Effect of Creative Teaching Intervention for Adolescents with Severe Refractory Asthma on their Own Medications Adherence, Asthma Control and Hospital Readmission

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ABSTRACT

Background: Severe refractory asthma characterized by difficulty in achieving disease control despite high-intensity treatment. Asthma burden is particularly notable in adolescents and associated with higher rates of prevalence and mortality compared with younger children. So, healthcare professionals should dedicate their effort to educate adolescents with severe refractory asthma. **Aim:** evaluate the effect of creative teaching intervention for adolescents with severe refractory asthma on their own medications' adherence, asthma control, and hospital readmission. **Research design**: A quasi-experimental design. **Setting:** The pediatric in-patient wards at Benha University Hospital. **Sample**: It is composed of 100 adolescents with severe refractory asthma who attended in the previous setting during study period. **Tools of data collection:** *Tool I;* Structured Interview Questionnaire, *Tool II;* observation checklist, *Tool III*: Asthma Morisky Medication Adherence Scale, *Tool IV;* Asthma Control Test. *Tool V*; Assessment sheet for asthma outcomes. **Results**: Less than two thirds of the adolescents in study group had high medication adherence level, and approximately two thirds of them had well asthma control, in addition to, two thirds did not readmit to the hospital after 30 post intervention with statistically significant differences between study and control group after the intervention. **Conclusion:** creative teaching intervention impacted positively on adolescent's knowledge level, practice, medications adherence, asthma control and decrease hospital readmission. **Recommendation**: Further studies for implementation of other creative teaching interventions for enhancement of asthma care should be done.

Key words: Asthma Control, Creative Teaching Intervention, Hospital Readmission, Medications Adherence, and Severe Refractory Asthma

Introduction

A chronic respiratory condition called bronchial asthma is characterized by recurrent episodes of wheezing and dyspnea, which can be mild or frequent depending on the person. An asthma attack is induced by chronic inflammation of the airway passages that results in epithelial fragility, airway cell hyperplasia, increased mucus secretion, enlargement of sub-mucosal mucus glands, increased airway smooth muscle mass and increased wall thickening. In an asthma attack, the lining of the airway passages swells,

causing airways obstruction and a reversible airway narrowing that are indicated by chest tightness, wheezing, shortness of breath, and coughing that vary over time and in severity, as well as variable limitation in expiratory airflow *(Moira et al., 2022)*.

Paroxysmal or chronic symptoms of dyspnea, wheezing, tightness in the chest, coughing up sputum, and associated with fluctuating airflow limitation and airway hyperresponsiveness to endogenous or exogenous stimuli are considered characteristics of severe refractory asthma (SRA). Additionally, because more resources are required to treat adolescents with severe refractory asthma, their healthcare expenses are at least 80% higher than those of adolescents with stable asthma *(Gonzalez-Perez et al., 2022)*.

Severe refractory asthma refers to adolescents whose asthma is uncontrolled despite treatment compliance and risk factor mitigation, or whose condition worsens when high-dose treatment is reduced. Biological and social risk factors can be identified to help create a risk assessment profile while providing individualized care *(Cheng et al., 2022)*.

Adolescents with SRA may continue to complain about difficulty exercising even when using various controller medicines in large doses on a consistent basis as a result, the goal of asthma treatment is to reduce hospital readmissions while still controlling asthma symptoms *(Faleiro et al., 2021)*.

Some environmental variables, such as respiratory virus infections, allergens, pollution, drugs, or other irritants, are potential predisposing factors for severe refractory asthma attacks. Additionally, there are hereditary factors, such as a family history of asthma attacks and early exposure to irritants. The mechanisms are complex; therefore, it is obvious that both genetics and environmental variables affect susceptibility to asthma attacks *(Mitropoulos et al., 2021)*.

Adolescents' knowledge, educational level, adherence to treatment regimens, behavioral changes, and access to healthcare resources all impact the treatment of severe refractory asthma and asthma control. The goal of treating an asthma attack is to achieve and sustain long-term control of the clinical signs. Adolescents are extremely capable of preventing attacks, avoiding symptoms, and maintaining physical activity once their asthma attack is under control. *(Cordeiro et al., 2021)*.

The vital period of growth and development known as adolescence is when people acquire their sense of responsibility and their capacity for self-care. So, adolescent bronchial asthma education should encompass educating problem-solving skills, developmental issues, and more personal responsibility as they learn how to control their asthma *(Wallace-Farquharsona et al., 2022)*. Adolescents typically undergo a variety of developmental, psychological, emotional, and social changes during these stages, which may contribute to the negative outcomes that have been seen for these age groups. Many adolescents with

asthma, especially those with several serious illnesses, experience anxiety, sadness, and low self-esteem, and their drug adherence is frequently poor *(Mansfield& Bernstein 2019).*

In terms of bronchial asthma symptoms, asthma control relates to how well they can be identified and controlled. Reduced symptoms throughout the day and at night, reduced long-term morbidity, and a lower chance of fatal bronchial asthma attacks are all signs of well-controlled asthma. Adolescents' ability to control their bronchial asthma gets better with age. The most effective self-management strategies for severe refractory asthma include raising asthma awareness, encouraging asthma control, and self-management geared on effectively managing severe refractory asthma *(Turner et al., 2021).*

Adolescents who suffer from severe refractory asthma tend to have poor medication adherence, which is defined as the habit of taking medications with the goal of following health recommendations. Medication adherence is crucial for better treatment outcomes because of maintaining medication concentrations in the blood regulate disease symptoms. Although, negative beliefs about the illness, its severity, and its treatment, forgetfulness, emotional disturbance, poor communication, lack of motivation, family dynamics, insufficient level of health, financial restrictions and poor adolescent information can all contribute to non-adherence to medication *(Khow et al., 2021).*Furthermore, as inhaled medications are the main form of treatment for asthma, improper inhaler technique or improper inhaler

handling might result in low bronchial deposition of the medication, which may lead to ineffective asthma management *(Al-Naimi et al., 2021).*

The pediatric nurse plays an important role in the management course of an adolescent with severe refractory asthma who is admitted to the hospital. Specifically, it provides correct and effective knowledge that meets the adolescent's needs. The adolescents who received education concerning severe refractory asthma using creative teaching methods could have shorter hospital stays when hospitalized *(Sumengena & Ocakcic, 2022).*

Asthma education remains the key component of care; however, using creative teaching methods for adolescents' education is very crucial *(O'Connor et al., 2021).* Creative teaching is a method of encouraging inventive, efficient, and enjoyable learning while fostering courageous and critical thinking. Furthermore, creative teaching methods help adolescents, especially those with chronic diseases like asthma, learn new material and apply it to life situations *(Suyudi et al., 2022).*

