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CLINICAL INVESTIGATION

The Effects of Asthma Education On Knowledge, Behavior and Morbidity in Asthmatic Patients

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Abstract: This work was carried out to study the effect of asthma education on asthma knowledge, behavior and morbidity in asthmatic patients. A randomized double blind controlled study was conducted with 54 adults with asthma followed-up at the outpatient clinic of Chest Diseases and Tuberculosis at the Faculty of Medicine of Suleyman Demirel University. Patients were randomized to the verbal (n: 17), written (n: 19), and verbal-written (n: 18) education groups. Knowledge of asthma was measured at the baseline, and 2 months and 1 year after education. Compliance with treatment, correct inhaler skill and admisssons to hospital in the previous year were assessed in asthmatic patients at the baseline and after 1 year.

Before education, knowledge of asthma was low in the 3 education groups. The rate of compliance with treatment was 51.9%. Twenty-four (44.4%) patients had perfect inhaler skill. Thirty-eight (70.4%) patients failed to use their drug regimes in compliance with the Consensus Report. Eleven (20.4%) patients were in strict compliance with the treatment and used their drug regimes in accordance with the Consensus Report. Twenty-six (48.1%) patients were in strict compliance with the treatment and also used inhaled corticosteroids. Eight (14.8%) patients had been hospitalized in the previous year.

After education, the mean change in the knowledge score was highest in the verbal-written education group. The mean change in the knowledge score 1 year after education was lower than that 2 months after education. Before and after education, the mean knowledge score was correlated with education level. After 1 year, the rate of compliance with the treatment was 66.6%, the rate of correct inhaler use was 63.0% and the rate of hospital admissions was 11.1%.

The results of this study suggested that asthmatic patients did not have sufficient information about their disease, and additional information about asthma increased their asthma knowledge and increased correct inhaler use but had no effect on compliance with treatment or admission to hospital.

Key Words: Asthma, knowledge, patient education, behavior, morbidity

Introduction

Asthma is the most common chronic respiratory disorder among all age groups. In recent decades there have been striking advances in the clinical treatment of asthma. However, in spite of this, the frequency, morbidity and mortality of asthma are increasing in many countries (1-3). This discrepancy between the scientific evidence and the continuing negative effect of asthma on society depends to a considerable extent on patients' behavior and doctors' performance (4).

Many factors have been identified as possible causes of the increase in the morbidity and mortality of asthma, including poor patient understanding of the disease process and of appropriate medication use, and non-compliance of the patients with prescribed medical regimens (5).

International efforts to reduce asthma morbidity and mortality have focused that on improving patient education and self-management behavior (4,6,7). Patients using hospital emergency departments generally have a poor knowledge of asthma and poor management techniques (8).

This work was carried out to study the effect of asthma education on asthma knowledge, behavior and morbidity in asthmatic patients.

Materials and Methods

This study was conducted with asthmatic patients followed-up at the outpatient clinic of Chest Diseases and Tuberculosis at the Faculty of Medicine of Suleyman Demirel University. Between January and August 2000, a total of 65 patients (52 female, 13 male, ages 21-63 years) with asthma confirmed by history and airflow obstruction according to the criteria of the Consensus Report (4) were eligible to participate in the study. None of the patients had taken part in an asthma education program before this study. All subjects were reviewed individually and in an organized way.

Data related to the enrolled asthmatic patients were collected at the baseline as part of a randomized clinical trial, and recorded on a form developed specifically for this study. The independent variables were divided into 2 categories: a) sociodemographic characteristics: including age, sex and education level and b) disease profile characteristics: including duration and severity of asthma, family asthma history, drug regimens, previously reported compliance with treatment, inhaler type and skill, and admissions to emergency departments and hospitals due to asthma in the previous year.

The severity of asthma was categorized according to patients' clinical features. The subjects were classified as mild, moderate and severe asthmatics, in accordance with the Consensus Report and placed into the highest severity class of which they had features (4).

