

Effect of a Nursing Educational Program Based on Theory of Planned Behavior in Enhancing Bronchial Asthma Management: A Quasi-experimental Study

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Abstract

Background: Effective management of bronchial asthma depends on a combination of appropriate medical care and the patient's active participation in self-management to achieve the best possible health outcomes. Nevertheless, managing asthma independently can be difficult, as the disease is lifelong, unpredictable, and varies in its course over time. It also places psychological demands on patients, requiring sufficient knowledge, motivation, self-confidence, and behavioural adaptation skills to maintain proper control of the condition. **Aim:** To evaluate the effectiveness of a Theory of Planned Behavior (TPB)-based nursing educational intervention in enhancing bronchial asthma management. **Methods:** A quasi-experimental pretest-posttest control group design with repeated measures was used. **Tools:** **Tool I:** Socio-demographic Characteristics and Medical Data Questionnaires, **Tool II:** Patients' Asthma Knowledge Questionnaires (PAKQ), **Tool III:** Asthma Control Test (ACT), **Tool IV:** Inhaler Use Scale (IUS), & **Tool V:** Allergen-Exposure Avoidance Scale (AEAS). **Setting:** A study was conducted in the chest outpatient clinics at South Valley University Hospital, Egypt. **Sample:** A purposive sample of 100 patients was divided into two equal groups with 50 patients in each group. **Results:** The study group demonstrated statistically significant improvements in asthma knowledge (PAKQ scores) at one month and three months post-intervention. Significant enhancements were also observed in asthma control, proper inhaler use, and allergen-exposure avoidance behaviors ($p < 0.05$). **Conclusion:** The findings highlight the effectiveness of TPB-based nursing educational program in improving multiple aspects of asthma management, including knowledge, disease control, and self-care practices. **Recommendation:** Incorporating structured behavioural interventions into routine nursing care may reduce asthma-related complications and hospitalizations, ultimately improving patients' asthma control.

Keywords: Bronchial Asthma Management, Nursing Educational Program, Theory of Planned Behavior.

Introduction

Bronchial asthma is a chronic respiratory condition marked by variable airflow limitation and respiratory symptoms such as cough, chest tightness, wheezing, and shortness of breath (Haghighi et al., 2021). It was recognized as the most widespread public health problem. It affects more than 339 million people worldwide and ranks as the 16th most common diseases in terms of years of disability (Chen et al., 2020). In Egypt, people suffering from bronchial asthma would represent 9.4% of the population (Hussein et al., 2020). In recent years, the primary objectives of asthma management have emphasized maintaining effective control of the disease and preventing future complications such

as reduced lung function, frequent exacerbations, hospital admissions, medication side effects, and even mortality (Global Initiative for Asthma, 2022).

Although highly effective inhaled treatments are available, asthma control remains inadequate for many patients. One major reason is that these medications are only beneficial when used correctly and consistently. According to Raherison et al. (2017), 56% of asthma patients acknowledged not using their controller medications daily and often experienced extended periods without treatment. Likewise, many patients struggle with correct inhaler techniques and proper use of peak flow meters (Dekhuijzen et al., 2018).

Poor adherence to treatment contributes to unfavorable health outcomes, reduced patient well-being, and increased healthcare costs. Effective asthma management, however, extends beyond pharmacological treatment and incorporates non-drug strategies such as environmental control and regular physical activity (**Weinstein et al., 2019**). The primary goals of asthma care include preventing exacerbations, minimizing emergency visits and hospital admissions, and maintaining normal or near-normal lung function typically above 80% of the predicted value. In addition, asthma frequently coexists with various organic and functional comorbidities, which further hinder disease control and negatively affect patients' quality of life (**Paoletti et al., 2020; Zhang, 2021**).

Asthma is characterized by several distinct features, such as fluctuating symptoms, the need for multiple medications, and the use of unfamiliar inhalation techniques, all of which contribute to poor medication adherence. Therefore, enhancing patients' education is essential, as patients with chronic respiratory diseases often have limited understanding of their treatment regimens, particularly regarding the correct use of medical devices (**Norful et al., 2020**).

Teaching patients with asthma can help them maintain self-management of their disease. Studies propose that educational programs designed to meet the patients' needs lead to improved disease control, increased quality of life, and compliance with treatment, as well as avoidance of factors that lead to asthma attacks and correct use of inhalers, which influence disease management for asthma patients (**Bruhl et al., 2020; Baggott et al., 2020**).

Educational programs that include knowledge of asthma triggers and focus on the crucial role of environmental control have led to better patient outcomes, including reduced hospital admissions or emergency department visits and improved quality of life (**Schreiber et al., 2020**). Adjusting a patient's behavior. Several approaches have been developed to support changed behavior in health teaching. The theory of planned behavior (TPB) is a model of patient behavior change. TPB describes a patient's desire and willingness to modify predictable behavior (**Michie et al., 2011**).

Theory-based behavior change interventions can provide scientifically systematic guidance, ensure feasibility, and achieve long-term effectiveness. Individuals' behaviors are influenced by three factors: Perceived Social Pressure, also known as Subjective Norm (SN), Perceived Behavioral Control (PBC), and Attitude Toward Behavior (ATB) (**Cavalheri et al., 2016**). Attitude toward behavior is the degree to which the behavior is performed positively or adversely based on one's attitude. Perceived behavioral control is the perceived difficulty of doing an activity. Subjective norms refer to an individual's social pressure when engaging in a behavior. Understanding how family and friends' perspectives influence patient behavior is critical (**Kok, 2016; Cradock, 2022**).

Behavior change is a complex task that requires the competencies and skills of both patients and health care professionals. Nurses are well-positioned in the continuum of care through behavior change counseling (BCC) to investigate patients' beliefs, assess their motivation to change, and intervene to promote behavior change. Nurses should change their counseling style from traditional patient education teaching to problem-solving skills and support them in changing their behavior, setting goals, and planning actions (**Pakyar et al., 2021**).