Creative teaching intervention is very important, as it helps adolescents cope, adapt, be open to new experiences, be highly disciplined, not be afraid to take risks, and succeed by thinking creatively. Moreover, creative teaching could also divert adolescents' attention to exploring something new based on problem-solving *(Hafizi &Kamarudin, 2020 & Mróz & Ocetkiewicz, 2021).* Furthermore, it helps adolescents to understand concepts better and enhances their ability and motivation to solve problems by using

realistic, open-ended problems during education to explore their creative thinking processes and assess their capacity to discover solutions and strategies to solve problems. Also, the inquiry-based learning method engages adolescents by connecting them with the real world through exploration and the use of high-level questioning *(Conradty et al., 2020 & Purwadi, 2021).*

Significant of the study

One of the most common chronic diseases in different pediatric ages is asthma which has seen a significant rise, and its frequency varies around the world. As, in many Western nations, asthma prevalence among adolescents' ranges between 7% and 10% *(Flores et al., 2022).*

Severe refractory asthma is the most common reason for hospital readmissions among adolescents. Hospital readmission rates are high and are associated with high healthcare costs. Severe refractory asthma symptoms can be controlled and prevented in most cases once early detection of asthma is established. To improve knowledge, medication adherence, and asthma control, creative teaching methods for asthma care education should be implemented for asthmatic adolescents *(The British Thoracic Society, 2019).*

Adolescents with asthma, as well as their families, can benefit from creative teaching methods. These interventions provide chances to increase the effectiveness of health care delivery and their activation. Additionally, participation in medical care and collaborative decision-making eventually enhances asthma outcomes and

treatment adherence *(Licari et al., 2019 & Hafizi &Kamarudin, 2020).* So, this study would implement creative teaching interventions for the enhancement of asthma care education for adolescents.

Aim of study

Evaluate the effect of creative teaching intervention for adolescents with severe refractory asthma on their own medications' adherence, asthma control and hospital readmission through:

1- Assessing adolescents' knowledge and practice regarding asthma care.

2- Assessing adolescents' medication adherence regarding asthma care.

3- Implementing creative teaching intervention for adolescents' education regarding asthma care

4- Evaluating the effect of creative teaching intervention on adolescents' knowledge, practice, medication adherence, asthma control and hospital readmission.

Research hypotheses

1- Adolescents' knowledge and practice expected to be improved after implementation of the creative teaching intervention in study group than in control groups.

2- The creative teaching intervention expected to improve adolescent's adherence for treatment in study group than in control group.

3- The creative teaching intervention is expected to raise the ratings for asthma control.

4- There will be significant reductions in adolescents' hospital readmissions in the study group after intervention.

Subject and Methods

Research design:

A quasi-experimental design using two groups pre-, and post-test was utilized.

Setting:

This study was carried out in the pediatric in-patient wards at Benha University Hospital, Egypt.

Sampling:

A purposive sample of adolescents (n=100) who attended study settings during study period. They were randomly separated into 2 groups, one study (50) that obtained asthma care education through creative teaching methods and the control (50) that just received routine care in accordance with hospital protocol. Following the fulfillment of the inclusion criteria, a study sample was chosen.

Criteria for inclusion

- 12- to 18-years-old of age.

- Both genders.

- They were given a medical diagnosis of severe refractory asthma.

Criteria for exclusion

- Suffer from another chronic condition.

- Have thoracic congenital abnormalities.

- Participated in or is presently enrolled in an asthma health education program.

Tools of data collection:

The necessary data were gathered using the following tools:

Tool I: Structured interview questionnaire: (pre & posttest).

It was developed by researchers to assess adolescents' level of knowledge related to all aspects of asthma care after reviewing the related literature. To accommodate adolescents' cognitive levels this tool was created in Arabic language. It was split into three sections:

Part 1- Personal characteristics of adolescents:

Gender, age, educational level, residence, family income.

Part 2- Adolescent Medical history: Asthma family history, siblings with asthma, smoking, and duration of asthma.

Part 3: Adolescent's knowledge about severe refractory asthma and its care (pre & posttest).

Utilizing Questionnaire for the Asthma Knowledge, which was adapted from *(Al-Motlaq & Sellick, 2021).* It was used to determine the level of knowledge that adolescents had on severe refractory asthma. It included 36 questions which were both true/false and open-ended. Including definition of severe refractory asthma, trigger factors, symptoms, treatment of asthma, and methods of asthma attack prevention, severe refractory asthma care, medication administration techniques, methods of trigger factors prevention, care plan, follow-up schedule, and its importance.

Scoring system

Correct answer rate mark (1) grade and incorrect answers/don't know mark (0) grade. The overall score of the questionnaire was obtained by adding up the marks for all questions. The total

scores range between 0 and 36. Total knowledge scoring system was adequate if total score ≥ 75%, and inadequate if total score < 75%.

Tool II. Observation checklists (pre & posttest).

This tool was modified from *Wilkinson et al, (2016); Bowden & Greenberg, (2016) and Achi (2020)*, It included using nebulizer, using inhaler drug, breathing, and coughing exercise. The use of observation checklists allowed for an evaluation of adolescents' actual asthma-related practices. The total score ranged from 0 to 58.

Scoring system

It was developed as each statement includes two responses:(1) mark was given for each done step and (0) for not done, out of (58 marks), the final score was calculated. Adolescents were divided into 2 categories based on the quality level of their practices; satisfactory practices, defined as those with a total score of 85% or higher, and unsatisfactory practices, defined as those with a total score of less than 85%.

Tool III-Asthma Morisky Medication Adherence Scale (MMAS-8) [pre-posttest].

This scale was adopted from *(Morisky et al., 1986)*. Eight questions made up the structured self-report measure of medication-taking behavior, and the wording of each item or question was developed by the researchers to fit the needs of the study.

Scoring system

Item one through seven have a yes-or-no response option, while item eight includes a five-point Likert response option. Item one to seven

scored as each response "yes" had one mark and each "no" had 0 mark, except for item 5, where each response "no" scored one mark and each "yes" had zero mark. Additionally, if the adolescents select response "0" for item eight, they will receive one mark; if they select response "4", they will receive zero marks. Responses 1, 2, and 3 received ratings of 0, 0.25, 0. 5, and 0.75, respectively. Total MMAS-8 ratings ranged from 0 to 8, and they were divided into 3 categories of adherence: high adherence (score = 8), medium adherence (scoring 6 to 8), and low adherence (score 6).

Tool IV- Asthma Control Test (ACT) [pre-posttest].

It was adopted from *(Nathan et al, 2004)*, and consisted of just five straightforward questions. Adolescents self-administer it, and for each question, they receive a number score between 1 and 5, ranging from poor control to well control. It served as a tool to aid medical professionals in determining whether asthma symptoms are under control or not.