Previously reported compliance with treatment was monitored on the basis of verbal information given by the patient.

Patients were then requested to demonstrate their usual inhaler skill twice. Proficiency in the use of the inhaler was assessed with a checklist containing the steps for different types of inhaler adapted from the Consensus Report (4). In subjects whose skills were inadequate, the correct procedure was demonstrated and their inhaler skill was rechecked.

Knowledge of asthma was measured with a verbally administered questionnaire based on the Consensus Report (4). The asthma knowledge questionnaire was composed of 17 close-ended questions, presenting yes/no/I don't know options (Table 1). The questionnaire contained questions about asthma etiology, pathophysiology, symptomatology, precipitant factors, medications and prognosis. Answers were graded from 0

Table 1. Asthma knowledge questionnaire.

1.	Is asthma an inflammatory disease of the airways?
2.	Is asthma a contagious disease?
3.	Is asthma a hereditary disease?
4.	Does asthma inflammation cause constriction in the airways?
5.	Are there symptoms such as coughing, wheezing, dyspnea, chest tightness in asthmatic patients?
6.	Do aspirin, some rheumatism drugs, and some antihypertensive drugs cause asthma symptoms?
7.	Is asthma a disease that cannot be treated and which continues throughout one's life?
8.	Could asthma be completely controlled with a continuous and regular treatment and can the patient continue a normal life?
9.	Should asthmatic patients use the prophylactic treatment regularly even if they feel well?
10.	If an asthmatic patient does not use the treatment regularly, do asthma attacks threaten life?
11.	Are inhaled medications the most effective delivery method for the treatment of asthma?
12.	Do inhaled drugs reach the airways directly?
13.	Do the effects of inhaled drugs disappear quickly and enter the circulation system in very small amounts?
14.	Are there any harmful side effects of inhaled medications?
15.	Do inhaled medications cause addiction?
16.	Can asthmatic patients do sports?
17.	Can asthmatic patients become pregnant?

(false answer/no answer) to 1 (true answer). Correct answers were counted and the knowledge score was determined as the total number of correct answers. The questionnaire was applied to all the subjects at the baseline interview, and 2 months and 1 year after education.

After completion of the baseline interview, in a double blind fashion, patients were randomized to 1 of the 3 education groups via the closed envelope technique: 1) the verbal education group were given only verbal information, 2) the written education group were given only a written asthma information sheet (Appendix) and 3) the verbal and written education group were given both verbal information and a written asthma information sheet. The patients were unaware of being involved in a study.

The format of the information sheet could not be independently assessed because of the unavailability of an educational psychologist.

The educational component of the study was individually administered to all the subjects. At the end of the education, treatment regimes were organized for each patient. The interview lasted approximately 45 min.

The asthma knowledge questionnaire was applied again to the subjects in telephone interviews 2 months after education. After 1 year, the questionnaire was administered verbally by face-to-face interview, and compliance with treatment, correct inhaler skill and hospital admissions of asthmatic patients were assessed.

Statistical analyses were conducted by the SPSS statistical package (SPSS 9.0 for Windows, Chicago, IL, USA). The results are expressed as mean values ± standard deviation (SD). Differences between the groups in quantitative variables were assessed using the Kruskal-Wallis test. Comparisons of the nominal and ordinal categorical data from the groups were made by the chi-squared test and significance was assessed using the Pearson chi-squared statistic. The chi-squared test was used to compare the differences for each question between the groups at the baseline, and 2 months and 1 year after education. The Kruskal-Wallis test was used to compare the mean scores between the groups at the baseline, and 2 months and 1 year after education, and the mean changes in knowledge scores among the groups after education. Differences in the mean scores between the baseline and after education within the groups were tested with the Wilcoxon test. The Mann-Whitney U test was used to determine differences between the groups in outcome variables. The association of continuous/ordinal independent variables, such as education level and duration of disease, with outcome scores was analyzed using correlation analysis. Subsequently, variables with significant associations ($P \leq 0.05$) were entered into the regression analysis. Differences in the binary categorical variables between the baseline and 1 year after education were analyzed using McNemar's test. All statistical tests were 2-tailed and a P value less than 0.05 was considered significant.

