AIM OF THE WORK

The aim of this study was to determine possible causes of treatment failure of asthmatic children attending the Asthma Clinic of Alexandria University Children's Hospital.

SUBJECTS AND METHODS

I. The study design:

A Cross-sectional survey was conducted to assess possible determinants of treatment failure among asthmatic children.

II. Research Setting:

The study was conducted in the asthma clinic in Alexandria University Children's Hospital (AUCH) at El shatby.

III. Target population:

100 sequential asthmatic children attending the study setting till completion of the convenient sample with the following inclusion criteria:

- Age <15 years

- Children with persistent asthma.

- On control therapy at least for 4 months.

IV. Data collection tools and methods:

Mothers or primary caregivers of studied children were interviewed using an interviewing questionnaire (Appendix). The questionnaire includes the following items:

1. **Sociodemograhic characteristics** of both parents including age, marital status, history of consanguinity, residence, their degree of education, working status, number of family members, number of rooms, monthly income and personal habits (smoking).
2. **Family history** of bronchial asthma, allergic rhinitis and sinusitis.
3. **Child demographic characteristics** mainly age, sex and school or daycare centers attendance.
4. **History of child bronchial asthma:**

- Date of diagnosis, duration since diagnosis and severity of asthma at the time of diagnosis.
- Frequency of day and night symptoms, limitation of activities, frequency of use of inhaled short-acting B_2-agonists and number of exacerbations (to allow identification of the degree of asthma control based on GINA guidelines).
- Number of hospital admissions, emergency visits to Emergency Room or PICU due to asthmatic attacks in the last four months.

- Type of ongoing asthma treatment, method of delivery and checking whether correct or incorrect, presence of major side effects and assessment if the prescribed treatment was appropriate to the step of asthma severity.

- Level of adherence to the prescribed treatment in full doses (always, sometimes or never) and possible causes of non-adherence (as poverty, ignorance, etc.).

5. **Other co-morbid conditions** e.g. allergic rhinitis, sinusitis, skin allergy gastro-esophageal reflux and overlapping diseases e.g. foreign body, cystic fibrosis, etc.

6. **Persistent exposure to known asthma triggers** as smoking, house dust mites, perfumes, URTI, etc.

V. Plan for data collection:

- **Getting Permission:**

The study was approved by Ethical Committee of Alexandria Faculty of Medicine.

- **Pilot Study:**

After constructing the questionnaire for assessing possible causes of treatment failure of asthmatic children, a pilot study involving 10 children (ensuring that they were not included in the study population) was conducted.

The pilot study aimed at**:**

a. Ensuring that all questions are clearly understood.

b. Pointing to any modification in the interview format needed.

Feedback of the pilot study:

Minimal changes were done as adding attending school or daycare centers and crowding index.

VI. Ethical consideration:

Objectives of the study and types of information to be obtained were explained to all children relatives to take their consent to participate in the study.

VII. Data preparation and analysis:

Daily revision of the completed data was routinely carried out. After completion of data collection, the data were coded and fed to the computer using Statistical Package for Social Science (SPSS, version 18).

1. **Crowding index**: Number of family members at home/number of rooms.

2. **Smoking index:** Number of cigarettes per day× duration of smoking in years.

3. The studied children were divided into three groups: controlled, partially controlled and uncontrolled groups as defined by GINA Guidelines (Table 3).[14]

Table (2): Levels of Asthma Control according to the GINA guidelines:

Characteristic	Controlled (All of the following)	Partially controlled (Any measure present in any week)	Uncontrolled
Daytime symptoms	None (twice or less/week)	More than twice/week	Three or more features of partially controlled asthma present in any week
Limitations of activities	None	Any	
Nocturnal symptoms/awakening	None	Any	
Need for reliever/rescue treatment	None (twice or less/week)	More than twice/week	
Lung function (PEF or FEV1)if feasible	Normal	<80% predicted or personal best (if known)	
Exacerbations	None	One or more/year	One in any week

The following statistical measures were used:

a. Descriptive statistics including frequency distribution, mean and standard deviation were used to describe different studied characteristics.

b. Comparison of the three groups of asthmatic children (based on the degree of asthma control) were done to delineate possible determinants of treatment failure using the following statistical tests:

- Chi-square test or Mont Carlo test for qualitative variables.
- ANOVA test and Kruskal wallis test for quantitative variables.

The 5% level was taken as the level of significance all through the results.

RESULTS

1. Sociodemographic characteristics of the parents:

a. Table 6 shows distribution of children according to degree of asthma control and sociodemographic characteristics of their mothers.

- Age of mothers:

Although the percentage of mothers aged between 20 to less than 30 years was higher in uncontrolled asthmatic children (60%) compared to controlled (46.5%) and partially controlled (40.5%) groups but the difference was not statistically significant.

- Marital status:

No statistically significant difference between the three groups of asthmatic children regards the marital status of their mothers (p =0.732).

- Level of education:

Illiterates / low levels of education were noticed in mothers of 60% of uncontrolled children as compared to only 38.1% and 37.2% of controlled and partially controlled children respectively but the difference was not statistically significant (p=0.267).

- Working status:

Mothers of the majority of uncontrolled children (93.3%) were housewives as compared to 83.3% and 88.4% of controlled and partially controlled children but the difference was not statistically significant (p=0.567).

- Smoking mothers:

Only one mother in controlled group reported smoking habit. No statistically significant difference was found between the 3 groups of asthmatic children as regard smoking habit of their mothers (p=0.556).