Scoring system

The final score was 25, with scores between 20 and 25 indicating that asthma symptoms were effectively under control and values between 19 and less indicating just partial control. Health care Providers must get in touch with the adolescents if the score is 15 or less since asthma may be extremely poorly controlled.

Tool V- Assessment sheet for asthma outcomes. it is a structured questionnaire sheet which was adapted from *(Parikh et al., 2018) &*

(Akin-Imran, 2023), to assess outcomes for enhancement of asthma care education on hospital readmission and length of hospital stay in both groups pre and post intervention. It consisted of 10 questions (true/false questions).

Validity and reliability of tools

Before data collection, Tool I, II, and V were examined by a panel of three pediatric nursing experts to guarantee their validity, and their suggestions were considered. The third and fourth tools, however, were standardized, the reliability of the third tool [medication adherence scale] was tested giving Cronbach's α coefficient of 0.80, the reliability of fourth tool [asthma control] was tested giving Cronbach's α coefficientof 0.83.

Ethical considerations

It was approved by the ethical research committee at the Faculty of Nursing, Benha University, before the beginning of the actual work (Code; REC.PN.P38). After describing the purpose, methods, timeline, and value of the study, the hospital director and the head of the pediatric in-patient wards gave their official consent. Furthermore, after explaining the purpose, value, and length/duration of the study to adolescents, oral agreement was obtained. They received guarantees about the privacy of the information gathered. The adolescents were informed of their right to participate in the study or not, as well as their right to withdraw from it at any moment.

Pilot study

To evaluate the feasibility, clarity, and applicability of the instruments, ten percent of the adolescent participants (n=10 adolescents) were used, and some modifications were made. Adolescents from the pilot research were excluded from the analysis.

Field of work

The data collection of this study was completed over six months from the beginning of October 2022 to the end of March 2023. Three days per week, between the hours of 9 a.m. and 12 p.m., the researchers were available in the study setting.

Data collection was carried out in 4 stages:

Stage 1. (assessment): The study group and the control group were established from the study's participants. Researchers conducted an individual interview with each adolescent in the study and control groups using the previously study tools. A simple introduction about the aim, duration of the study, the questionnaire, and how the adolescents answered it has been explained by researchers. Then, each adolescent was asked to complete the questionnaire (tool I) individually; it took between 20 and 25 minutes. Then, the researchers observed each adolescent when they demonstrated actual practices related to asthma (tool II); it took between 25 and 30 minutes. Also, the researchers assessed the medication-taking behavior questionnaire (tool III) and the asthma control test (tool IV). Also, the researchers assess adolescents' outcomes, such as hospital readmission and length of hospital stay (tool V).

Stage 2. (Planning) An Arabic booklet concerning severe refractory asthma care was

developed by researchers based on adolescents' needs identified during the assessment phase.

The general objectives of creative teaching interventions for adolescents suffering from severe refractory asthma were to improve their knowledge, practice, asthma control, medication adherence, and decrease hospital readmissions.

Stage 3. (Implementation): severe refractory asthma care education was given in five sessions (three theoretical and two practical); each session lasted from 45 to 60 minutes. Each session began with a review of the previous session and the objectives of the present one, considering the usage of Arabic.

Contents of each session:

The first theoretical session focused on general and specific objectives, an introduction to the anatomy and function of the lung, different types of asthma, and the characteristics of severe refractory asthma. The **second theoretical session** focused on causes, diagnostic ways, complications, and management of severe refractory asthma. **The third theoretical session** focused on precautions to avoid aggregating factors for severe refractory asthma, different methods for prevention of asthma attacks, and methods of subsequent care (follow-up).

The first practical session concentrated on steps of using nebulizers and inhalers to administer medication, as well as steps for infection control measures.

The second practical session focused on the application of breathing and coughing exercises and the principles of using a breathalyzer.

Many creative teaching methods were used, as well as teaching media in the form of a power point, an educational handout about severe refractory asthma care, audio, and visual materials, which were used as a useful method of teaching to help in explaining the essential details in a way that today's adolescents may most easily understand. These materials include models, short films, videos, images, infographics, and many more brain mapping techniques.

The creative teaching methods utilized in the current study included four methods as following:

a) **Creative problem-solving technique:** the researchers observe how each adolescent views a problem and the steps they take to get a solution in their own unique way. Problem solving helps them in discovering entirely new solutions to repetitive problems, help in developing creative vision, allowing them to see objects, ideas, and problems in a new way. Also, improve teamwork skills with peers. In the current study the adolescents start to define the problem, list all potential solutions, analyze the alternatives, select the best one, develop a plan for putting each solution into action, and then explain each one.

b) **Creative thinking method:**

The researchers used creative thinking-based tasks including creative feedback, drawing exercise and then compare the drawings, explain ideas in their own words through writing or free writing, create a poster using a variety of materials, such as printed images, markers, and stickers. These tasks improved flexible thinking, enables

adolescents to innovate and respond to unexpected situations, help them to build authentic connections with self and others.

Also, the **Six Thinking Hats technique** was applied in the current study. It is a method that might offer various viewpoints of a circumstance. By employing the six thinking hats strategies, adolescents can share their ideas and points of view from many perspectives and develop their creative thinking. Each hat represents a different perspective. The time restriction for each hat was determined by the researchers based on the appropriate thinking style. Write down facts in the **white hat** part, sentiments and intuitions in the red hat section, challenges and threats in **the black hat** section, and opportunities and advantages in **the yellow hat** portion. **The blue hat** represents controlling and observing the thought process, while **the green hat** represents possibilities and new creative thoughts. It is used during theoretical sessions to allow adolescents to look at possible solutions from different perspectives or thinking directions.

c) **Reverse Inquiry based learning method.**

This method incorporates active participation of adolescents by involving them in posing questions,problems or scenarios and bringing real-life experiences to them. Instead of providing direct instruction to adolescents, the researchers help adolescents to generate their own content-related questions and guide the steps that follow.

Additionally, inquiry-based learning method applied for adolescents in the current study through complex situations with limited information and they need effective critical thinking to answer Inquiry based learning method fosters curiosity, deepens adolescents' understanding of topics, increases their motivation and engagement. Inquiry-based learning method is positively associated with adolescents' performance.

D) **Role play**:

Adolescents can learn interpersonal skills and become more assured and persistent in their problem-solving by using role play, which is a very successful technique. By using this approach, adolescents can empathize with the characters they play, which aids in their learning and remembering that information. Also, they simulate real-world issues in a secure environment without perfect knowledge. This gives them the opportunity to try out various solutions over time, get feedback, and assess how they used the information and made judgments. Adolescents can assess the symptoms to make the right decisions using their better knowledge and abilities, allowing them to perform at a greater level than they would otherwise.