Results

Three of the 65 patients initially enrolled in the study (2 from the written education group and 1 from the verbal-written education group) were excluded because they did not read the asthma information sheet. Therefore, the study was limited to 62 patients after 2 months who completed the protocol. Among the 62 patients who completed the study, 8 patients dropped out after 1 year because they could not be contacted. As a result, 54 patients (17 subjects in the verbal education group, 19 in the written education group, and 18 in the verbal-written education group) completed the follow-up assessment at 1 year.

The main characteristics of patients receiving verbal, written, and verbal-written asthma education are given in Table 2. It was found that there were no differences between the groups in sociodemographic and disease profile characteristics.

The results related to the comparison of correct responses to each question between the baseline and after education are given in Table 3.

Before education, it was found that the questions most often answered correctly for each group were related to the symptoms of asthma and the cause of inadequate treatment of an asthma attack. It was found that the questions least often answered correctly for each group were related to the effects and side effects of inhaled medications, and whether the inhaled medications cause addiction.

After 2 months and 1 year, it was found that there were significant increases in the response rates of all the questions for each group. Questions having increases at

Table 2. Main characteristics of patients receiving verbal, written, and verbal-written education.

Characteristics	Verbal	Written	Verbal-written	P value
Sample size	17	19	18	
Mean age in years	43.9 ± 10.7	43.0 ± 11.0	44.9 ± 14.0	0.857
Sex (female)	12 (70.6%)	16 (84.2%)	15 (83.3%)	0.534
Educational level				0.480
Literate	3 (17.6%)	1 (5.3%)	3 (16.7%)	
Completed primary school	6 (35.3%)	11 (57.9%)	9 (50.0%)	
Completed junior high school	- (0.0%)	1 (5.3%)	1 (5.6%)	
Completed high school	3 (17.6%)	5 (26.3%)	3 (16.7%)	
Completed college or university	5 (29.4%)	1 (5.3%)	2 (11.1%)	
Mean duration of asthma (year)	9.7 ± 8.6	8.5 ± 9.23	7.8 ± 7.5	0.670
Severity of asthma				0.997
Mild	6 (35.3%)	6 (31.6%)	6 (33.3%)	
Moderate	3 (17.6%)	4 (21.1%)	4 (22.2%)	
Severe	8 (47.1%)	9 (47.4%)	8 (44.4%)	
Family asthma history	9 (52.9%)	10 (52.6%)	10 (55.6%)	0.981
Previously reported drug compliance	11 (64.7%)	7 (36.8%)	10 (55.6%)	0.230
Correct inhaler use	9 (52.9%)	10 (52.6%)	5 (27.8%)	0.219
Hospital admissions in the previos year	2 (11.8%)	3 (15.8%)	3 (16.7%)	0.910
Emergency department visits in the previos year	4 (23.5%)	5 (26.3%)	3 (16.7%)	0.770
Adequate drug regimes	5 (29.4%)	6 (31.6%)	5 (27.8%)	0.968
Inhaled steroid use	11 (64.7%)	15 (78.9%)	15 (83.3%)	0.405

Table 3. Comparison of correct responses to each question between the baseline and after education.