Table (6): Distribution of asthmatic children according to the degree of asthma control and sociodemographic characteristics of their mothers (primary care givers)

Sociodemographic characteristics of the mother	Studied children	Controlled cases (n= 42)		partially controlled (n=43)		Uncontrolled (n=15)		Test of significance (P value)
	No=100	No	%	No	%	No	%	
Age(years)								
20 to <30	46	17	40.5	20	46.5	9	60	$^{kw}\chi 2=2.138$
30 to < 40	41	18	42.9	18	41.9	5	33.3	$(0.710)^{ns}$
40 -52	13	7	16.7	5	11.6	1	6.7	
Min. - Max.	25-52	22-52		22-45		24-47		$^{kw}\chi 2=1.408$
Mean ± SD	34.46±6.74	33.56±6.93		32.93 ± 6.04		31.26 ± 6.21		$(0.495)^{ns}$
Median	34	32		33		30		
Marital status								
Married	90	39	92.90	38	88.4	13	86.7	$^{MC}p= 0.732^{ns}$
Divorced	10	3	7.1	5	11.6	2	13.3	
Education								
-Illiterate	17	8	19.8	6	14	3	20	
Lower education								
-Read and write	8	3	7.1	3	7	2	13.3	
-Primary education	13	4	9.5	5	11.6	4	26.7	
-Preparatory education	3	1	2.4	2	4.7	0	0	$^{MC}p = 0.677$
Higher education								
-Secondary education	43	19	45.2	18	41.9	6	40	
-University education or higher	16	7	16.7	9	20.9	0	0	
Illeterate/lower education	41	16	38.1	16	37.2	9	60	$\chi^2= 2.640$
Higher education	59	26	61.9	27	62.8	6	40	$(0.267)^{ns}$
Working condition								
House wife	87	35	83.3	38	88.4	14	93.3	$\chi^2= 1.103$ $(0.567)^{ns}$
Working	13	7	16.7	5	11.6	1	6.7	
smoking mothers								
Smoker	1	1	2.40	0	0	0	0	$(^{MC}p= 0.556)^{ns}$
Non Smoker	99	41	97.60	43	100	15	100	

ns: not significant at 5% level of significant

χ^2: Chi square test

KW: Kruskal Wallis test MC: Monte Carlo test

b. Table 7 shows distribution of asthmatic children according to degree of asthma control and sociodemographic characteristics of their fathers.

- Father age:

13.3% fathers of uncontrolled children aged between 40 to less than 64 years as compared to 40.5% and 48.8% among controlled and partially controlled respectively, but the difference was not statistically significant (p=0.072). Also, no statistically significant difference between the three groups was found as regard the mean age of the fathers (p=0.491).

- Level of education:

Illiterates / low levels of education were noticed in fathers of 73.3% of uncontrolled children as compared to only 57.1% and 41.9% of controlled and partially controlled children respectively but this was not statistically significant (p=0.085).

- Smoking habit of the father:

There was no statistically significant difference between the three groups of asthmatic children regards the smoking habit of their fathers.

Among fathers who are currently smokers, 66.7% of uncontrolled group were smoking indoors as compared to 65.2% and 85.7% of controlled and partially controlled children and these difference was not statistically significant (p=0.322).

No statistically significant difference were noticed between the three groups whose their fathers were currently smokers regarding the mean duration of smoking or smoking index (p=0.260 and 0.916 respectively).

Table (7): Distribution of asthmatic children according to the degree of asthma control and socio-demographic characteristics of their fathers

Socio-demographic characteristics of the father	Studied children	Controlled cases (n= 42)		Partially controlled (n= 43)		Uncontrolled (n=15)		Test of significance (P value)
	N0=100	No	%	No	%	No	%	
Age in years								
20 to < 30	12	7	16.7	4	9.3	1	6.7	
30 to < 40	48	18	42.9	18	41.9	12	80	$(^{MC}p = 0.072)^{ns}$
40 -64	40	17	40.5	21	48.8	2	13.3	
Min. – Max	25-56	28-56		28-64		25-54		$^{KW}\chi^2 = 1.424$
Mean ± SD	39.86±7.08	39.31±7.15		40.04± 7.49		37.33± 6.43		$(0.491)^{ns}$
Median	39	39		40		36		
Education								
-Illiterate	10	4	9.5	4	9.3	2	13.3	
Lower education								
-Read and write	12	5	11.9	3	7	4	26.7	$^{MC}p = 0.409^{ns}$
-Primary education	15	9	21.4	4	9.3	2	13.3	
-Preparatory education	16	6	14.3	7	16.3	3	20.0	
Higher education								
-Secondary education	36	12	28.6	20	46.5	4	26.7	
-University education or higher	11	6	14.3	5	11.6	0	0	
Illiterate/Lower education	53	24	57.1	18	41.9	11	73.3	$\chi^2 = 4.921$
Higher education	47	18	42.9	25	58.1	4	26.7	$(0.085)^{ns}$
Habits of Father								
Smoker	50	23	54.8	21	48.8	6	40	$\chi^2 = 1.004$
Non Smoker	50	19	45.2	22	51.2	9	60	$(0.605)^{ns}$
If currently smoking (n=50)								
Type of smoking								
Indoors and outdoors	37	15	65.2	18	85.7	4	66.7	$^{MC}p = 0.322^{ns}$
Outdoor only	13	8	34.8	3	14.3	2	33.3	
Duration of smoking (years)								
Min. - Max.	5-30	5-30		2-25		5-25		$^{KW}\chi^2 = 2.693$
Mean ± SD	15.83±6.33	15.09±7.51		16.19± 5.51		19±7.21		$(0.260)^{ns}$
Median	15	15		15		20		
Smoking index**								
Min. - Max.	15-1000	15-1200		10-1000		100-800		$^{KW}\chi^2 = 0.176$
Mean ± SD	285.5±224.9	354±327		311.19± 239.47		353.33± 270.31		$(0.916)^{ns}$

**Smoking index: Number of cigarettes per day x duration of smoking in years.
$^{KW}\chi^2$:Kruskal Wallis test
MC: Monte Car

2. Family characteristics:

Table 8 shows distribution of asthmatic children according to degree of asthma control and some family characteristics.

- Residence:

The number of total studied children living in urban areas is significantly higher than those living in rural areas. Concerning the patients' groups, 80% of uncontrolled children live in urban areas as compared to only 74.4% and 57.1% of partially controlled and controlled children. Comparing each 2 groups of children, the differences in residency between uncontrolled and both the controlled and partially controlled groups were significant, while the difference between the latter 2 groups was not significant.

- Monthly income:

The mean monthly income for families of uncontrolled children was (679±304 Egyptian Pounds) lower than that among controlled and partially controlled children however the difference was not statistically significant (p=0.584).

- Crowding index:

No statistically significant difference was found between the three studied groups as regards the mean crowding index (p=0.421).

- Consanguinity:

Positive consanguinity between both parents was found in 35.7% of controlled children as compared to 20.9% and 33.3% of partially controlled and uncontrolled children but the difference was not statistically significant (p=0.299).