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Nurses are often the first healthcare professionals to come into contact with patients suffering from asthma, giving them a vital role in both disease management and patient education. As frontline care providers, asthma nurses begin by assessing patients' existing knowledge and perceptions of their condition. Through direct communication, they evaluate the patient's level of understanding and provide education grounded in the latest evidence-based practices.

Depending on the patient's health status, nurses offer guidance on necessary adjustments to daily routines and lifestyle behaviors. Moreover, they play a key role in teaching patients self-management strategies, promoting self-monitoring, and instructing them on appropriate responses during asthma exacerbations (Qiu et al., 2017).

Significance of the study

Asthma is a prevalent chronic respiratory disorder that affects around 300 million people globally. It is anticipated to reach 400 million by 2025 (Tarraf et al., 2018; Alavinezhad, & Boskabady, 2018), with a death rate of over 250,000 each year. In recent decades, the goals of asthma care have evolved to attain and maintain adequate asthma control while minimizing future risks such as impaired lung function, asthma exacerbations, hospitalizations, medication side effects, and death (Global Initiative for Asthma, 2022). In Egypt, asthma is expected to affect 8.2% of children and 6.7% of adults, with males outnumbering females (1.2:1) (Eissa et al., 2020). Furthermore, 250 patients with bronchial asthma visited the chest outpatient clinics for follow-up due to worsening asthma. They were hospitalized at South Valley University Hospital in Egypt (South Valley University Hospitals Records, 2023).

The best available evidence supports the recommendation that asthma education be a crucial part of managing bronchial asthma, according to current asthma guidelines and practices. Patients' lung function and asthma control can be improved, nocturnal respiratory disorders and asthma attacks can be less frequent, hospitalizations, unplanned medical visits, and missed work or school days can be decreased, and ultimately, the quality of life for asthma patients can be enhanced (Paoletti, et al., 2020).

Aim of the study

Evaluate the effectiveness of a Theory of Planned Behavior (TPB)-based nursing educational program in enhancing bronchial asthma management.

Research hypotheses:

H1: Participants receiving the educational program based on the Theory of Planned Behavior

(TPB) will demonstrate a statistically significant increase in asthma knowledge compared to the control group.

H2: Participants receiving the TPB-based educational program will show a statistically significant improvement in asthma control compared to the control group

H3: Participants receiving the TPB-based educational program will exhibit a statistically significant enhancement in proper inhaler use compared to the control group.

H4: Participants receiving the TPB-based educational program will display statistically significant improvements in allergen-exposure avoidance behaviors compared to the control group.

Subjects and Method

Research design:

This research employed a quasi-experimental design with a pretest-posttest control group. It repeated measures to assess the effectiveness of a nursing educational program grounded in the Theory of Planned Behavior (TPB). Participants in both the intervention and control groups were administered pretest and posttest assessments to measure changes in asthma knowledge, control, inhaler use, and allergen-exposure avoidance behaviors, enabling comparisons between and within the groups.

Setting:

The current study was carried out in the chest outpatient clinics of South Valley University Hospital, located in Qena, Egypt. The hospital operates under the Ministry of Health and Population and serves as a major healthcare center for the Upper Egypt region. These clinics provide specialized services for the diagnosis, treatment, and follow-up of patients with respiratory disorders such as bronchial asthma, chronic obstructive pulmonary disease (COPD), and other pulmonary conditions. On average, the clinics receive between 20 and 32 patients per day and function six days a week, from 8:00 a.m. to 2:00 p.m.

Subjects:

A purposive sample of 100 adult patients was selected and randomly divided into two equal groups of 50 participants each. The study

group received an educational program emphasizing behavior modification in addition to routine hospital care, while the control group was provided with routine hospital care and pharmacological treatment only. To minimize the risk of contamination between groups, data collection began with the control group.

Inclusion and Exclusion Criteria

The inclusion criteria for this study encompassed adult male and female patients aged 20 to < 60 years with a confirmed diagnosis of bronchial asthma for at least six months. Eligible participants were required to be clinically stable at enrollment, as documented in their medical records, and capable of effective communication. Participants were also required to provide voluntary consent to participate in the study. To ensure homogeneity and consistency, individuals with neuropsychiatric disorders and those with visual or hearing impairments that could hinder communication were excluded from the study.

Sample size calculation:

The study sample size was determined based on the findings of **Hashem et al. (2020)** & the statistical approach described by **Cohen (2013)**. Considering a significance level of 5% ($\alpha = 0.05$) and a statistical power of 80% ($\beta = 0.20$), the required sample size was calculated using the following formula:

$$\frac{Z(\alpha/2 + Z\beta)^2 \times p(1-p)}{(d)^2}$$

Therefore, $n = [(1.96 + 0.84)^2 \times \{2(2.4)^2\}] / (0.95)^2 = 100.08$. The above calculation requires a sample size of 50 in each group.

Tools of data collection:

Five tools were used for data collection:

Data relevant to the current study were collected using the following five tools.

Tool (I): Socio-Demographic Characteristics and Medical Data Questionnaires: This questionnaire consisted of 15 closed-ended questions it was designed by researchers by using relevant literature (**Van der Pas, 2019; Tas, et al., 2015**). The first eight listed socio-demographic data include age, gender, educational level, marital status, place of residence, monthly income, working status, and living conditions. The last seven questions focused on several aspects of bronchial asthma, including family history, severity, duration, type of inhaler device, and smoking habits.