Stage 4 (evaluating):

The researchers evaluate the effect of implementation the creative teaching intervention on adolescents' knowledge, practices, medication adherence, and asthma control, immediately and post 30 days after completion of creative teaching intervention in the study group to evaluate the adolescent's capacity for quickly remembering the knowledge and skills they have learned. But the effect of intervention on severe refractory asthma outcomes such as hospital readmission and length of hospital stay evaluated post 30 days during follow up. The goal of establishing this interval

was to evaluate if an intervention be beneficial after a period after implementation. Adolescents are asked to complete a posttest via WhatsApp if they are unable to show up for scheduled follow-up appointments. While adolescents in the control group received only routine care and were assessed without implementing creative teaching intervention.

Data analysis

SPSS for Windows version 20.0 was used for the analysis. Standard deviation (SD) and mean were used to convey continuous data, whereas number and percentage were used to express categorical data. The independent sample t test was used to compare variables with continuous data, whereas the Chi-square test was used to compare variables with categorical data. P<0.05 was used to determine statistical significance.

Results

The studied adolescents' characteristics were illustrated in **Table 1** that, 48.0% &44.0% of the studied adolescents in the study and control groups respectively, their age was from 12- < 14 years old, with mean age (14.9 ±2.8 &14.2 ±2.6) respectively.

More than half of adolescents in the study group (56.0%) were girls and more than one third (38.0%) were boys in the control group, and more than half in the study and control groups (58.0% & 64.0% respectively) were from rural areas. As regards the educational grade level, less than half in the study and control groups (48.0% &44.0%) respectively were in secondary school.

Table 2 illustrated that less than two thirds of the study and control groups (66.0%& 60.0%) respectively had positive family history of asthma. Also, most of the study and control groups (82.0%& 74.0%) respectively had siblings with asthma. The majority of the study and control groups (94.0% & 98.0%) respectively were exposed to passive smoking.

In addition, less than half of the study and control groups (44.0%&36.0%) respectively suffered from asthma since >3 years. There was no statistically difference between the two groups at (p>0.05).

Figure 1 showed that 34.0% &38.0 % in the study and control groups respectively had inadequate knowledge pre intervention, while immediately after intervention 88.0% of the adolescents in the study group and 84.0% of them post 30 days had adequate of knowledge compared with minority among adolescents in the control group who had adequate knowledge immediately post and after 30 days.

Figure 2 reflected that, less than three quarters (70.0%) of adolescents in the study group and (72.0%) of adolescent in the control group had unsatisfactory practice level pre intervention, this percentage was improved to less than three quarters (74.0% & 72.0%) respectively among adolescence who showed satisfactory practice level immediately post and after 30 days in the study group compared with more than one quarter (26.0%&28.0%) who had satisfactory practice level among adolescents in the control group respectively.

Figure 3 showed that, (54.0%) of studied adolescents in the study group and (52.0%) of adolescent in control group had low medication adherence level pre intervention, while immediate post, less than two thirds of the adolescents (60.0%) and after 30 days, more than two thirds of them (68.0%) in the study group showed high adherence compared with less than one quarter (22.0%) of adolescents in the control group immediate post and post 30 days showed high adherence.

Figure 4 clarified that 54.0% & 62.0% of adolescents in the study and control groups showed poor asthma control, pre intervention respectively, while post immediate, (64.0%) and after 30 days, (58.0%) in the study group had well asthma control compared to less than one quarter (24.0%& 22.0%) of adolescents in the control group immediate post and 30 days, respectively.

Table 3 illustrated that less than three quarters in the study and control group (68.0%&72.0%) readmitted to hospital one-time pre intervention. While immediately post intervention, two thirds (66.0%) of adolescents in the study group did not readmit to hospital in the past post 30 days, compared to only (12.0%) of adolescents in the control group, with highly statistically significant differences between both groups at (p <0.001).

As regard mean length of hospital stay (by days), this table reflected that, the mean length of hospital stay was 3.4 ±0.67 in the study group compared with 7.3 ±1.8 in the control group post intervention, with highly statistically significant differences between both groups at (p <0.001).

Table 4 showed relation between gender and adolescents' medication adherence, asthma control, knowledge, and practice in the study group after intervention post 30 days. It was cleared from this table that; the high medication adherence was significantly more frequent among girls than among boys (50.0% versus 82.1%) respectively. Also, a well-controlled asthma among the study group was found among less than two thirds (60.7%) of the girls compared to more than half (54.5%) among the boys.

The same table clarified that, most (89.3%) of adolescent's girls had adequate knowledge compared to more than three quarters (77.3%) among adolescent's boys, Also, more than three quarters (78.6%) of adolescent's girls had satisfactory practice level compared to less than two thirds (63.6%) of the adolescent's boys. Also, there was a relation between the studied adolescents' gender and their medication adherence, asthma control, knowledge, and practice among the study group after intervention post 30 days with statistically significant difference between them.

Table 5 showed the relation between educational level and adolescents' medication adherence, asthma control, knowledge, and practice in the study group after intervention post 30 days. It was cleared from this table that, most of adolescents (87.5%) who were in university education had high medication adherence. Also, a well-controlled asthma was found among all adolescents who were in university education in the study group.

The same table clarified that, all of adolescents who were in university education in the study group had adequate knowledge, and satisfactory practice after intervention and post 30 days. Also, there was a relation between the studied adolescents' educational level and their medication adherence, asthma control, knowledge, and practice among the study group after intervention post 30 days with statistically significant difference between them.

Table 6 demonstrated that, there were a positive correlation between severe refractory asthma control and adolescents' hospital readmission among the study group post 30 days with statistically significant differences at (p<0.001).

Table 1. Characteristics of the studied adolescents in both study and control groups (n= 100).

Adolescent's characteristics	Study (n=50)		Control (n=50)		Chi square test	
	No	%	No	%	X^2	P-value
Age (years)						
12 –<14	24	**48.0**	22	**44.0**		
14- <16	16	32.0	17	34.0		
16 ≤ 18	10	20.0	11	22.0	0.324	0.836
Mean ±SD	14.9 ±2.8		14.2 ±2.6		0.356	0.795
Gender						
Boys	22	44.0	19	**38.0**	1.163	0.275
Girls	28	**56.0**	31	62.0		
Residence						
Rural	29	**58.0**	32	**64.0**	0.814	0.324
Urban	21	42.0	18	36.0		
Educational level						
Preparatory	24	**48.0**	22	**44.0**	1.323	0.723
Secondary	18	36.0	19	38.0		
University	8	16.0	9	18.0		

No statistically significant at (p>0.05).

