

# Effectiveness of Indoor Environment Management Education for Prevention of Allergic Asthma

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**Purpose.** The objective of this research is to provide the indoor environment management education program for the asthma patients and their families and then analyze the effectiveness in education preventing allergic asthma.

**Methods.** A pre-post single group quasi-experimental design was used to provide an education program about correct indoor environment management to a total of 58 households (29 patient households and 29 normal households). The performance rate of correct indoor environment management procedure, amount of house dust mite antigen, allergy subjective symptoms score and knowledge score about indoor environment management were compared before and after the education to test the effectiveness of the education.

**Results.** Home-visit education in this research had effects in improving subject households' performance rate of indoor environment management procedures, reducing the amount of house dust mite antigen - an important inducing factor of allergy, and reducing perceived subjective symptoms of allergy.

**Key Words:** Education, Indoor environment, allergy symptom, House Dust Mite(HDM)

## INTRODUCTION

### 1. Need for research

In overseas, it has already been reported that indoor environment pollution was considerably more hazardous to influence on the health of general population than air pollution, due to tightening of interior space and increase in usage of various appliances from economic status improvement, emitting unexpected pollution substances (Song, 2002).

In case of allergic asthma, genetic factors and environmental factors participate in development of the disease. Well-known environmental factors include house dust mite, cockroaches, animal antigen, fungi and pollens. In research by Kang et al. (1994), they showed that in Korea, a half of all adult patients with respiratory allergy and

more than 70% of child patients showed positive results in skin sensitivity test against house dust mite antigen. In addition, environmental factors such as smoke from cigarettes, air pollution and dietary habits facilitate and amplify sensitization, thus it is important to thoroughly avoid such factors and reduce exposure to various indoor and outdoor antigens including house dust mite for management of asthma (The Korean Society of Asthma and Allergy, 1998). In particular, reducing the amount of indoor allergen through an effective management of indoor environment not only reduces allergy occurrence but also improves the symptoms (The Korean Society of Asthma and Allergy, 1999; Hong, 1993).

The Korean Treatment Guideline for Bronchial Asthma published by The Korean Society of Asthma and Allergy in 1998, recommended maintaining a relative humidity of 50% at 20°C (important for growth of

house dust mite), washing the blankets and beddings weekly with warm water of 55°C or higher and not using the indoor carpet and furniture with fabric covering rather than using chemical substance to efficiently control house dust mites (The Official Publication of the Korean Society of Allergology, 1998).

Unlike western countries, most rooms in Korea are 'ondol' (floor-heated) rooms that do not use carpets. Yet house dust mite is reported as the most important allergen, and it is also reported that house dust mite inhabits in blankets and even in buck-wheat bark blankets (Kang, 1994). Also, Hong & Lee (1992) reported that a weekly vacuum cleaning alone couldn't achieve a significant reducing effect of house dust mite allergen (Hong & Lee, 1992).

Effective presentation of information is needed for asthma management. This information promotes the ability of the patients to classify the events happening to them and increases the recognition abilities that help to manage the situations happening to them (Christman et al., 1988). However, according to the research by DiMotte (1994), 43% of asthma patient cannot comply with treatment procedures, cannot distinguish what they should do and not do, and fail to change their lifestyles according to their health status. Thus DiMotte (1994) suggested appropriate education as a cost-effective measure to improve the patients' quality of life. In 1998, The Korean Society of Allergology stated in 'Korean Treatment Guideline for Bronchial Asthma' that if asthma patients actively participated in correct treatment program, they could live normally without much difficulty. It also stated that medical professionals must bring the patient and the family into the program through continuing education, confirming the drug administration and discussing the treatment methods, thus enhancing the patients' quality of life through customization of treatment. The guideline recommended including contents about inducing factors of asthma and ways to avoid worsening factors as parts of treatment education program (The Official Publication of The Korean Society of Allergology, 1998).

In fact, Abdulwadud et al. (1999) observed an improvement in self-management skills after performing ninety-minute education sessions for 3 weeks to adult outpatients. Song (2002) reported that the knowledge and skills of self-management of environment were improved after performing home-visit education of asthma patients, verifying the effectiveness of education.

However, a research that verifies the effectiveness of indoor environment management education extending to

families of the patient and other members of the community to prevent allergy has not been performed yet in Korea. Researchers attempted to make general public members aware of the importance of environment management, and educate correct methods for indoor environment management, thus preventing asthma and allergy.