Tool (II): Patients' Asthma Knowledge Questionnaire (PAKQ):

This questionnaire was adopted from **Beaurivage et al. (2018)**. It included a 54-item questionnaire, which was divided into four sections: Asthma pathophysiology (13 elements), triggers (15 elements), diagnosis and management (19 elements), and treatment of asthma (7 elements). A correct and a wrong answer were coded, and I would like to know if the answer was counted as wrong. The questionnaire was graded using an answer key. One grade was taken for each correct answer, while incorrect answers were given a zero grade. The overall score ranges from 0 to 54. The overall score ranges from 0 to 54. The knowledge was categorized into satisfactory, $\geq 60\%$ (≥ 32 points), and unsatisfactory, $< 60\%$ (< 32 points). The scale demonstrated good internal consistency with a Cronbach's alpha of 0.82.

Tool (III): Asthma Control Test (ACT):

It is a self-administered tool designed to identify individuals with poorly controlled asthma. The instrument was adapted from the work of **Schatz et al. (2006)** and includes five items that assess asthma control over the previous four weeks. The questions evaluate the frequency of shortness of breath, general asthma symptoms, use of rescue medications, the impact of asthma on daily activities, and the patient's overall perception of asthma control. Each item is scored on a 5-point Likert scale, yielding a total score ranging from 5 to 25. Lower scores indicate poorer asthma control, while higher scores denote better control. Specifically, scores between 20 and 25 suggest well-controlled asthma, scores of 19 or below reflects moderate control, and scores under 15 indicate poorly controlled asthma. The scale has demonstrated strong internal consistency, with a Cronbach's alpha coefficient of 0.85.

Tool (IV): Inhaler Use Scales (IUS): It is a standardized tool designed to assess the proper use of inhalers among patients with respiratory conditions, particularly asthma and chronic obstructive pulmonary disease (COPD). It was adopted from **Sanlıtürk & Ayaz-Alkaya, (2018)**. The IUS consists of 13 items, each rated on a 5-point Likert scale, where responses range from "strongly agree" (5) to "strongly disagree" (1). This scale is divided into three subscales: Subjective Norms (SN), Attitude Toward Behavior (ATB), and Perceived Behavioral Control (PBC). Each subscale evaluates different inhaler techniques and adherence aspects, ensuring patients effectively utilize their prescribed inhalation therapies. The total score for the IUS is calculated by summing the

scores of all 13 items, with higher scores indicating better inhaler use and adherence. Additionally, each subscale score is derived by summing the relevant items within that subscale, providing insights into specific areas of strength or weakness in inhaler use among patients. Notably, in the ATB subscale of the Inhaler Use Scale (IUS), item 7 was unique as it had a negative score and required a reversed approach. The IUS typically demonstrates acceptable internal consistency with a Cronbach's alpha value of 0.72.

Tool (V): The Allergen-Exposure Avoidance Scale (AEAS): It was adopted from **Sanlıtürk & Ayaz-Alkaya, (2018)**. It consisted of twelve items designed to assess patients' intentions and behaviors related to avoiding allergens that may trigger asthma symptoms. The first item represents the overall intent of allergen avoidance, while items 2, 4, 6, 7, 10, and 12 pertain to the Subjective Norms (SN) subscale. Items 3 and 8 are categorized under the Attitude Toward Behavior (ATB) subscale, and items 5, 9, and 11 fall under the Perceived Behavioral Control (PBC) subscale. The arithmetic means of the related items were determined independently to calculate the scores for each subscale. This process involved summing the total item scores for each subscale and dividing by the total number of items within that subscale to yield the respective subscale scores. The AEAS showed high internal consistency with a Cronbach's alpha value of 0.89.

Validity of the study tools:

Five experts, including three academic nursing faculty members from South Valley University's Faculty of Nursing and two specialists in internal medicine focusing on chest diseases, rigorously evaluated the content validity of the study tools. The experts thoroughly reviewed the tools to ensure their relevance, clarity, and appropriateness for the study objectives. Based on their feedback, necessary modifications and refinements were made to enhance the tools' validity and alignment with the study's requirements.

Reliability of the study tools:

The reliability of the study tools was evaluated using Cronbach's Alpha, a widely recognized statistical measure for assessing internal consistency. This coefficient ranges from 0 to 1.0, with 1.0 indicating perfect reliability and a minimum acceptable value of 0.65. Scores below this threshold suggest inadequate reliability of the instrument. In this study, the Cronbach's alpha

coefficients for Tools II, III, IV and V were 0.82., 0.85, 0.72 & 0.89, respectively. These values demonstrate high reliability across all tools, indicating their consistency and suitability for accurately measuring the intended variables.

Pilot study:

A pilot study was conducted on 10% of the total sample, which included 10 patients with asthma to evaluate the clarity, applicability, and feasibility of the study instruments, as well as to identify any potential issues that might arise during data collection. These participants were recruited from the same clinical setting but were excluded from the main study sample. The results of the pilot study indicated that the tools were clear and practical; therefore, no modifications were required. After completing the pilot phase, the trained research team proceeded to administer the validated instruments to the study participants for data collection.

Ethical consideration:

The South Valley University Faculty of Nursing's Research Ethics Committee (REC) granted official approval (SVU-NUR-MED-SUR-7-4-9-23). All participants were provided with information forms that detailed the study's purpose, importance, and methodology. They were also allowed to ask questions about the research and were assured that they could leave the study at any moment without facing any consequences. Before data collection began, participants provided written informed consent. The anonymity and confidentiality of the obtained data were ensured by coding and retaining the documents in a secure location.

Fieldwork of data collection Procedure:

Data collection and program implementation lasted nine months, from September 2023 to May 2024. After gaining formal approval to conduct the study, the researchers seek eligible participants who match the study's inclusion criteria. The data was collected in three phases, as follows:

Assessment Phase

The researchers clarified the nature and goal of the study, and the participants provided written informed consent. Then, the researchers collected personal and medical data during face-to-face interviews, each lasting approximately 15-20 minutes with the patients. In addition, each participant (either the control or the study group) received pretest of 54 questions from the tool (II),

which took about 15-20 minutes for each patient. After that, the researchers interviewed each patient in both groups and assessed them by using asthma control, inhaler use, and allergen-exposure avoidance scales (III, IV & V). The tools were completed by the researchers, and took approximately 15 to 20 minutes with each patient.