Table 2. Medical history of adolescents in both study and control groups (n= 100).

| Adolescent's medical history	Study (n=50)		Control (n=50)		Chi square test	
	No	%	No	%	X^2	P-value
Family history of asthma						
Yes	33	**66.0**	30	**60.0**	0.539	0.475
No	17	44.0	20	40.0		
Sibling with asthma						
Yes	9	18.0	13	26.0	2.312	0.146
No	41	**82.0**	37	**74.0**		
Smoking						
Active	3	6.0	1	2.0	0.221	0.531
Passive	47	**94.0**	49	**98.0**		
Duration of severe refractory asthma						
Less than 1 year	6	12.0	8	16.0	2.791	0.427
1 – 2 years	10	20.0	14	28.0		
2 – 3 years	12	24.0	10	20.0		
>3 years	22	**44.0**	18	**36.0**		

No statistically significant at (p>0.05).
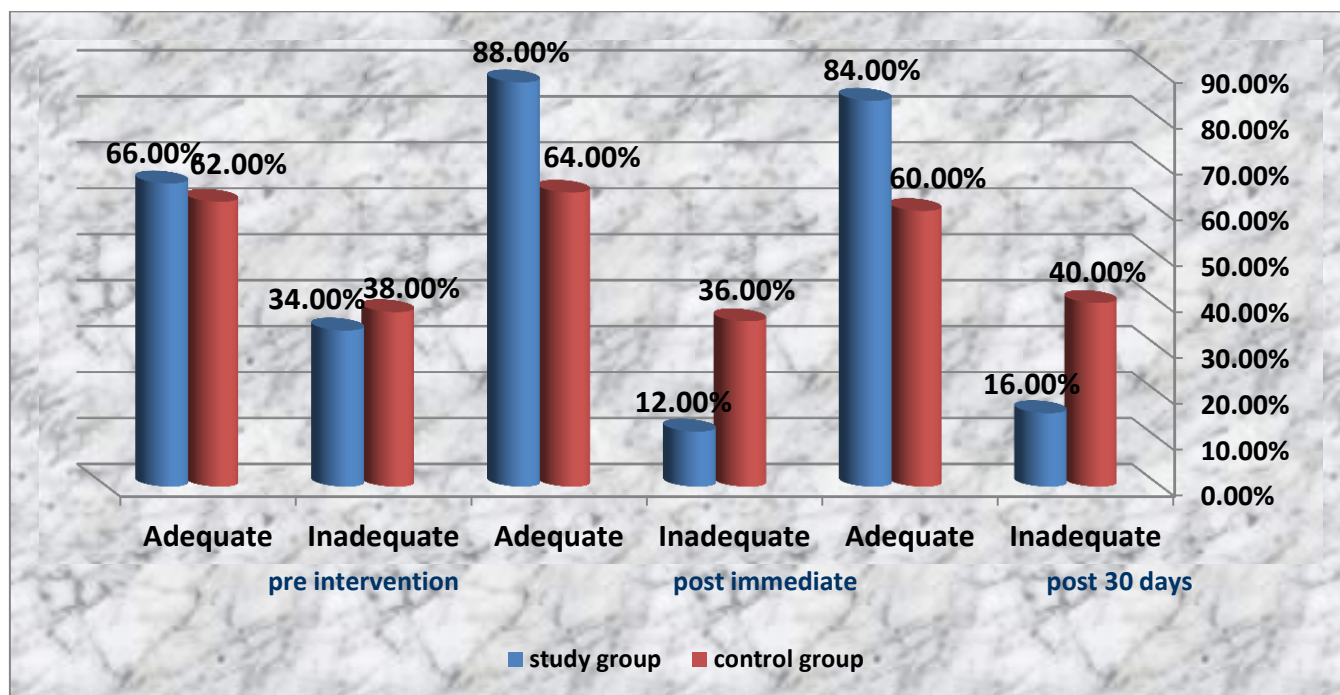
Figure 1. Adolescents' total knowledge about severe refractory asthma and its care in both study and control groups pre, post immediate and post 30 days of intervention (n= 100).
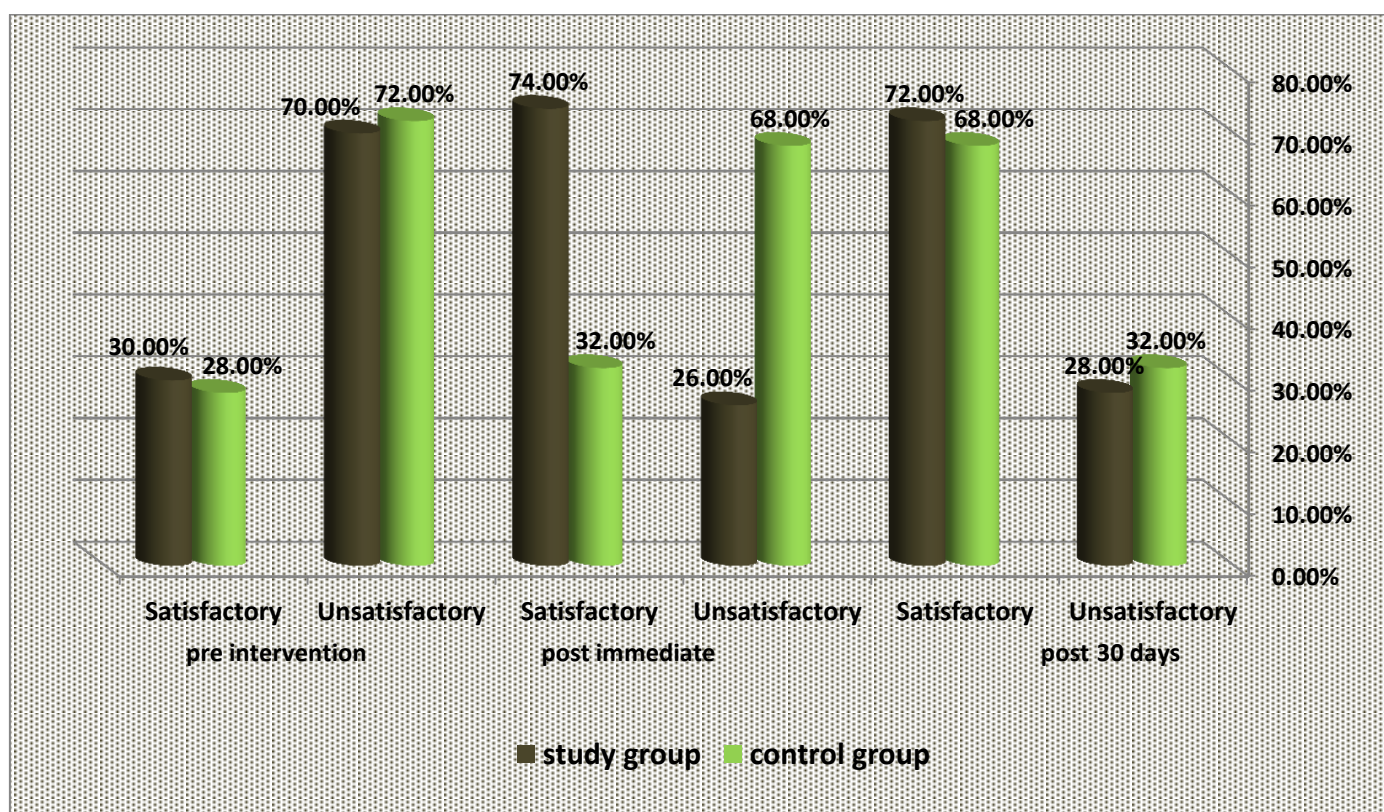