Table (8): Distribution of asthmatic children according to the degree of asthma control and some family characteristics

Family characteristics	Studied children	Controlled cases (n=42)		partially controlled (n=43)		Uncontrolled (n=15)		Test of significance (P value)
	No=100	No	%	No	%	No	%	
Residency								χ^2= 6.317
Rural	32	18	42.9	11	25.6	3	20	(0.042)*
Urban	68	24	57.1	32	74.4	12	80	
Difference between groups								
Group 1&2	2.82(0.093)^{ns}							
Group 1&3	6.284(0.012) *							
Group 2&3	5.831(0.016) *							
Monthly income (n=77)								
Min. - Max.	250-3000	250-2500		200-3000		250- 1200		χ2=1.075
Mean ± SD	897.4±646.48	800±450.6		930± 604		679.17± 304.11		(0.584)
Median	700	800		800		600		
Crowding index								
Min. - Max.	0.6-5.2	0.6-6		1-4.5		1-4		$^{Kw}\chi^2$= 1.732
Mean ± SD	2.09±1.06	2.02±1.13		1.93± 0.94		2.11± 0.82		(0.421)
Median	2	2		1.6		2		
Consanguinity								
No	71	27	64.3	34	79.1	10	66.7	χ^2= 2.416
Yes	29	15	35.7	9	20.9	5	33.3	(0.299)^{ns}

*: Statistically significant at $p \leq 0.05$
$^{KW}\chi^2$: Kruskal Wallis test

3. Family history of allergic and other related diseases:

Table 9 shows distribution of asthmatic children according to the degree of asthma control and their family history of allergic diseases.

- 73% of cases had positive family history of asthma. Out of those, 90.41% had family history of asthma in one or more of their 1stdegree relatives; asthma in 2nd degree relatives was reported by 9.59%.
- About one third of cases (36%) had family history of allergic rhinitis. 94.4%in their 1st degree relatives, 5.5% in 2nd degree relatives.
- 25% had positive family history of sinusitis.

There were no significant differences between 3 studied groups as regard family history of bronchial asthma, allergic rhinitis and sinusitis.

Table (9): Distribution of asthmatic children according to the degree of asthma control and their family history of allergic diseases

Family history	Studied children (n=100)		Controlled cases (n=42)		Partially controlled (n=43)		Uncontrolled (n=15)		Test of significance (P value)
	No.	%	No.	%	No.	%	No.	%	
Chronic bronchial Asthma									χ^2=1.772
Yes	73	73.00	29	69	31	72.1	13	86.7	$(0.412)^{ns}$
No	27	27.00	13	31	12	27.9	2	13.3	
If Yes: (n= 73)									
First degree relative	66	90.41	26	89.7	29	93.5	11	84.6	$(^{MC}p =0.678)^{ns}$
Second degree relative	7	9.59	3	20.3	2	6.5	2	5.4	
Allergic rhinitis									
Yes	36	36	14	33.3	18	41.9	4	26.7	χ^2=1.338
No	64	64	28	66.7	25	58.1	11	73.3	$(0.512)^{ns}$
If Yes: (n= 36)									
First degree relative	34	94.45	13	92.9	17	94.4	4	100	----------
Second degree relative	2	5.55	1	7.1	1	5.6	0	0	
Chronic sinusitis									
Yes	25	25.00	9	21.4	11	25.6	5	33.3	χ^2=0.849
No	75	75.00	33	78.6	32	74.4	10	66.7	$(0.654)^{ns}$

MC: Monte Carlo test

4. Child demographic characteristics:

Table 10 shows the distribution of the studied children according to the child demographic characteristics and the degree of asthma control.

- Gender:

Male children constituted two thirds (68%) of the study sample. Concerning the studied groups 86.7% of uncontrolled children were males as compared to 73.8% and 55.8% of controlled and partially controlled children but the difference was not statistically significant (p=0.05).

- Age in years:

The mean age of studied children was 6.26± 3.11 years. Nearly one half (48%) of them were in preschool age (less than six years) and the other half (52%) were in school age (six years or more). No statistically significant difference was found between the three groups of children regarding their mean age (p=0.362).

- Attending a school or daycare center:

About three quarters of the studied children (76%) were attending schools or daycare centers. Concerning the studied groups (table 10 and figure 1), 60% of uncontrolled asthmatic children never attend a school or daycare center before as compared to only 16.7% and 18.6% of controlled and partially controlled groups. The difference was statistically significant (p=0.002). Comparing each 2 groups, significant differences regarding school attendance were noticed between uncontrolled and partially controlled groups (p=0.002) and between controlled and uncontrolled groups (p=0.001), while the difference between controlled and partially controlled groups was not significant.

Table (10): Distribution of asthmatic children according to the degree of asthma control and child demographic characteristics

Child demographic characteristics	Studied children	Controlled cases (n= 42)		or partially controlled (n=43)		Uncontrolled (n=15)		Test of significance (P value)
	(n=100)	No	%	No	%	No	%	
Gender								
Females	32	11	26.2	19	44.2	2	13.3	$\chi 2$=5.988
Males	68	31	73.8	24	55.8	13	86.7	$(0.050)^{ns}$
Age in years								
Preschool age(3 to <6 years)	48	19	45.2	20	46.5	6	40.0	$\chi 2$=1.032
School age (≥6 years)	52	23	54.8	23	53.5	9	60.0	$(0.597)^{ns}$
Min. - Max.	3-13.5	2-13		2-15		1.5-13		
Mean ± SD	6.26±3.11	6.45±3.16		6.44± 3.1		5.2± 2.97		$^{KW}\chi^2$= 2.03
Median	6	6		6		5.5		$(0.362)^{ns}$
Attending a school or daycare center								χ^2=12.582
Yes	76	35	83.3	35	81.4	6	40.0	(0.002)*
No	24	7	16.7	8	18.6	9	60.0	
Intergroup significance								
Group 1&2	0.055(0.815)ns							
Group 1&3	10.27(0.001) *							
Group 2&3	9.197(0.002) *							