Implementation Phase

The study group received an educational program based on the TPB, designed to enhance participants' understanding and motivation regarding self-management practices. The intervention consisted of five sessions and took approximately 45 minutes, conducted weekly during clinic follow-up visits. The TPB is a behavioral theory that emphasizes the role of

intention in influencing behavior, with crucial components including attitudes, subjective norms, and perceived behavioral control. During each session, trained researchers explained the purpose and content of the intervention, ensuring participants understood how to apply the concepts in their daily lives. To reinforce adherence to the educational material, researchers followed up with participants via phone calls throughout the week. After each session, participants were encouraged to practice self-management behaviors regularly before the next meeting. The educational program utilized various teaching methods, including presentations, demonstrations, videos, and discussions (see **Table 1** and **Fig. 1**).

Table 1: The TPB-based educational intervention session protocol

Sessions	Description
1st session	This session focuses on the structure of awareness, distributing pamphlets, educational films, and booklets an introduction to self-care behaviors, the pathophysiology of bronchial asthma, signs/symptoms, triggers, diagnosis, and treatment.
2nd session	Focuses on the attitude toward behavior; during this training session, overcome negative attitudes and strengthen positive attitudes about self-care and provide information to avoid exposure to triggers and the use of the inhaler by explaining the benefits of preventing exposure and correct use of the inhaler, as well as their positive effects on adherence to medication and controlling asthma, the disadvantages of incorrect use of the inhaler and exposure to asthma allergens, how to organize the home environment, and how to motivate people to correct and change wrong behaviors.
3rd session	This session focuses on the subjective norm. Family members are involved in the program and process during this training session. By establishing a home environment for patients, families play a crucial role in ensuring the appropriate use of the inhaler and motivating family members to change their behavior.
4th session	This session focuses on perceived behavioral control. During this training session, patients will be taught how to avoid exposure to asthma allergens, and inhaler use techniques will be demonstrated. The correct steps for patients who perform incorrectly will be shown, and control levels for correct behaviors will be increased.
5th session	Focus on general lifestyle behaviors such as eating a nutritious diet, exercising regularly, relaxing, hand washing, and drinking water. Participants were instructed to keep a daily diary of these practices. In addition, a review of the offered information and assigned questions is required.

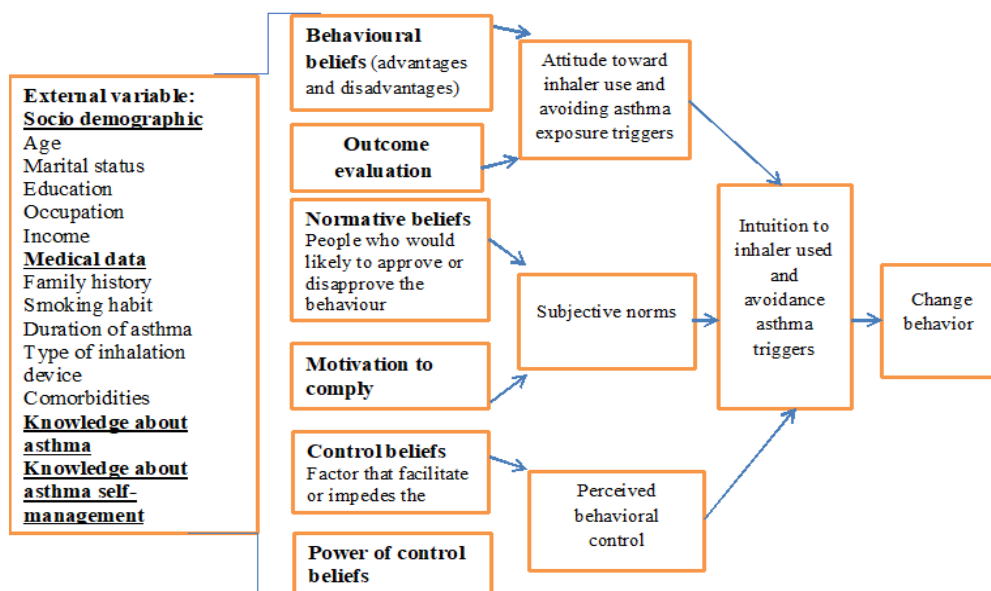


Fig. 1 Constructs of the Theory of Planned Behavior (TPB) framework applied to asthma patients Evaluation Phase

Each participant in the study and control groups was evaluated during follow-up clinic visits at one month and three months after the intervention. These evaluations lasted approximately 15 to 20 minutes and included assessments of their progress and adherence to the educational program.

Statistical analysis

All collected data were organized, coded, and statistically analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0 for Windows. The normality of quantitative variable distributions was carefully evaluated using the Kolmogorov–Smirnov (KS) and Shapiro–Wilk (SW) tests.

Quantitative variables were presented as mean $\pm$ standard deviation (SD) and range, while qualitative variables were summarized as frequencies and percentages. Appropriate statistical tests were employed, including the student's t-test, Chi-square test or Fisher's exact test, and repeated-measures analysis of variance (ANOVA). A p-value of less than 0.05 was considered statistically significant.

Results

Table (2) shows that 34% and 30% of the study and control groups were between 30 -< 40 years with a mean of 40.64 ± 10.69 for the study group, and 41.38 ± 9.24 for the control group.