Figure 2. Adolescents' total practice regarding severe refractory asthma care in both study and control groups pre, post immediate and post 30 days of intervention (n= 100).
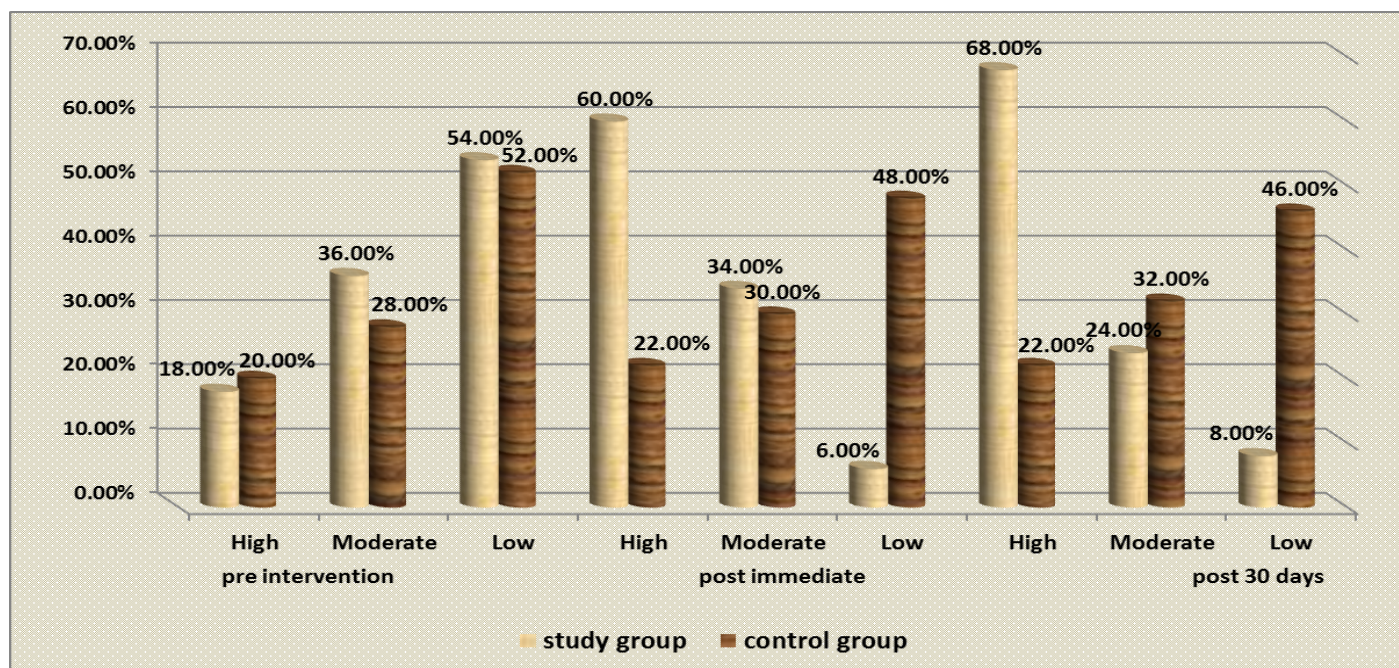
Figure 3. Adolescents' medication adherence in both study and control groups pre, post immediate and post 30 days of intervention (n= 100).
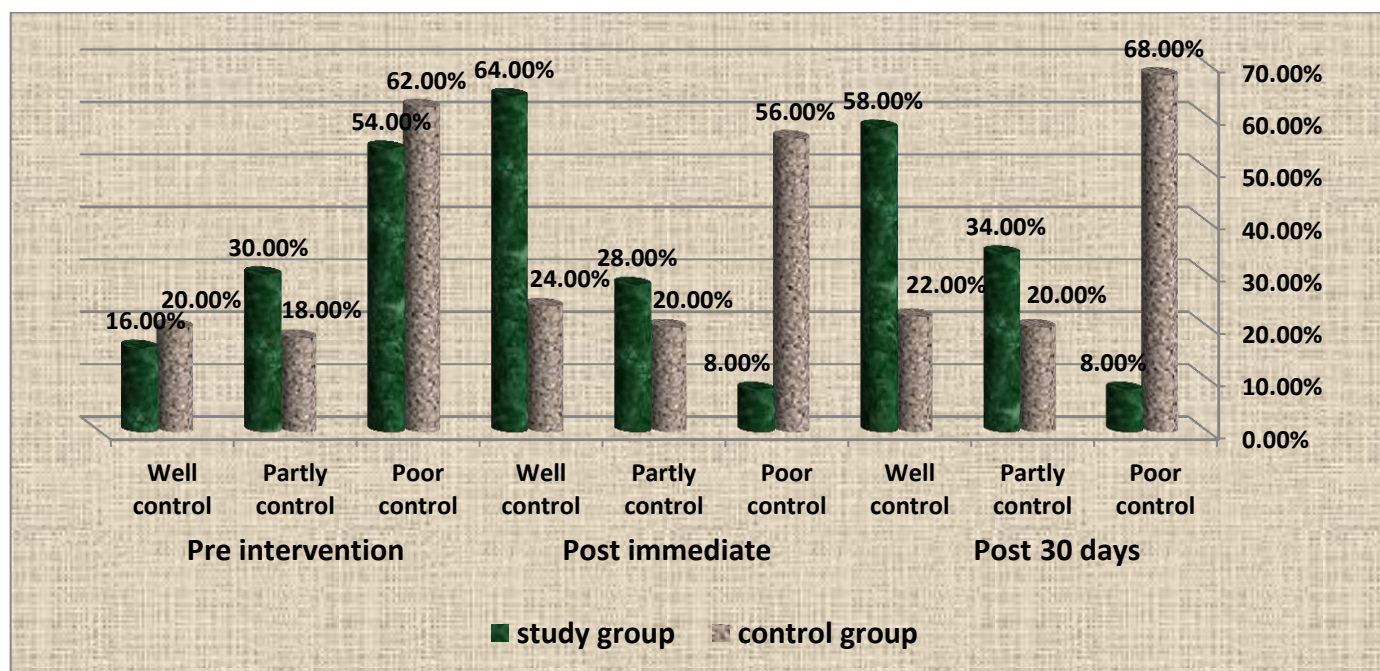

Figure 4. Asthma control test for the adolescents in both study and control groups pre, post immediate and post 30 days of intervention (n=100).