*: Statistically significant at $p \leq 0.05$
$^{KW}\chi^2$: Kruskal Wallis test

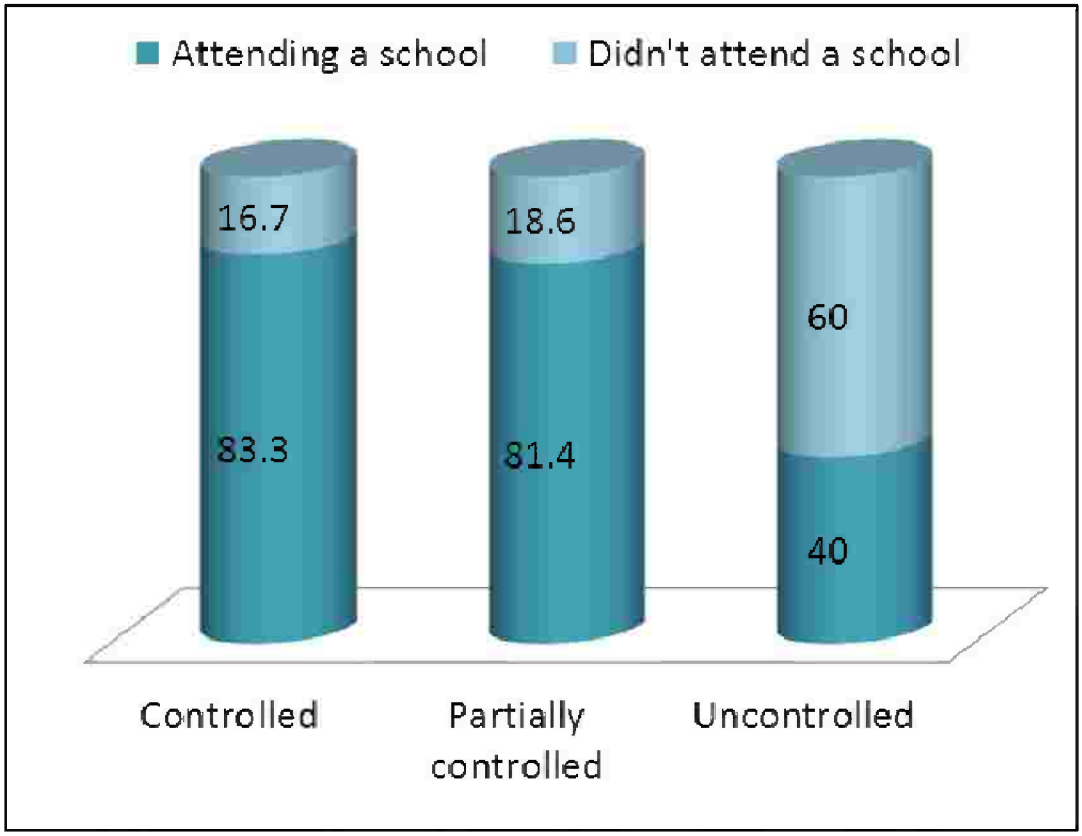

Figure (1): Distribution of studied asthmatic children according to school attendance and degree of asthma control

5. Associated co-morbid conditions:

Table 11 shows the distribution of asthmatic children according to the degree of asthma control and associated co-morbid conditions. Nearly two fifths of studied children (43%) had associated allergic rhinitis. Moreover skin allergy was reported by 15% of them. Conjunctivitis was reported by 12% and only 5% had GERD.

Although the percentages of children who had allergic rhinitis, allergic conjunctivitis and GERD were higher in uncontrolled group, but the differences were not significant.

Table (11): Distribution of asthmatic children according to the degree of asthma control and associated co-morbid conditions

Associated co-morbid conditions	Studied children	Controlled cases (n= 42)		partially controlled (n=43)		Uncontrolled (n=15)		Test of significance (P value)
	N=100	No.	%	No.	%	No.	%	
Allergic Rhinitis								
Yes	43	16	38.1	20	46.5	7	46.7	$\chi^{2=}$ 0.711
No	57	26	61.9	23	53.5	8	53.3	$(0.701)^{ns}$
Conjunctivitis								
Yes	12	4	9.5	5	11.6	3	20	$^{MC}p=0.637$
No	88	38	90.5	38	88.4	12	80	
Skin Allergy								
Yes	15	7	16.7	6	14	2	13.3	$\chi^{2=}$ 0.161
No	85	35	83.3	37	86	13	86.7	$(0.923)^{ns}$
Gastroesophageal reflux disease								
Yes	5	0	0	0	0	5	5	$^{MC}p=0.135$
No	95	42	100	43	100	10	95	

MC: Monte Carlo test

6. Persistent exposure to asthma triggers:

Table 12 shows that 86% of studied children had frequent attacks of upper respiratory tract infections (URTI). About half of studied children (54%) were victims of passive smoking at their homes. Continuous exposure to cold air and perfumes were reported by 35% and 10% of studied children respectively and 34% of them were exposed to house dust mites and 10% reported exposure to other irritants. There was no significant difference between the 3 studied groups regarding exposure to asthma triggers.

Table (12): Distribution of asthmatic children according to the degree of asthma control and history of continuous exposure to various triggers

Environmental triggers	Studied children	Controlled cases (n=42)		partially controlled (n=43)		Uncontrolled (n=15)		Test of significance (P value)
	(n=100)	No.	%	No	%	No	%	
House dust mites								
Yes	34	17	40.5	11	25.6	6	40	χ^2= 2.384
No	66	25	59.5	32	74.4	9	60	(0.304)^{ns}
Perfumes								
Yes	10	3	7.1	5	11.6	2	13.3	^{MC}p =0.731
No	90	39	92.9	38	88.4	13	86.7	
URTIs								χ^2 =0.918
Yes	86	35	83.3	37	86	14	93.3	(0.632)^{ns}
No	14	7	16.7	6	14	1	6.7	
Cold air								χ^2= 2.631
Yes	35	13	31	14	32.6	8	53.3	(0.268)^{ns}
No	65	29	69	29	67.4	7	46.7	
Smoking								
Yes	54	25	59.5	22	51.2	7	46.7	χ^2 = 0.980
No	46	17	40.5	21	48.8	8	53.3	(0.613)^{ns}
Other irritants*								^{MC}p =0.364
Yes	10	2	4.9	6	14	2	13.3	
No	90	39	95.1	37	86	13	86.7	

MC: Monte Carlo test

*Other irritants as exercise, animal dander.

7. History of bronchial asthma (duration, severity and frequency of acute attacks) among studied children:

Table 13 shows the distribution of asthmatic children according to the degree of asthma control and their past medical history of bronchial asthma.

- Duration of the disease:

The mean duration of the disease was nearly similar in the 3 studied groups (about 3.5 years) without significant difference between them (p=0.991).