In addition, the majority of them were female, accounting for 56% of the study group and 54% of the control group, respectively. Regarding marital status 70.0% of the study group and 76.0%, the control group were married. In terms of educational level 40.0% of the study group and 38.0% of the control group attended secondary school. Regarding place of residence, both groups lived in urban regions, with 62.0% and 58%, respectively. With reference to occupation, 54.0% of the study group and 50.0% of the control group didn't work. According to the monthly income from the patients' perspective 76.0%, & 84.0% respectively, of both the study and control groups had sufficient monthly income. Finally, almost all of them live with their families. Also, no statistically significant differences were observed between the two groups regarding all socio-demographic characteristics.

Table (3) shows that 66.0% & 60.0% of the study and control groups, respectively, had a family history. In addition, 42.0% and 40.0 % of the study and control groups, respectively, had bronchial asthma for <5 years. Regarding the severity of asthma 46.0%, & 44.0 % of the study and control groups, respectively, had moderate manifestations of bronchial asthma. With a reference history of smoking 62.0%, & 68.0% of the study and control groups, respectively, were

nonsmokers. In relation to type of type of inhaler used, 34.0%, & 36.0% were used a metered-dose inhaler of both study and control groups respectively. As regards the presence of comorbid 66.0%, & 54.0 % of both study and control groups had comorbidities, and 90.0%, 84.0% of both study and control groups experienced an asthma attack in the previous year. Furthermore, there was no statistically significant difference in medical data between the two groups.

Table (4) shows that in the pre-educational program, the total mean knowledge scores for the study and control groups were 25.88 ± 8.55 and 26.06 ± 8.85 , respectively. One-month post, these values were 43.08 ± 7.77 and 28.58 ± 7.94 , respectively. Post three-month follow-up after intervention, these values were 44.42 ± 6.97 and 29.74 ± 7.39 , respectively. There was no statistically significant difference in the mean knowledge scores before the educational program in the two groups ($P > 0.05$). However, the study group showed a statistically significant difference in the mean knowledge scores compared to the control group ($P < 0.05$) after one month and three months of implementing the educational program. The mean score of knowledge in the study group increased post one month and post three months follow-up after intervention, compared to the control group, which was significantly higher than the control group ($P < 0.05$).

Figure (2) illustrates that 78.0% & 68.0% of the study and control groups, respectively, had unsatisfactory levels of knowledge before the pre-educational program. In contrast, 92.0% & 34.0% of both groups, respectively, had a satisfactory level of knowledge one month after the intervention regarding bronchial asthma $\chi^2 = 30.643$, $P = < 0.001$. As well as, 90.0% & 34.0% respectively of both the study and control groups had satisfactory levels of knowledge at the three-month follow-up $\chi^2 = 23.645$, $P = < 0.00$.

Table (5) shows that the mean score of asthma control pre-educational program in the study group and control group was 17.04 ± 2.05 and 16.88 ± 1.98 , respectively, which indicates no statistically significant difference between the study and control groups ($P = 0.693$). The mean score of participants post one month among the study and control groups was 18.34 ± 2.57 and

16.98 ± 1.99 , respectively, with a statistically significant improvement after the implementation of the educational program ($P = 0.004$). Also, the mean score of participants post three months follow-up among the study and control groups was 18.82 ± 2.52 and 17.10 ± 2.52 , respectively, with a statistically significant improvement after the implementation of the educational program ($P < 0.001$). The mean score of asthma control in the study group increased post one month and post three months follow-up after the intervention, compared to the control group of the intervention.

Table (6) shows that in the pre-educational program, the total mean scores of inhaler use in the study and the control groups were 6.68 ± 0.74 and 7.90 ± 0.70 , respectively. One-month post, these values were 8.34 ± 0.65 and 6.82 ± 0.71 , respectively. Post three-month follow-up after intervention, these values were 9.44 ± 0.61 and 6.78 ± 0.73 , respectively. There was no statistically significant difference in the mean scores of inhalers use regarding intention, attitude, subjective norms, and perceived behavior control before the educational program in the two groups ($P > 0.05$). However, the study group showed a statistically significant difference in the mean scores for inhaler use, in terms of attitudes, subjective norms, and perceived behavior control, compared with the control group ($P < 0.05$) after one month and three months of implementing the educational program. The mean score of inhaler use in the study group increased post one month and post three months follow-up after intervention, compared to the control group, which was significantly higher than the control group ($P < 0.05$).

Table (7) shows that in the pre-educational program, the total mean scores of the allergen-exposure avoidance scale in the study and the control groups were 5.92 ± 0.66 & 5.06 ± 0.61 , respectively. One-month post, these values were 7.32 ± 0.47 and 6.02 ± 0.65 , respectively. Post three months follow-up after intervention, these values were 8.40 ± 0.49 and 5.96 ± 0.72 , respectively. There was no statistically significant difference in the mean scores for all allergen-exposure avoidance, in terms of intention, attitude, subjective norms, and perceived behavior control, between the two

groups before the educational program ($P > 0.05$). However, the study group showed a statistically significant difference in all allergen-exposure avoidance scale mean scores regarding attitudes, subjective norms, and perceived behavior control compared to the control group ($P < 0.05$) after one month and three months of

implementing the educational program. The mean score of allergen-exposure avoidance in the study group increased post one month and post three months follow-up after intervention, compared to the control group, the was significantly higher than the control group ($P < 0.05$).