Question number	Before education n (%)	2 months after education n (%)	1 year after education n (%)
1	12 (22.2)	46 (85.2)	45 (83.3)
2	18 (33.3)	34 (63.0)	36 (66.7)
3	24 (44.4)	39 (72.2)	37 (68.5)
4	25 (46.3)	51 (94.4)	49 (90.8)
5	53 (98.1)	54 (100.0)	54 (100.0)
6	11 (20.4)	31 (57.4)	24 (44.4)
7	7 (13.0)	30 (55.6)	32 (59.3)
8	21 (38.9)	52 (96.3)	45 (83.3)
9	23 (42.6)	52 (96.3)	52 (96.3)
10	31 (57.4)	51 (94.4)	51 (94.4)
11	18 (33.3)	52 (96.3)	42 (77.8)
12	25 (46.3)	50 (92.6)	46 (85.2)
13	6 (11.1)	44 (81.5)	37 (68.5)
14	6 (11.1)	35 (64.8)	36 (66.7)
15	6 (11.1)	35 (64.8)	32 (59.3)
16	23 (42.6)	44 (81.5)	48 (88.9)
17	20 (37.0)	46 (85.2)	40 (74.1)

the highest rates for each group were related to the definition of asthma and effects of inhaled medications.

Before and 2 months after education, the mean scores obtained from the asthma knowledge questionnaire for each group and mean changes in the knowledge scores are given in Table 4. Before education, it was found that there were no statistically significant differences in the mean knowledge scores between the groups (P = 0.216).

After 2 months, it was found that there were no differences in the knowledge scores among the groups (P = 0.232), but there were statistically significant differences in the mean changes in knowledge scores among the groups. The mean change in knowledge score was significantly higher in the verbal-written education group than that in the verbal education group (P = 0.047). The mean change in the knowledge score of the written education group was significantly higher than that of the verbal education group (P = 0.050). The mean knowledge scores increased significantly in each group compared to the baseline scores (P = 0.000).

Table 4. Before and 2 months after education, the mean knowledge scores obtained from the asthma knowledge questionnaire for each group and mean changes in the knowledge scores.

Groups	Before education		2 months after education			P
	Mean score (%)	Range	Mean score (%)	Range	Mean change	value
Verbal	7.4 ± 7 (43.1)	2-14	13.4 ± 2.7 (77.5)	6-17	6.1 ± 3.7	0.000
Written	5.1 ± 2. 7 (30.0)	1-9	13.5 ± 1.7 (75.5)	5-16	8.4 ± 3.1	0.000
Verbal-written	5.6 ± 3.9 (30.1)	1-14	14.4 ± 2.2 (84.9)	8-17	8.8 ± 4.2	0.000
P value	0.216		0.232		0.086	

Table 5. Before and 1 year after education, the mean knowledge scores obtained from the asthma knowledge questionnaire for each group and mean changes in the knowledge scores.

Groups	Before education		1 year after education			P
	Mean score (%)	Range	Mean score (%)	Range	Mean change	value
Verbal	7.4 ± 7 (43.1)	2-14	13.4 ± 2.7 (77.5)	6-17	6.0 ± 3.3	0.000
Written	5.1 ± 2. 7 (30.0)	1-9	12.7 ± 3.2 (75.5)	6-16	7.6 ± 4.0	0.000
Verbal-written	5.6 ± 3.9 (30.1)	1-14	13.4 ± 2.6 (84.9)	8-17	7.8 ± 4.2	0.000
P value	0.216		0.874		0.291	

Before and 1 year after education, the mean knowledge scores obtained from asthma knowledge questionnaire for each group and mean changes in the knowledge scores are presented in Table 5. There were no differences in the knowledge scores among the groups (P = 0.291), but the mean change in the knowledge score was higher in the verbal-written education group than those of the verbal and written education groups. The mean knowledge scores increased significantly in each group compared to the baseline scores (P = 0.000). The mean change in the knowledge score 1 year after education was lower than the change 2 months after education.

It was found that the mean knowledge score was directly correlated with education level before education (r = 0.431, P = 0.000) and after education (r = 0.339, P = 0.012 and r = 0.434, P = 0.001), before education, previously reported compliance (P = 0.002) and correct inhaler skill (P = 0.023), but not with the duration of asthma, asthma severity, family asthma history, or admissions to emergency departments or hospitals in the previous year.