- Asthma severity:

The studied asthmatic children were classified according to the severity of asthma before the start of long term preventive treatment to 43 children with mild persistent asthma, 33 children with moderate persistent asthma and 24 children with severe persistent asthma. There was no significant difference between the three studied groups as regards asthma severity at time of diagnosis (p=0.087).

- Number of acute attacks during last 4 months:

During last 4 months; 40 children had no exacerbations, 36 children had from 1 to 2 attacks, 10 children had from 3 to 4 attacks and 14 children had >4 attacks. It was found that 53.3% of uncontrolled children had more than 4 attacks during last 4 month compared to 14% and 0% of partially controlled and controlled children. These differences between each group versus others were statistically significant.

Table (13): Distribution of asthmatic children according to the degree of asthma control and their past medical history of bronchial asthma

History of bronchial asthma	Studied children	Controlled cases (n= 42)		partially controlled (n=43)		Uncontrolled (n=15)		Test of significance (P value)
	N=100	No	%	No	%	No	%	
Duration of the disease(year)								
Min. - Max.	0.5-10	1-9		1-10		0.5-10		$^{KW}\chi^2$=0.019
Mean ± SD	3.69±2.19	3.67 ±2.22		3.69±2.14		3.73±2.4		(0.991)^{ns}
Median	3	3		3		4		
Severity at time of diagnosis								χ^2=8.127 (0.087)^{ns}
Mild persistent	43	24	57.1	16	37.2	5	20.0	
Moderate persistent	33	12	28.6	14	32.6	7	46.7	
Severe persistent	24	6	14.3	13	30.2	3	33.3	
Number of acute attacks (During last 4 months)								(^{MC}p< 0.001)*
No attacks	40	23	54.8	16	37.2	1	6.7	
1-2	36	17	40.5	15	34.9	4	26.7	
3-4	10	2	4.8	6	14.0	2	13.3	
>4	14	0	0	6	14	8	53.3	
Intergroup significance								
Group 1&2	9.37(0.023) ^{Mc}*							
Group 1&3	30.201(<0.001)^{Mc} *							
Group 2&3	X^2=10.916 p^{Mc}=0.012*							

*: Statistically significant at $p \leq 0.05$
$^{KW}\chi^2$: Kruskal Wallis test
MC: Monte Carlo test

8. Asthma treatment:

Table 14 shows the distribution of asthmatic children according to their degree of asthma control and their treatment plan. Among the studied asthmatic children, 93% of asthmatic children were on ICS, 12% were on combined treatment (ICS+LABA and ICS+ montolukast) and 11% were on montolukast. There was no significant difference between the three studied groups as regards the type of prescribed treatment.

Table 14 and figure 2 show distribution of studied asthmatic children according to degree of asthma control and appropriateness of prescribed treatment. Regarding appropriateness of treatment, 86.7% of uncontrolled children were receiving inappropriate treatment compared to only 4.7% and 2.4% of partially controlled and controlled children. The differences were statistically significant (p=0.001).

The difference between uncontrolled children and both the controlled and partially controlled children were statistically significant while the difference between the latter 2 groups was not significant.

Table (14): Distribution of asthmatic children according to the degree of asthma control and their treatment plan

Type of prescribed treatment	Studied children	Controlled cases (n= 42)		partially controlled (n= 43)		Uncontrolled (n=15)		Test of significance (P value)
	No=100	No.	%	No	%	No	%	
Inhaled corticosteroids								
Yes	93	38	90.5	41	95.3	14	93.3	$^{MC}p=0.769^{ns}$
No	7	4	9.5	2	4.7	1	6.7	
Inhaled Long acting B2 agonist(LABA)								
Yes	8	4	9.5	3	7	1	6.7	$^{MC}p=0.882^{ns}$
No	92	38	90.5	40	93	14	93.3	
Montulokast								
Yes	11	7	16.7	3	7	1	6.7	$^{MC}p=0.295$
No	89	35	83.3	40	93	14	93.3	
Antihistaminic								
Yes	8	2	4.8	4	9.3	2	13.3	$^{MC}p=0.693$
No	92	40	95.2	39	90.7	13	86.7	
Intranasal steroid								
Yes	5	4	9.5	1	2.3	0	0.0	$^{MC}p=0.197$
No	95	38	90.5	42	96.6	15	100.0	
Combined treatment✓								
Yes	12	2	11.7	4	11.7	6	12.2	$^{MC}p=0.693$
No	88	15	88.2	30	88.2	43	87.7	
Appropriateness of prescribed treatment								
Yes	84	41	97.6	41	95.3	2	13.3	$^{MC}p<0.001*$
No	16	1	2.4	2	4.7	13	86.7	
Intergroup significance								
Group 1&2	$0.32(^{MC}p=1)^{ns}$							
Group 1&3	$39.01(^{MC}p<0.001)$ *							
Group 2&3	$43.37(^{MC}p<0.001)$ *							

*: Statistically significant at $p \leq 0.05$

MC: Monte Carlo test

✓The most common combination was ICS+ LABA (8), followed by ICS+ montolukast (4)