Table (2): Distribution of socio-demographic characteristics of the study and control groups (N=100)

Socio-demographic characteristics	Study group (N= 50)		Control group (N=50)		χ^2	P- value
	N	%	N	%		
Age (yrs).						
20 -< 30	10	20.0	10	20.0	0.556	0.917
30 -< 40	17	34.0	15	30.0		
40 -< 50	10	20.0	13	26.0		
50 -< 60	13	26.0	12	24.0		
Mean $\pm$SD	40.64 $\pm$ 10.69		41.38 $\pm$ 9.24		t=0.370	0.712
Gender						
Female	28	56.0	27	54.0	0.040	0.841
Male	22	44.0	23	46.0		
Marital status						
Single	8	16.0	7	14.0	0.690	0.919
Married	35	70.0	38	76.0		
Widowed	2	4.0	2	4.0		
Divorced	5	10.0	3	6.0		
Education level						
Primary School	20	40.0	21	42.0	0.237	0.984
Secondary School	20	40.0	19	38.0		
University	10	20.0	10	20.0		
Place of Residence						
Rural	19	38.0	21	42.0	0.167	0.683
Urban	31	62.0	29	58.0		
Occupation						
Working	23	46.0	25	50.0	0.160	0.689
NotWorking	27	54.0	25	50.0		
Monthly income from the patients' perspective						
Sufficient	12	24.0	8	16.0	1.00	-
Insufficient	38	76.0	42	84.0		
Living Status						
Living alone	3	6.0	2	4.0	0.211	0.646
Lives with family	47	94.0	48	96.0		

(*) Statistically significant at $p < .05$; (χ^2) Chi-Square test

Table (3): Percentage distribution of medical data of both study and control group (N= 100)

Medi cal Data	Study group (N= 50)		Control group (N=50)		χ^2	P- valu e
	N	%	N	%		
Family history						
Yes	33	66.0	30	60.0	0.386	0.543
No	17	34.0	20	40.0		
Duration of illness (years)						
<5	21	42.0	20	40.0	0.233	0.934
5-10	10	20.0	12	24.0		
>10	19	38.0	18	36.0		
Severity of bronchial asthma						
Mild	17	34.0	16	32.0	0.234	0.936
Moderate	23	46.0	22	44.0		
Severe	10	20.0	12	24.0		
Smoking history						
Nonsmoker	31	62.0	34	68.0	0.578	0.748
Ex-smoker	13	26.0	12	24.0		
Current smoker	6	12.0	4	8.0		
Type of inhaler used						
Aerolizer	12	24.0	9	18.0	4.235	0.245
Turbuhaler	15	30.0	11	22.0		
Metered-dose inhaler	17	34.0	18	36.0		
Discus	6	12.0	12	24.0		

(*) Statistically significant at $p < .05$; (χ^2) Chi-Square test

Table (4): Comparison between the study and control group regarding patients' knowledge about bronchial asthma pre, post one month and three months follow-up (N=100)

Knowledge mean score	Study (N=50)	Control (N=50)	t test	P- value
	Mean $\pm$ SD	Mean $\pm$ SD		
Knowledge about asthma				
Pre-	6.96 $\pm$ 5.01	6.64 $\pm$ 4.66	0.331	0.742
Post one month	10.84 $\pm$ 3.03	7.48 $\pm$ 4.91	4.110	<0.001*
Three-month follow-up	11.06 $\pm$ 2.65	7.84 $\pm$ 4.55	4.316	<0.001*
F (p)	54.671(<0.001*)	2.406 (0.127)		
Triggers of asthma				
Pre-	7.94 $\pm$ 4.30	8.50 $\pm$ 3.80	0.689	0.493
Post one month	12.72 $\pm$ 2.25	9.42 $\pm$ 3.12	6.061	<0.001*
Three-month follow-up	13.04 $\pm$ 2.09	9.60 $\pm$ 2.92	6.763	<0.001*
F (p)	51.891 (<0.001*)	1.693(0.189)		
Diagnosis and management				
Pre-	8.38 $\pm$ 3.02	8.28 $\pm$ 3.38	0.156	0.877
Post one month	14.50 $\pm$ 3.86	8.68 $\pm$ 3.26	8.137	<0.001*
Three-month follow-up	14.88 $\pm$ 3.60	9.12 $\pm$ 3.58	8.024	<0.001*
F (p)	119.259 (<0.001*)	3.043(0.87)		
Treatment				
Pre-	2.60 $\pm$ 2.33	2.64 $\pm$ 2.41	0.840	0.933
Post one month	5.02 $\pm$ 2.18	3.00 $\pm$ 2.47	4.323	<0.001*
Three-month follow-up	5.44 $\pm$ 1.89	3.18 $\pm$ 2.37	5.263	<0.001*
F (p)	72.650 (<0.001*)	0.525(0.593)		
Total knowledge mean score:				
Pre-	25.88 $\pm$ 8.55	26.06 $\pm$ 8.85	0.103	0.918
Post one month	43.08 $\pm$ 7.77	28.58 $\pm$ 7.94	9.223	<0.001*
Three-month follow-up	44.42 $\pm$ 6.97	29.74 $\pm$ 7.39	10.211	<0.001*
F (p)	183.69 (<0.001*)	2.717(0.106)		

t= Independent sample-test; (SD) standard deviation; F= ANONA with repeated measures

*Statistically significant p-value at <0.05

Table (5): Comparison between the study and control groups pre-, post-one month, and three-month follow-up regarding ACT(N=100)

ACT	Study (N=50) Mean $\pm$ SD	Control (N=50) Mean $\pm$ SD	t test	P- value
Pre-	17.04 $\pm$ 2.05	16.88 $\pm$ 1.98	0.395	0.693
Post one month	18.34 $\pm$ 2.57	16.98 $\pm$ 1.99	2.951	0.004*
Three-month follow-up	18.82 $\pm$ 2.52	17.10 $\pm$ 2.52	3.808	<0.001**
F (p)	29.707(<0.001*)	1.592(0.209)		

t= Independent sample-test;(SD) standard deviation F= ANONA with repeated measures