Only 28 (51.9%) of asthmatic patients claimed to use their medications as prescribed. Compliance with treatment was not associated with the duration of asthma, age, sex, education level, correct inhaler use, asthma severity, family asthma history, or admissions to emergency departments or hospitals in the previous year. The study indicated that the most common reason given for non-compliance was giving up the treatment after feeling well (61.53%).

When the drug regimes of each subject were carefully reviewed, it was found that 14 mild asthmatics, 7 moderate asthmatics and 17 severe asthmatics inappropriately used drug regimes when compared to the Consensus Report. Only 11 (20.4%) of the patients were in strict compliance with the treatment and used their drug regimes in accordance with the Consensus Report. It was found that 41 (75.9%) of the patients (12 mild, 11 moderate and 18 severe asthmatics) used inhaled corticosteroids. Only 26 (48.1%) of the patients were in strict compliance with the treatment and also used inhaled corticosteroids.

The results suggest that 24 (44.4%) asthmatic patients had perfect inhaler skill. The most common mistakes were in breathing out before pressing the inhaler, in holding the breath for 10 s and in waiting 1 min between puffs. It was found that correct inhaler use

had a statistically significant relation with sex (male, P = 0.005), but not with device type, education level, asthma severity, duration of asthma, family asthma history, or admissions to emergency departments or hospitals in the previous year.

After 1 year, it was found that the rates of compliance with treatment was 66.6% (P = 0.077), the rates of correct inhaler use was 63.0% (P = 0.007) and the rates of hospital admissions was 11.1% (P = 0.754).

Discussion

The results of this study suggested that asthmatic patients did not have sufficient information about their disease, and additional information about asthma increased their asthma knowledge and increased correct inhaler use but had no effect on compliance with treatment or admissions to hospital.

In this study, prior to education, it was found that asthmatic patients had a lack of knowledge about the disease and an overall knowledge of the disease was found to be adequate in only 35.8% of patients. After individualized education, although knowledge of asthma increased in the 3 education groups, the mean change in the knowledge score was significantly higher in the verbal-written education group. The mean change in the knowledge score 1 year after education was lower than the change 2 months after education. Other studies have shown that an education program considerably increased patients' knowledge of asthma with respect to the pre-education period but at the end of the study, the asthma knowledge score was lower than that just at the end of the education (9,10). The Consensus Report emphasizes that educational efforts should be continuous and it is necessary to periodically review information and skills covered previously because patient self-management behavior is likely to decline over time (4). For this reason, the emphasis must be on the development of an ongoing partnership among health care professionals and the patient.

Non-compliance with therapy is a major impediment to effective asthma management and can lead to failure of treatment, excessive use of medications, avoidable costs, life-threating exacerbations, and ultimately death (11). In this study, it was found that only 48.1% of asthmatic patients used their drugs as prescribed and asthma education had no effect on compliance. Non-compliance with asthma medication regimes is widespread behavior in both children and adults (2,12,13). Some studies evaluating the effect of educational programs on compliance in persons with asthma have shown that education improved patient compliance (5). Other studies have not shown such success rates with compliance and knowledge (14,15). It seems that such programs may influence how well patients cope with asthma episodes, but may be less successful in facilitating compliance long-term preventive medication regimes (16). Knowledge is important only to the extent that it may have a beneficial influence on illness-related behavior and hence morbidity (14). Becker found that provision of knowledge for motivated patients improves compliance (5). Other studies indicated that variables such as patient motivation, attitudes toward asthma, and control of symtoms may influence compliance more significantly than knowledge (5,13).

In this study, it was found that the large majority of asthmatic patients used drug regimens that were not in compliance with the Consensus Report, and only 11 (20.4%) of the patients were in strict compliance with the treatment and used their drugs in accordance with the Consensus Report. Although 77.4% of the patients used inhaled corticosteroids, only 26 (48.1%) of the patients were in strict compliance with the treatment and also used inhaled corticosteroids. These findings are consistent with previous findings that asthmatic patients had a tendency to over-utilize the immediate reliever and under-use long-term preventive medications (14,15,17).