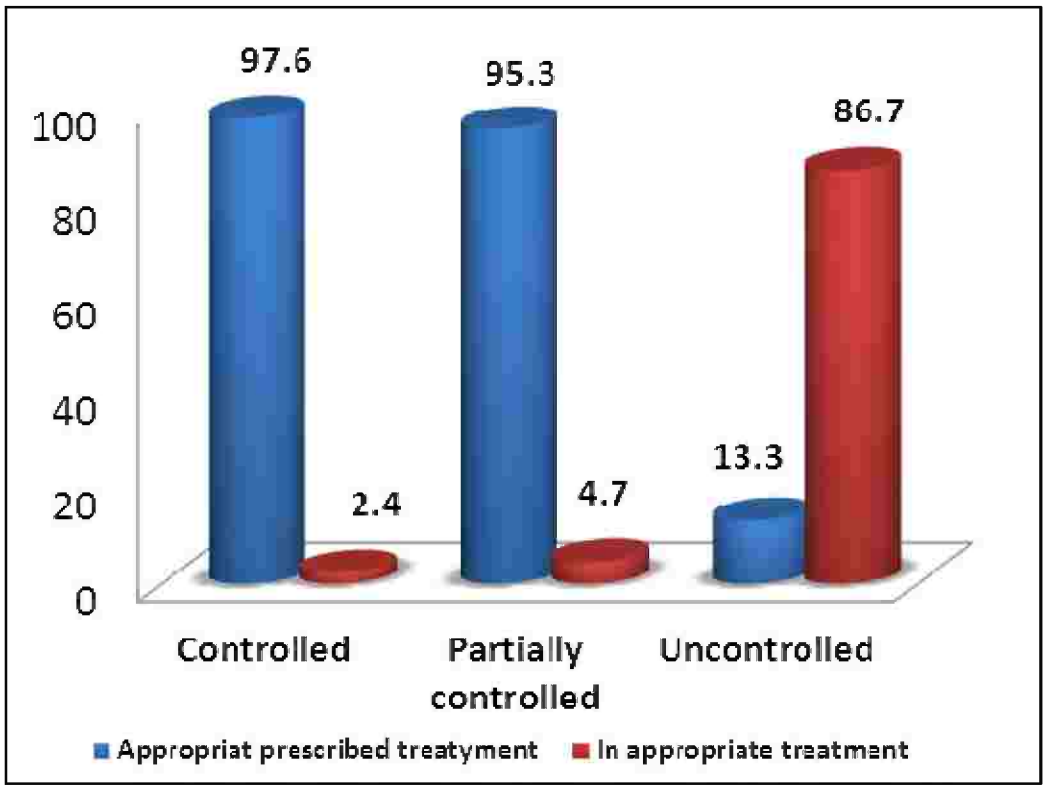

Figure (2): Distribution of studied asthmatic children according to degree of asthma control and appropriateness of prescribed treatment

9. Treatment behavior among studied children:

Table 15 shows the distribution of asthmatic children according to their degree of asthma control and their treatment behavior.

- Compliance with the prescribed treatment:

Figure 3 and table 15 show distribution of studied asthmatic children according to their level of compliance with the prescribed treatment. More than half (58) of children were compliant with the prescribed treatment, 36 were sometimes compliant and 6 were not compliant.

As shown in table 15 and figure 4, the percentage of compliant uncontrolled children was significantly lower compared to partially controlled or controlled children (33.3%, 53.5%, 71.4% respectively), while the difference between the latter 2 groups was not significant.

- Compliance with the prescribed full doses:

Compliance with the full prescribed doses was reported by 65% of the patients, 31% were compliant only sometimes and 4% were not compliant at all.

As shown in table 15 and figure 5, the patients' compliance with the full doses of prescribed drugs was lowest in uncontrolled group and highest in controlled group with significant difference between the 3 groups of patients (53.3%, 55.8% and 78.6% respectively).

- Method of drug delivery:

Among the studied patients, 83% of asthmatic children were using inhalational devices correctly and only 10% were using them incorrectly. As shown in table 10 and figure 6, the percentage of patients with uncontrolled asthma who was using inhalation devices incorrectly were higher than that in partially and well controlled groups (33.3%, 20.9% and 7.1% respectively). The difference was statistically significant. On the other hand, the difference between well controlled and partially controlled groups was not significant.

- Regular medical checkup:

As shown in table 15, 62% of cases were regularly attending follow up visits while 38% of cases were not regularly attending follow up visits. Concerning regular check up 46.7 of uncontrolled children were not attending regular medical checkup compared to 38.1% and 34.9% of controlled and partially controlled children and the differences were not statistically significant (p=0.721).

- Presence of major side effects:

Minority of cases (10%) reported side effect including obesity, oral candidiasis and growth retardation. Among the studied patients groups, 20% of uncontrolled children reported side effect of the medication compared to 11.6% and 4.8% of partially controlled and controlled children. The differences between the 3 groups were not statistically significant (p=0.227).

Table (15): Distribution of asthmatic children according to the degree of asthma control and their treatment behavior

Treatment behavior	Studied children	Controlled cases (n= 42)		partially controlled (n= 43)		Uncontrolled (n=15)		Test of significance (P value)
	(No=100)	No.	%	No	%	No	%	
Compliance with the prescribed treatment								
Always	58	30	71.4	23	53.5	5	33.3	$^{MC}p<0.001$*
Sometimes	36	12	28.6	19	44.2	5	33.3	
Not at all	6	0	0	1	2.3	5	33.4	
Intergroup significance								
Group 1&2	$X^2=3.331(p=0.068)^{ns}$							
Group 1&3	$X^2=16.69(^{MC}p<0.001)$ *							
Group 2&3	$X^2=11.58(p=0.003)$ *							
Compliance with prescribed full doses								
Always	65	33	78.6	24	55.8	8	53.3	$^{MC}p<0.001$*
Sometimes	31	9	21.4	19	44.2	3	20	
Not at all	4	0	0	0	0	4	26.7	
Intergroup significance								
Group 1&2	$12.189(^{MC}p=0.003)$ *							
Group 1&3	$13.194(^{MC}p=0.002)$ *							
Group 2&3	4.89(p=0.026) *							
Method of drug delivery(n=93)								
Correct	83	39	92.9	35	79.1	8	66.7	$\chi^2=6.199$
Incorrect	10	2	7.1	4	20.9	4	33.3	(0.045)*
Intergroup significance								
Group 1&2	$3.331(p=0.068)^{ns}$							
Group 1&3	6.284(p=0.012) *							
Group 2&3	0.934(p=0.334) *							
Regular medical check up								
Yes	62	26	61.9	28	65.1	8	53.3	$\chi^2=0.656$
No [@]	38	16	38.1	15	34.9	7	46.7	$(0.721)^{ns}$
Presence of major side effects©								$(^{MC}p=0.227)^{ns}$
Yes	10	2	4.8	5	11.6	3	20.0	
No	90	40	95.2	38	88.4	12	80.0	

*: Statistically significant at $p \leq 0.05$

MC: Monte Carlo test

[@] due to inaccessibility (13%), poor communication (1%) and other causes (24%) as (travelling, sick mother, etc.).