* Statistically significant p-value at <0.05

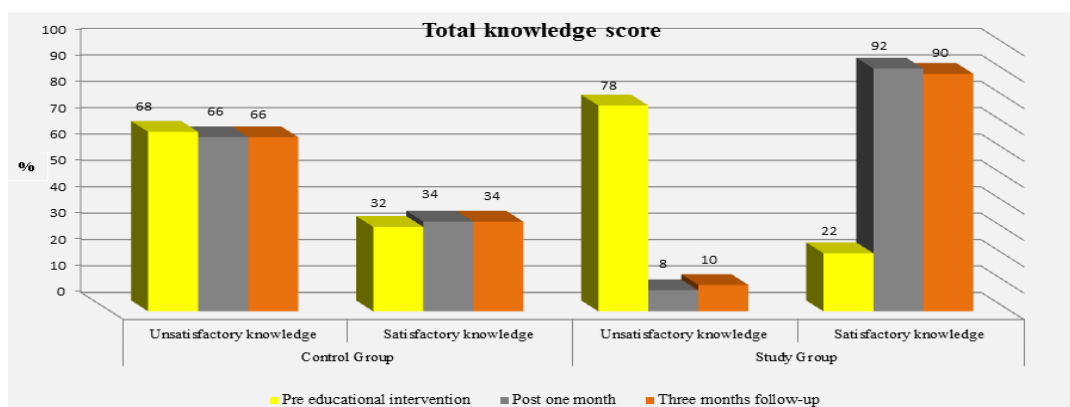


Figure (2): Percentage distribution of the study and control groups pre, post-one month, and three months follow-up regarding satisfactory level of bronchial asthma knowledge (n= 100)

Table 6: Comparison between the study and control groups pre-, post-one month, and three-

IUS	Study (N=50)	Control (N=50)	t test	P- value
	Mean ± SD	Mean ± SD		
Total of IUS				
Pre-	6.68±0.74	7.90 ±0.70	1.519	0.132
Post one month	8.34±0.65	6.82 ±0.71	3.770	<0.001*
Three-month follow-up	9.44±0.61	6.78±0.73	4.875	<0.001*
F (p)	15.962 (<0.001*)	0.470(0.627)		
Attitude Toward Behavior (ATB)				
Pre-	4.02±0.55	4.08±0.56	0.563	0.539
Post one month	4.42±0.54	4.04±0.53	3.548	0.001*
Three-month follow-up	4.50±0.54	4.00±0.49	4.808	<0.001*
F (p)	19.381 (<0.001*)	3.018(0.083)		
Subjective Norms (SN)				
Pre-	4.32±0.55	4.38±0.49	0.575	0.566
Post one month	4.60±0.57	4.34±0.47	2.467	0.015*
Three-month follow-up	4.70±0.46	4.28±0.49	4.375	<0.001*
F (p)	8.493(<0.001*)	0.815(0.446)		
Perceived Behavioral Control (PBC)				
Pre-	3.58±0.67	3.56±0.70	0.145	0.885
Post one month	4.38±0.49	3.66±0.68	6.024	<0.001*
Three-month follow-up	4.46±0.52	3.70±0.65	6.366	<0.001*
F (p)	47.771(<0.001*)	3.128(0.083)		

month follow-up regarding the IUS (N=100)

t= Independent sample-test; (SD) standard deviation; F= ANONA with repeated measures

* Statistically significant p-value at <0.05

Table 7: Comparison between the study and control groups pre-, post-one month, and three-month follow-up regarding AEAS (N=100)

AEAS	Study (N=50)	Control (N=50)	t test	P- value
	Mean $\pm$ SD	Mean $\pm$ SD		
Total of AEAS				
Pre-	5.92 $\pm$ 0.66	5.06 $\pm$ 0.61	1.089	0.279
Post one month	7.32 $\pm$ 0.47	6.02 $\pm$ 0.65	2.361	0.010*
Three-month follow-up	8.40 $\pm$.49	5.96 $\pm$ 0.72	3.537	0.001*
F (p)	22.014 (<0.001*)	1.753(0.179)		
Attitude Toward Behavior (ATB)				
Pre-	4.14 $\pm$ 0.63	4.24 $\pm$ 0.55	0.853	0.406
Post one month	4.42 $\pm$ 0.60	4.16 $\pm$ 0.61	2.116	0.037*
Three-month follow-up	4.50 $\pm$ 0.61	4.10 $\pm$ 0.67	3.092	0.003*
F (p)	17.372(<0.001*)	1.790(0.172)		
Subjective Norms (SN)				
Pre-	4.22 $\pm$ 0.60	4.30 $\pm$ 0.50	0.688	0.493
Post one month	4.48 $\pm$ 0.70	4.16 $\pm$.61	2.410	0.018*
Three-month follow-up	4.58 $\pm$ 0.64	4.26 $\pm$ 0.66	2.450	0.016*
F (p)	21.637(<0.001*)	1.515(0.225)		
Perceived Behavioral Control (PBC)				
Pre-	3.62 $\pm$.63	3.64 $\pm$ 0.72	0.147	0.883
Post one month	4.18 $\pm$ 0.71	3.60 $\pm$ 0.67	4.171	<0.001*
Three-month follow-up	4.32 $\pm$.0.71	3.74 $\pm$ 0.78	3.889	<0.001*
F (p)	23.772*(<0.001*)	1.890(0.157)		

t= Independent sample-test;(SD) standard deviation; F= ANONA with repeated measures

* Statistically significant p-value at <0.05

Discussion

The present study applied TPB to provide an educational program aimed at promoting behavior change. According to Ajzen (2020), an individual's intention to act is the main predictor of TPB Determining individuals' attitudes and

beliefs about their desired behaviors is crucial for adherence to medication and effective asthma control. The TPB is an active model for explaining why individuals with asthma exhibit specific behavior (Riebl et al., 2015).

Nursing educational guidelines are a way of supporting patients in resuming self-care. Furthermore, encouraging patients to participate in their care increases their knowledge while decreasing their anxiety. Guidelines can enhance the consistency and quality of care; nurses can educate family members while the patient is still in the healthcare facility. Patient and family education should concentrate on the disease condition, how to adjust behavior, odor control, self-care activities, clothing, and activities, as well as the necessity of follow-up to avoid complications (**Elbannaa et al., 2017**).

