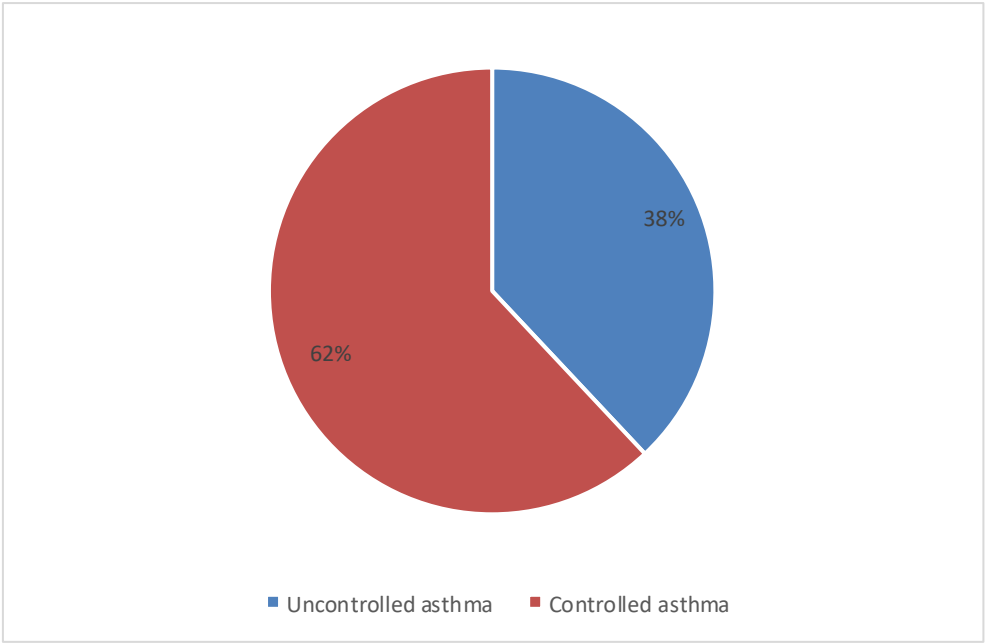
*Data are presented as number (%).

Table (6): Comparison of daily life at school between controlled and uncontrolled asthma.

		Asthma				X^2	p-value
		Controlled (n = 34)		Un-controlled (n = 56)			
Stayed home from school due to respiratory symptoms/asthma	No	30	88.2%	32	57.1%	9.5	0.002 S
	Yes	4	11.8%	24	42.9%		
Do not having the same physical fitness as Schoolmates	No	28	82.4%	26	46.4%	11.4	0.0007 HS
	Yes	6	17.6%	30	53.6%		
Do not taking full part in physical education in School	No	31	91.2%	35	62.5%	8.9	0.003 S
	Yes	3	8.8%	21	37.5%		
Have respiratory symptoms/asthma associated with physical education, running or other sports	No	27	79.4%	31	55.4%	5.3	0.02 S
	Yes	7	20.6%	25	44.6%		

X^2: Chi-square test. S: p-value < 0.05 is considered significant.
HS: p-value < 0.001 is considered highly significant.

Figure 1:



Distribution of uncontrolled asthma of the Included Patients.