Table 3. Adolescent's outcomes pre and post creative teaching intervention regarding hospital readmission in past 30 days and mean length of hospital stay in both groups (n=100)

Items	Pre (n=100)				X^2	P-value	Post (n=100)				X^2	P-value
	Study group (n=50)		Control group (n=50)				Study group (n=50)		Control group (n=50)			
	No	%	No	%			No	%	No	%		
Hospital readmission in past 30 days												
No	3	6.0	5	10.0	1.316	0.799	33	66.0	6	12.0	22.941	**<0.001
One	34	68.0	36	72.0			10	20.0	31	62.0		
Two	11	22.0	8	16.0			7	14.0	12	24.0		
Three or more	2	4.0	1	2.0			0	0.0	1	2.0		
Mean length of hospital stay (days)	6.3 ±1.2		7.5 ±0.5		T test 2.475	0.510	3.4 ±0.67		7.3 ±1.8		T test 16.261	**<0.001

** Highly statistically significant with (p<0.001).

Table 4. Relation between adolescents' gender and their medications adherence, asthma control, knowledge, and practice level among the study group post 30 days after intervention (n= 50)

Variables	Boys (n=22)		Girls (n=28)		Chi square test	
	No	%	No	%	X^2	%
Adolescents' medication adherence						
High adherence	11	50.0	23	82.1	10.133	0.096*
Moderate adherence	8	36.4	4	14.3		
Low adherence	3	13.6	1	3.6		
Asthma control						
Well control	12	54.5	17	60.7	13.121	0.007*
Partly control	8	36.4	9	32.1		
Poor control	2	9.1	2	7.2		
Knowledge						
Adequate	17	77.3	25	89.3	11.355	0.015*
Inadequate	5	22.7	3	10.7		
Practice						
Satisfactory	14	63.6	22	78.6	11.899	0.009*
Unsatisfactory	8	36.4	6	21.4		

* A statistically significant with (p<0.05).

Table 5. Relation between adolescents' educational level and their medications adherence, asthma control, knowledge, and practice level among the study group post 30 days after intervention (n= 50)

Variables	Preparatory education (n=24)		Secondary education (n=18)		University education (n=8)		Chi square test	
	No	%	No	%	No	%	X^2	%
Adolescents' medication adherence								
High adherence	14	58.3	13	72.2	7	87.5	12.921	0.004*
Moderate adherence	7	29.2	4	22.2	1	12.5		
Low adherence	3	12.5	1	5.6	0	0.0		
Asthma control								
Well control	10	41.7	11	61.1	8	100.0	10.174	0.038*
Partly control	12	50.0	5	27.8	0	0.0		
Poor control	2	8.3	2	11.1	0	0.0		
Knowledge								
Adequate	19	79.2	15	83.3	8	100.0	11.162	0.010*
Inadequate	5	20.8	3	16.7	0	0.0		
Practice								
Satisfactory	16	66.7	12	66.7	8	100.0	10.912	0.007*
Unsatisfactory	8	33.3	6	33.3	0	0.0		

* A statistically significant with (p<0.05).

Table 6. Correlation between severe refractory asthma control and adolescents' hospital readmission among the study group after intervention post 30 days (n= 50)

Variables	Well control (n=29)		Partly control (n=17)		Poor control (n=4)		Chi square test	
	No	%	No	%	No	%	X^2	P
Hospital readmission in past 30 days								
No	25	86.2	8	47.0	0	0.0	17.612	0.004*
One	4	13.8	4	23.5	2	50.0		
Two	0	0.0	5	29.5	2	50.0		

* A statistically significant with ($p<0.05$)

Discussion

A worldwide average of 14% of children and adolescents suffer from asthma, which renders it the most prevalent chronic respiratory disease in childhood**.** Moreover, the third most common reason for pediatric hospitalization is severe refractory asthma. Adolescents are particularly at risk for worse asthma outcomes, with asthma fatality rates more than twice as high for those aged 11 to 17 years compared to those aged 0 to 10 years *(Martin et al, 2022).*

Adolescence offers a special chance to provide behavioral intervention to enhance long-term bronchial asthma outcomes. These chances exist despite the difficulties of uncertainty, complacency, and a sense of invincibility. During this crucial developmental stage, patterns of healthy behavior and essential self-management skills that last a lifetime are formed. Adolescents' success in altering their health-related behaviors may last into adulthood *(Mosnaim et al., 2021).* Adolescents were better able to manage and prevent asthma when they had adequate information and experience with its management., this study was aimed to evaluate the effect of creative teaching methods for enhancement of asthma care education among adolescents on their medication's adherence, asthma control and hospital readmission.

Concerning the studied adolescents' characteristics, the current study illustrated that less than half of studied adolescents' age in the study and control groups were from 12- < 14 years old, with mean age (14.9 ±2.8 &14.2 ±2.6) respectively. This result supported by (**Kosse et al., 2019**) who reported that, most participants' mean age was 15.1 ± 1.9 years.

Additionally, more than half of adolescents in the study group were girls and more than one third were boys in the control group. This may indicate that girls are more susceptible to severe refractory asthma than boys. These results supported by (**Kosse et al.,2019**), who reflected that, 52.6% of study participants were females. In contrary with the **Schuh et al., (2021)** who found that less than two thirds (63.4%) of participants were males.

The current study's findings on family history of asthma and smoking history illustrated that less than two thirds of the study and control groups respectively had positive family history of asthma. Also, most of the study and control groups had siblings with asthma. Most of the study and control groups were exposed to passive smoking. This may be due to smoking being considered an

important triggers factor for asthma. This finding was agreed with **Zedan et al., (2023)**, who showed that there was a relation between the incidence of "passive smoking" among adolescents and the existence of asthma symptoms. In addition to, in both groups, about half of the adolescents with asthma had a family history.

Concerning adolescent's knowledge, the current study showed that about one third in the study and control groups had inadequate knowledge pre intervention, while immediately after intervention and post 30 days, more than three quarters of the adolescents in the study group had adequate level of knowledge compared with minority among adolescents in the control group. This might be because of the creative educational intervention influencing adolescents' knowledge and raising their awareness of sever refractory asthma care.

These results were agreed with **Alreshidi et al., (2022),** who found that, knowledge of asthma increased significantly in study group after program implementation (p<0.001). Additionally, **Cheng et al., (2022)** clarified that before empowering adolescents with self-help skills, it is important to address their knowledge, which calls for multidisciplinary healthcare support. Moreover, **El Abed et al., (2023)** showed that an educational intervention had significantly improved knowledge of adult patients.