In this respect, these findings are compatible with the findings of a study done by **Abo El-Fadl & Sheta, (2019)**, who reported that most of the study subjects had unsatisfactory asthma knowledge before implementing the educational program and attributed the reason to the fact that participants were from rural regions and had a low level of education. The findings are consistent with **Phan et al. (2020)**, who clarified that asthma knowledge among adult patients in Vietnam was low, attributing this to low educational levels.

From the researchers' perspective, knowledge deficits before implementing educational program may stem from a lack of self-care guidelines provided to the studied patients, which included necessary information about BA. This could be explained by the fact that the highest percentage of participants had a secondary school education and that more than half of them were female homemakers.

According to the total knowledge of the studied patients regarding bronchial asthma, the current study's findings demonstrated noticeable progress in the patients' total knowledge score from pre- to post-intervention, at one-month, and at sustained three-month follow-up after educational program implementation. This highlights the need for greater understanding of the elements of self-management. This may be related to the need for educational programs and informational resources about the illness and its consequences. This needs to be improved in the educational role of providers.

After the program was implemented, patients' knowledge improved significantly; this supports the hypothesis that the knowledge deficit was caused by a lack of exposure to the educational materials provided to patients and

indicates that meeting the patients' information needs could fill this knowledge gap. This improvement in patients' knowledge continued throughout the follow-up period without a decline in any knowledge domains. This finding was confirmed by **Mohammed & Abu Zead (2023)**, who found no significant differences between the two groups on the pre-test asthma knowledge exam, indicating group homogeneity. Also, **Mishra et al. (2017)** discovered that an extensive asthma education program improved asthma control as measured by the ACT while decreasing hospital and emergency room (ER) visits in an urban asthma population.

These results align with those of a study conducted by **Abo El-Fadl & Sheta (2019)**, which reported that the majority of study participants did not have enough knowledge about asthma before the implementation of the educational program. These could be attributed to the participants' low educational attainment and rural origins. Furthermore, the findings are consistent with those of **Phan et al. (2020)**, who discovered that adult patients in Vietnam had limited awareness of asthma, a finding the study linked to low educational attainment.

From the researchers' perspective, knowledge deficits before implementing an educational program may stem from a need for self-care guidelines provided to the studied patients, who required information about BA. This could be explained by the fact that most participants had a secondary school education, and more than half were female homemakers.

Regarding asthma control, the current study showed a statistically significant difference between the pre- and post-one-month and three-month follow-ups after implementing the educational program. This finding is congruent with a survey by **Zeng et al. (2018)** stating that asthma education is a critical element of asthma management. The outpatient pulmonary clinic's educational programs have been successful in controlling asthma. Compared to standard clinic treatment, most patients who received educational intervention during their visit had higher ACT scores.

Lastly, as the patients' understanding of their condition increased, so did their adherence to taking their medications regularly and their control over their asthma. From the researchers' perspective, these findings were deemed

significant because the patients' ability to manage their condition improved through increased awareness, adherence to their medication regimens, and assurance that the educational intervention was followed.

Based on the findings, the study concluded that participants' inhaler use improved significantly after the educational program, influenced by positive changes in subjective norms, attitudes, and perceived behavioral control. This improvement was statistically significant following the program's implementation. These results are consistent with those of **Sanlıtürk & Ayaz-Alkaya (2024)**, who found that the study group achieved significantly higher posttest mean scores on the Inhaler Use Scale (IUS) compared to the control group. Moreover, nearly all participants in the study group demonstrated correct inhaler technique after receiving the educational program, whereas the control group, which did not receive any education, showed no such improvement.

The current study also revealed a statistically significant enhancement in allergen exposure avoidance following the program. This finding aligns with **Sanlıtürk & Ayaz-Alkaya (2024)**, who reported higher posttest mean scores on the Allergen Exposure Avoidance Scale (AEAS) among the study group compared to the control group. These improvements indicate that the educational program effectively influenced behavioral change. Evidence supports that TPB-based (Theory of Planned Behavior) program can successfully promote positive health behaviors, such as maintaining a balanced diet and engaging in regular physical activity among diabetic and cardiac patients. However, limited research has explored the impact of TPB-based education on inhaler use and allergen avoidance among asthma patients.

Following the implementation of the program, participants in the study group were positively influenced by their environment and demonstrated greater willingness to engage in desired health behaviors. They developed more favorable attitudes toward proper inhaler use, gained confidence in their ability to use inhalers correctly, enhanced their perceived behavioral control, and increased their awareness of asthma triggers and strategies to avoid them.

Conclusion

The study demonstrated that nursing educational program, guided by the Theory of Planned Behavior (TPB), had a significant impact on knowledge of asthma, asthma control, inhaler use practices, and avoidance behaviors related to allergen exposure. The participants demonstrated substantial improvements in their understanding and management of asthma over time, with statistically significant differences observed at both one-month and three-month follow-ups.

Recommendations

The current study recommended:

- Implementing structured educational programs grounded in the Theory of Planned Behavior (TPB) framework can strengthen asthma management practices, leading to improved disease control, better health outcomes, and enhanced quality of life for individuals with asthma.

- Telephone consultations should be integrated into follow-up care to support sustained behavioral changes and promote long-term asthma control.

- Future research should be conducted with a larger sample size to confirm and expand upon the findings of the current study.

- Continuous promotion of self-care management is essential, including the use of visual aids such as images of asthma triggers and permitted foods, as well as structured follow-up as part of post-treatment rehabilitation programs.

- Comprehensive educational materials, both written and visual, should be made available and distributed to all asthma patients to facilitate understanding and encourage active participation in their care.

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Conflict of interest:

No conflicts of interest.

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