©Side effects include obesity, candidiasis, and stunted growth

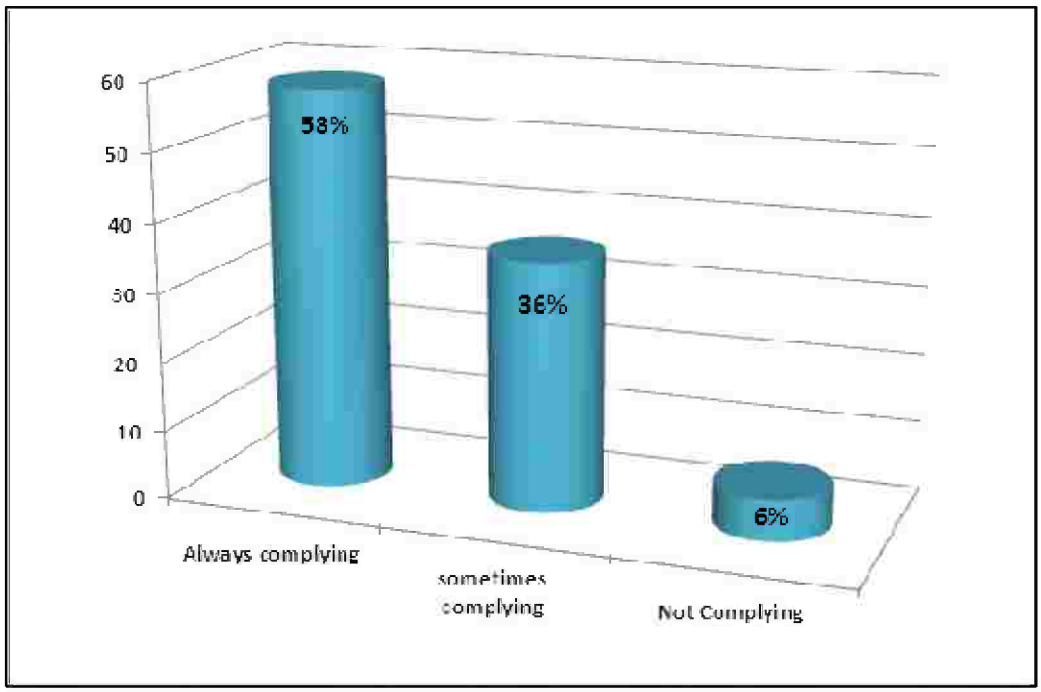

Figure (3): Distribution of studied asthmatic children according to their level of compliance with the prescribed treatment

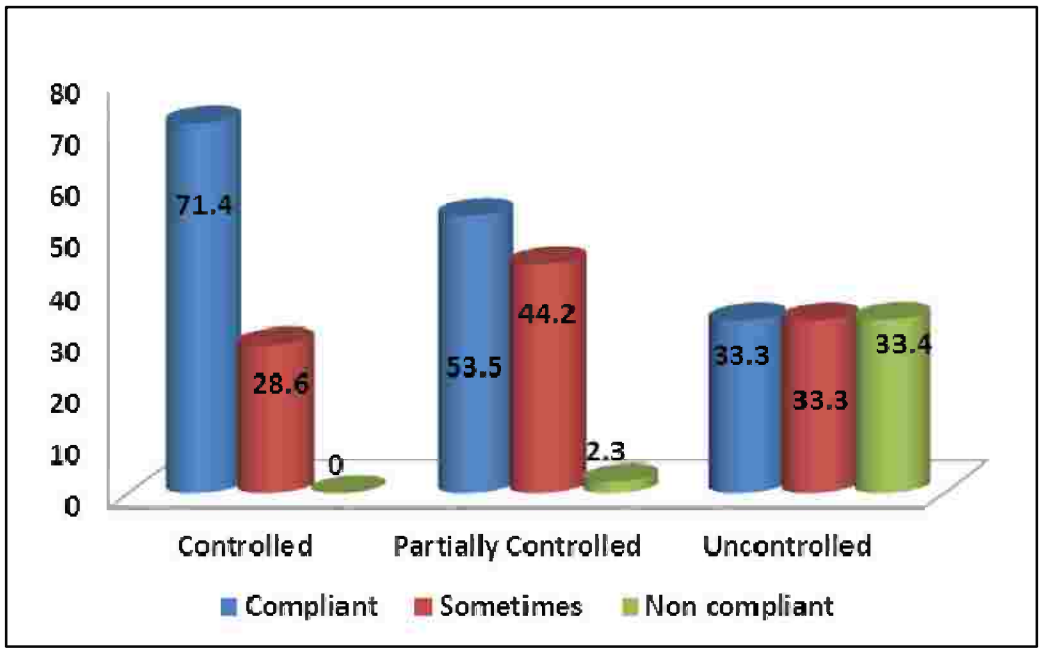

Figure (4): Distribution of studied asthmatic children according to degree of asthma control and degree of compliance with the prescribed treatment

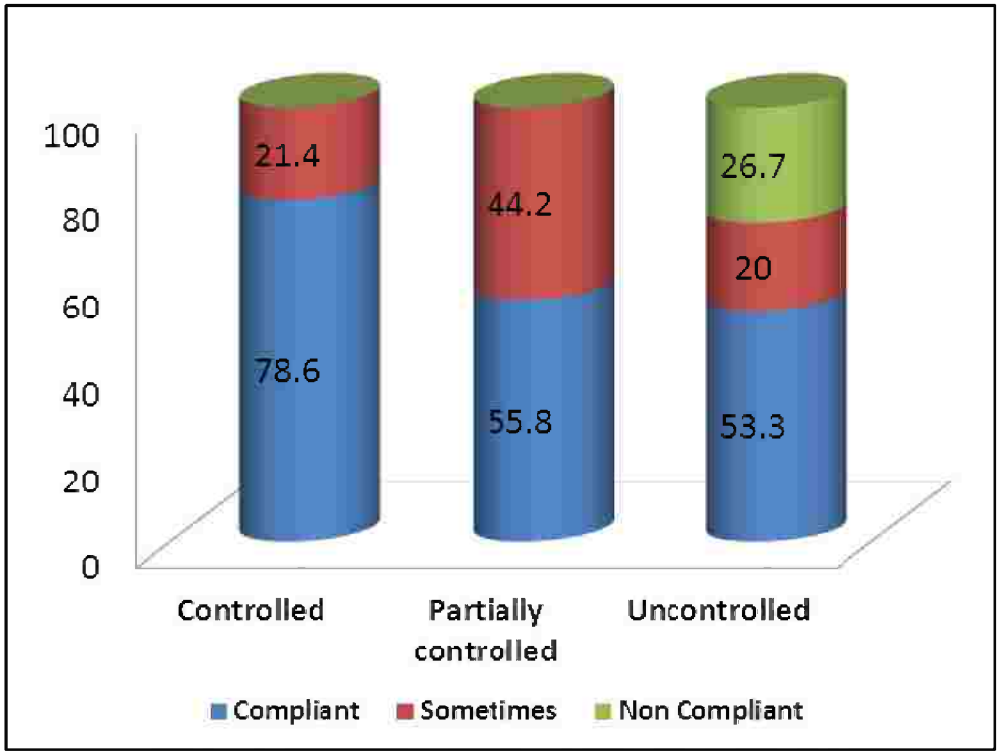

Figure (5): Distribution of studied asthmatic children according to degree of asthma control and degree of compliance with the full dose of prescribed treatment