Regarding to adolescents' practice the finding of the current research, reflected that, less than three quarters of adolescents in the study group and control group had unsatisfactory practice level

pre intervention, and this percentage was improved to less than three quarters among adolescence who showed satisfactory practice level immediately post and after 30 days in the study group compared with more than one quarter who had satisfactory practice level among adolescents in the control group. This result could be attributed to creative teaching intervention to improve adolescents' practice. This result is supported with **Martin, et al, (2022)**, who reported that practices on how to take treatment effectively, and actions to take during acute attacks via personalized asthma action plans is essential to enhance asthma control. Practice education is key to improve asthma outcomes.

Regarding the adolescents' medication adherence, current study findings showed that, more than half of studied adolescents in the study group and control group had low medication adherence level pre intervention, while immediate post and after 30 days, less than two thirds of the adolescents and more than two thirds of them in the study group respectively showed high adherence compared with less than one quarter of adolescents in the control group immediate post and post 30 days showed high adherence. This may be related to the direct application of innovative teaching techniques for adolescents that emphasize the significance of medication delivery in preventing recurrent asthma attacks and how the proper use of inhaler medications can improve adolescent medication adherence.

These findings of the present research were in harmony with **Kaplan &Price, (2020)**, who stated

that, throughout the implementation of the study course, most of the subjects had a noticeably higher percentage of medication adherence and highlighted that poor medication adherence is one factor contributing to insufficient asthma control in adolescents. So, adherence is critical to helping adolescents improve their quality of life.

Findings of the present research pointed out that, more than half of studied adolescents in the study and control groups showed poor asthma control, pre intervention, while post immediate, approximately two thirds and after 30 days, more than half in the study group had well asthma control compared to less than one quarter of adolescents in the control group immediate post and 30 days. This may be attributable to health education programs that increase understanding, home care, and asthma control. This result was agreed with **Giorgio et al, (2022)** who reported, the levels of change in asthma control showed a statistically significant difference (p=0.0017).

Also, **Licari et al., (2020)** who found that, in 55% of the study group, asthma was successfully under control. On the same context **Davis et al., (2022)** who found that, more provider education may be necessary for adolescents with more severe refractory asthma to learn how to control their asthma on their own While, the current study findings were disagreed with **Jonsson, (2015),** who showed that, only a small percentage of teenagers had under control asthma. Most adolescents lacked full or partial control.

The finding concerns outcomes of severe refractory asthma care in relation to hospital readmission past 30 days before and after intervention. The study result illustrated that less than three quarters in the study and control group readmitted to hospital one-time pre intervention. While immediately post intervention, two thirds of adolescents in the study group did not readmit to hospital in the post 30 days, with highly statistically significant differences between both groups at (p <0.001).This may be due to the implementation of the creative teaching methods for adolescents in the study group which lead to improve adolescence level of knowledge about severe refractory asthma care and practice through the nebulizer and inhaler medications, as well through breathing and coughing exercise.

This result was in the same line with **Philips et al., (2020)**, found that a lower risk of long-term readmission is linked to attending a post-discharge visit within 14 days of being admitted to the hospital. This information is crucial for promoting effective care transitions for children with asthma. Moreover, **Lee & McCullough, (2016),** who reported that, the interventions lead to significantly reduce in the number of hospitalizations after implementation of the educational programs, also, it was effective in reducing the number of hospitalizations and decreasing the risk of hospitalization by more than one third among the studied subjects with (p < 0.05).

As regard mean length of hospital stay (by days), study finding reflected that, the mean length of hospital stay was 3.4 ±0.67 in the study group compared with 7.3 ±1.8 in the control group post intervention, with highly statistically significant

differences between both groups at (p <0.001).These results were in agreement with **Kenyon et al, (2019),**who reported that, implementing a standardizing program about asthma care through clinical pathways, is a successful method to increase compliance with the use of peak flow meters, spacers, and the prescription of controller drugs at the time of discharge. It has also been demonstrated to reduce length of stay and, consequently, hospitalization expenditures. Also, these results were in the same line with **Nkoy et al, (2020),** who reported that, implementing an evidence-based care process model at Primary Children's Hospital resulted in a significant decrease in length of stay and cost (p <0.001).

Concerning the relation between gender and adolescents' medication adherence, asthma control, knowledge, and practice in the study group after intervention and post 30 days. It was cleared from the study result that high medication adherence was significantly more frequent among girls than among boys. Also, a well-controlled asthma among the study group was found to be less than two thirds among girls compared to more than half among the boys. In addition to, most of girls had adequate knowledge compared to more than three quarters among boys. Also, more than three quarters of girls had satisfactory practice level compared to less than two thirds of boys. This may be because the girls in this age group felt a sense of obligation, they had a high percentage of medication adherence, which helped to lessen asthma attacks. However, the boys typically denied

asthma symptoms due to their inability to communicate with their families at this young age.

This result was agreed with **Chan et al., (2016)**, who indicated that female sex was substantially related to improved medication adherence. Also, this result was agreed with **Alreshidi et al., (2022),** who reported that, at post-test, both the girls and the boys' participants' knowledge had increased by the time of the post-test. But girls' scores were higher than the boys.

Regarding the relation between educational level and adolescents' medication adherence, asthma control, knowledge, and practice in the study group after intervention and post 30 days. The study result cleared that, most of adolescents who were in university education had high medication adherence, a well- controlled asthma, adequate knowledge, and satisfactory practice with statistically significant difference. This could be attributed to participant at university have higher perception, and more likely to learn and remember the asthma intervention, so that they had adequate knowledge and practice levels with high adherence scores, which led to well-controlled asthma symptoms. These findings agreed **Al-Nawayseh et al., (2021)** who clarified that less than two thirds of the study participants had bachelor's degree. Disagreed with **El Abed., (2023)** who stated that half of the studied adolescents had no schooling, this difference may be related to study setting difference.

The study result showed that there was a positive correlation between severe refractory asthma control and adolescents' hospital

readmission among the study group post 30 days with statistically significant differences at (p<0.001). This may explain that the effect of the intervention program on increasing adolescent control level of asthma affects subsequently on their hospital readmission.

This study result was in line with **Longo et al., (2021),** who reported that asthma control after 2 years was associated with hospital readmission reduction.

II- Conclusion

The study concluded that creative teaching intervention for adolescents about severe refractory asthma had a positive impact on their knowledge, practice, medication adherence, asthma control and decrease hospital readmission.

III- Recommendation

- Implementation of educational intervention programs for mothers regarding care of their children with asthma.

- New and updated training interventions about asthma care to nurses in outpatient and in the inpatient wards should be done.

- Further studies for implementation of other creative teaching interventions for enhancement of asthma care should be done.

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