Another finding of this study is that severity of asthma did not significantly influence the compliance rate. It has been observed that subjects suffering from more severe asthma did not show better compliance with antiasthmatic treatment than those with milder asthma (2). These findings show that it is reasonable to suppose that noncompliance with treatment may result in increased asthma severity and unnecessary hospitalizations.

The adoption of asthma guidelines by clinicians and patients has been slow. Compliance with guidelines has been reported to be low in the literature (18-21). In the United States, although most doctors were aware of the asthma treatment guidelines, of patients with severe persistent asthma symptoms 20.0% reported current use of anti-inflammatory medication (22). Studies have shown that compliance with the Consensus guidelines'

recommendation of the use of inhaled steroids was associated with a decrease in the relative risk of asthma-related hospitalizations, emergency room visits, and asthma costs (14,21).

Proper use of the inhaler, as well as use on an appropriate treatment schedule, is important for achieving the full benefit from these medications. Patient education in the proper use of inhalers is an important part of asthma treatment (23). In this study, about half (55.6 %) of the patients did not have perfect inhaler skill and asthma education increased correct inhaler use. The results of many studies have shown that education could have a large impact on the percentage of patients who use an inhaler correctly (24,25).

Many clinical trials have examined the relation between education and health outcomes and a systematic review has suggested that these programs generally reduced the use of health services (26). In this study, it was found that asthma education had no effect on the rate of hospital admissions during the 12 months of follow-up. Here, undertreatment of asthma with inhaled steroids and noncompliance might have been factors contributing to asthma morbidity. Studies have indicated that excessive use of bronchodilatators and inadequate anti-inflammatory treatment, coupled with therapeutic noncompliance, social disadvantage, and psychological factors, are important indicators for excess hospital admissions and asthma deaths (27,28). These findings highlight the need for better patient education on the proper use of pharmacologic agents for asthma management.

In conclusion, the results of this study indicated that asthma education had a positive impact on patients' knowledge of asthma, but did not bring about lasting changes in behavior and mortality. The primary focus of patient education and asthma management strategies should be on identifying negative behaviors and working towards positive behavioral changes. To achieve behavioral changes, the patients' general and asthma-specific expectancies and outcome expectancies should be increased, and more social support should be established, in order to increase the intentions towards self-management behavior.

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Appendix 1

Appendix. Asthma information sheet.

Asthma is an inflammatory disease of the airways. Asthma is not a disease that is spread by contagion. In the occurrence of this inflammation of the airways, factors related to inheritance and the environment are equally responsible. This inflammation causes constriction in the airways. Thus, symptoms such as coughing, wheezing, dyspnea, and chest tightness in asthmatic patients appear. Some factors (infection, exercise, cigarette smoke, allergens, aspirin, some antihypertensive drugs and some rheumatism drugs) can facilitate the bringing on of asthma symptoms.

Asthma is not a disease that cannot be treated or continues throughout one's life. However, it is a chronic disease that requires long-term treatment. If asthma is treated regularly and continously, it could be completely controlled and the patient can continue a normal life. For this, asthmatic patients must use the prophylactic treatment regularly even if they feel well. If an asthmatic patient does not use the treatment regularly, asthma attacks can threaten life.

Medications for asthma can be administered in different ways, including inhaled, oral (ingested), and parenteral (intramuscular or intravenous) ones. However, the most effectual treatment is the inhalation route. Inhaled drugs reach the airways directly. The effects of inhaled drugs disappear quickly and these enter the circulation system in very small amounts. There are no harmful side effects from inhaled medications and these medications do not cause addiction.

Asthmatic patients must not avoid exercising.

Asthmatic patients can become pregnant.