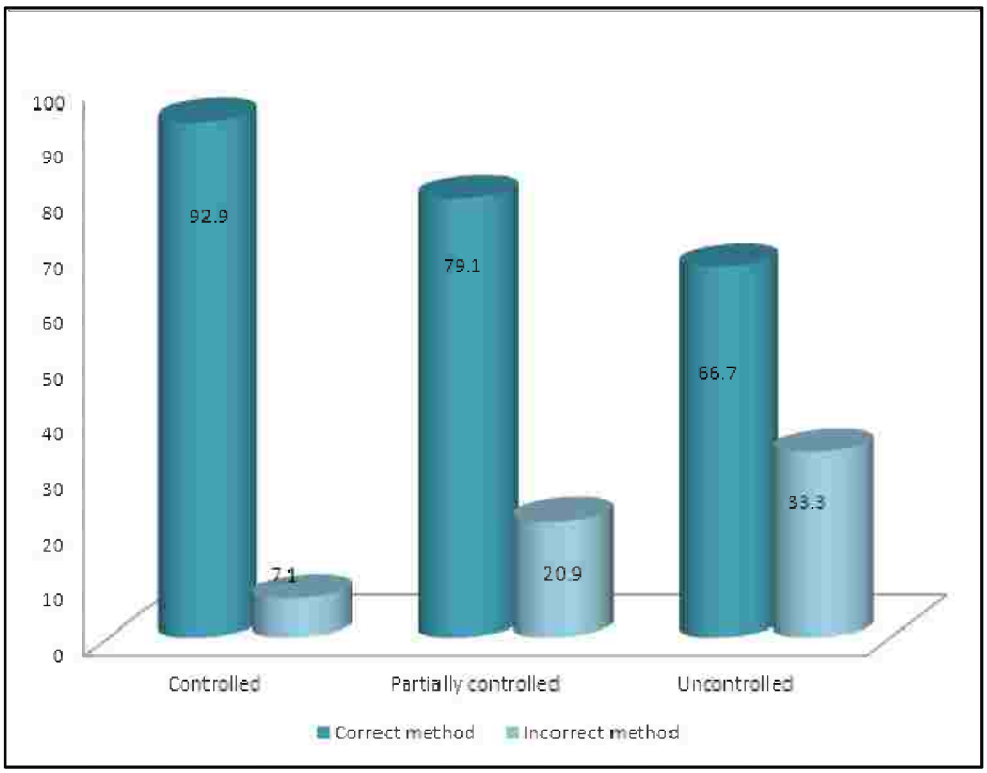

Figure (6): Distribution of studied asthmatic children according to degree of asthma control and the method of drug delivery

10. Causes of poor compliance among asthmatic children:

Table 16 and figure 7 show causes of poor compliance among asthmatic children. Poor compliance with the prescribed treatment was attributed to failure to afford the treatment by about 35% of children. On the other hand 23% of them refer poor compliance to ignorance about the importance of continuous treatment for children. Moreover, inability to use the inhalation devices was reported by 13% of non-compliant mothers. Other causes were complexity of treatment regimen and perceived ineffectiveness of the treatment.

Table (16): Causes of poor compliance among asthmatic children

Causes of poor compliance (n=42)	No	%
Failure to afford treatment	35	83.33
Complexity of treatment regimen	5	11.90
Inability to use the inhalation devices	13	30.95
Lack of knowledge about the importance of continuous treatment	23	76.19
Perceived ineffectiveness of the treatment	3	7.14

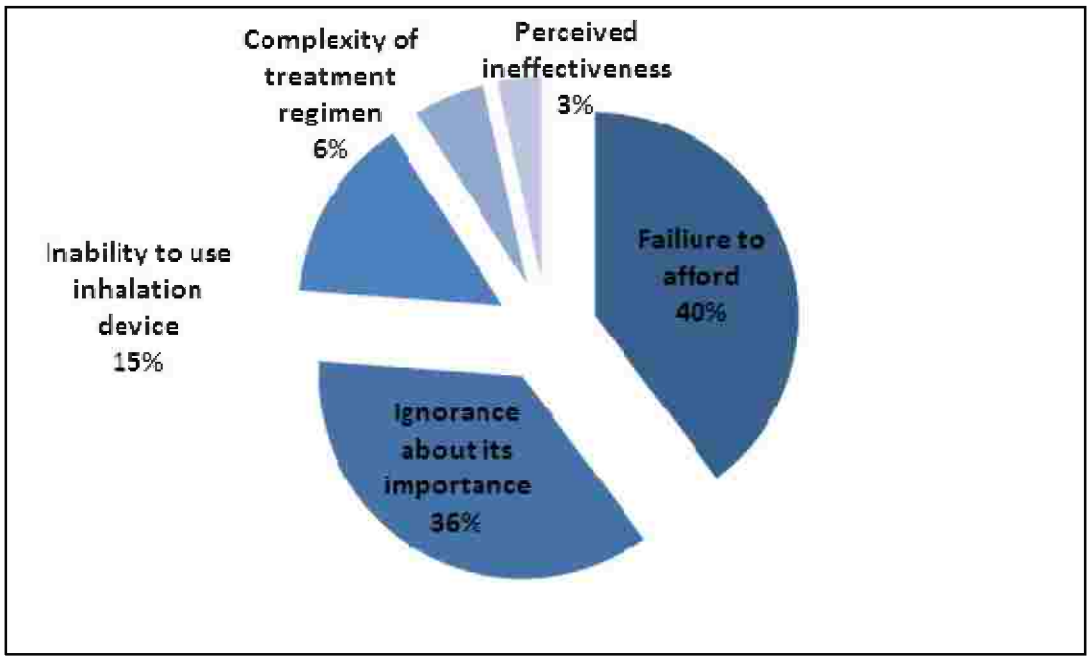

Figure (7): Distribution of non-complying asthmatic children (n=42) according to the most common cause of poor compliance.