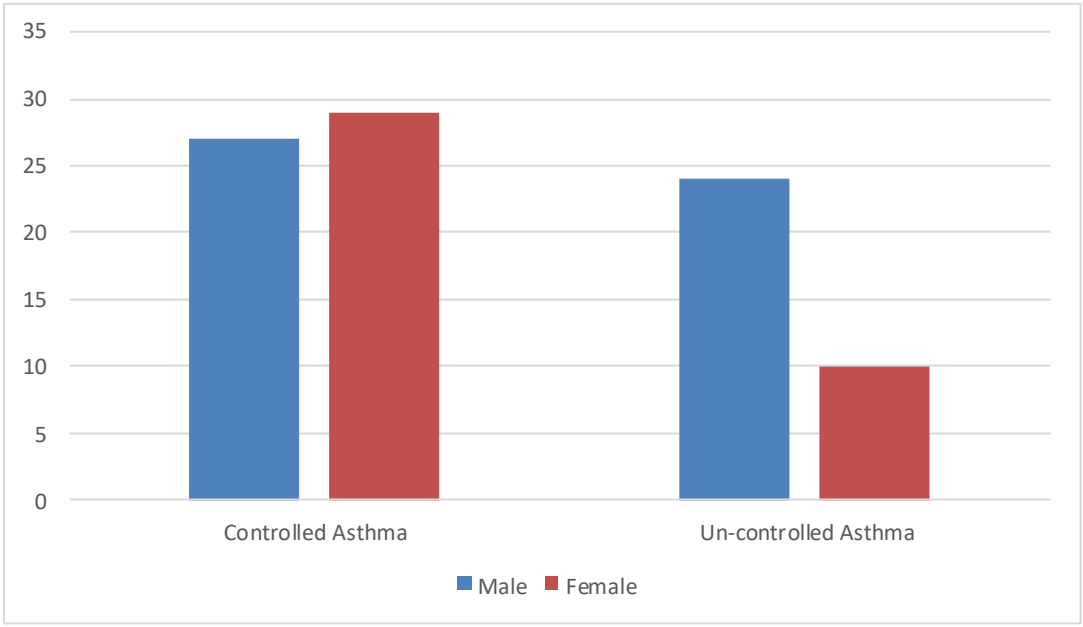


Figure 2: The comparison of risk factors for controlled & uncontrolled asthma

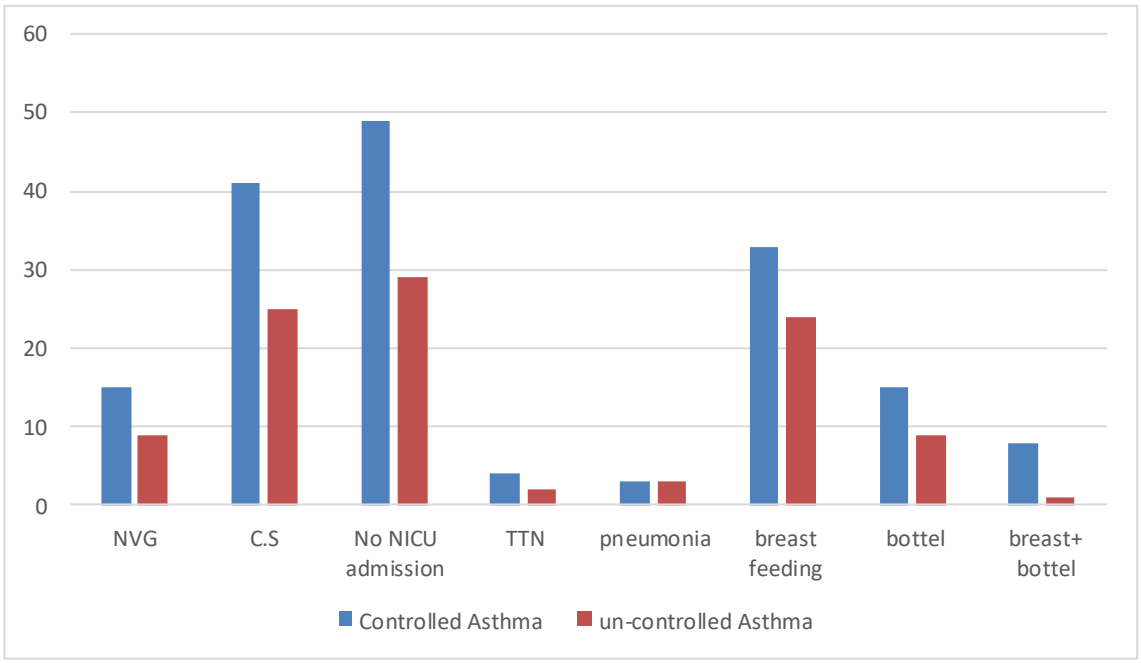


Figure 3: postnatal history of the included patients