## 2. Objectives

The objective of this research is to provide the indoor environment management education program for the asthma patients and their family members and then analyze the effectiveness of the education preventing allergic asthma. More specific objectives of the research are as follows:

- 1) To compare adherence to correct indoor environment management procedures before and after the education.
- 2) To compare amounts of house dust mite antigen before and after the education.
- 3) To compare allergy perceived subjective symptom scores before and after the education.
- 4) To compare knowledge score about correct indoor environment management before and after the education.

## RESEARCH METHODS

### 1. Research design

A pre-post single group quasi-experimental design was used on the intervention group (58 households) to verify the effectiveness of education of indoor environment management.

Procedures were as follows. During the home-visits in April 2002, pre-test was first taken, and immediately after the pre-test, a 40-minute education session was held. At one week and three weeks after the education, reinforcement education was conducted through a phone interview. Post-test took place after 4 weeks, in May 2002.

### 2. Subjects and data collection

Subjects included families of 29 patients residing in Seoul who had been diagnosed as and receiving outpatient treatment for allergic asthma at Y University Hospital in Seoul for at least a year as of April 2000. It also included 29 adjacent families of patients' families without allergy patients, introduced by the patients. In total, 58 households were convenient sampling method selected for the study.

For pre-investigation before the initiation of education program, in April 2002, questions about level of knowledge on indoor environment management methods and presence of perceived subjective symptoms related to allergy within the family were asked in interviews with housewives of each household, and then house-dust was collected. For post-investigation, second visits were made 1 month after the education and questionnaires about adherence to indoor environment management method, level of knowledge and presence of perceived subjective symptoms of allergy within the family were completed. Then house-dust was also collected at the same time.

### 3. Instruments

#### 1) Education program for indoor environment management method

A booklet about correct guiding principles of indoor environment management was developed after a consultation with a specialist in allergology. Contents of the education booklet were composed of effectiveness of indoor environment pollution on health, major inducing factors of allergy and symptoms, environment and bedding management method for lounge, bathroom and living rooms.

Education program was delivered to housewives in normal families, without asthma patients and to both patients and housewives in families with asthma patients, using this booklet in a forty-minute session for each household. During home-visits, major problems with indoor environment in each household were noted down. Then on the first and third weeks after the education, the researcher who visited homes conducted phone interviews to reinforce the contents taught at home-visits and also management problems of each household.

#### 2) House dust mite antigen

HDM allergens were collected from 58 households.

A trained investigator visited subject households personally and collected house-dust from lounge (floor, sofa, carpet), bedroom (floor, blanket, bed) and kitchen floor using same vacuum cleaner for the duration of two minutes per meter squared - a method presented at international house-dust workshop (1992). Collected dust was treated according to methods of Chapman et al (1987). Fine house-dust 100mg was put into borate buffered saline (pH 8.0) 2ml and abstracted in lower temperature room (4 °C) for 18 hours, after which supernatant fluid was separated and frozen at -20 °C. Der f I of group I was analyzed using ELISA method.

#### 3) Questionnaire

##### (1) The measuring tool for perceived subjective symptoms of allergy for patients

Subjective symptoms of allergy were collected through patients.

The four categories of perceived subjective symptoms of allergy symptoms were measured after dividing them into 20 category-specific questions (eye - 5 questions, nose - 4 questions, daytime breathing difficulty symptoms - 5 questions, breathing difficulty symptoms during sleep at night - 6 questions) in the questionnaire. The questionnaire was designed so that each degree of symptomatic manifestation for each member of a family could be measured in a Likert scale from 0 (no symptoms) to 4 (frequent occurrence). The higher score indicate, the more severe symptoms are.

##### (2) The measuring tool for indoor environment management method

Carrying out of indoor environment management method in each household was investigated through housewives of each family.

Indoor environment management method was investigated using a questionnaire for house environment on the degree of usual indoor ventilation practice, floor cleaning method and bedding management method.

##### (3) The measuring tool for knowledge on indoor environment management

Knowledge on indoor environment management were investigated through housewives of each family.

The measuring tool for the knowledge on the substances and the management method using 20 questions was developed by the researchers and used after certification by two specialists in allergology. Score range was from 0 (minimum) to 20 (maximum), higher score indicating higher level of knowledge.

### 4. Data analysis

Frequency, %,  $\chi^2$ -test, Wilcoxon Signed Ranks Test, paired t- test were done on the collected data for analysis, using a statistics program - SPSS Win Version 10.0.

## RESULTS

### 1. Demographic characteristics of research subjects.

Looking at demographic characteristics of 58 housewives in 58 households, the age group with most subjects was 30s with 37.9, and there were 2 subjects in their 40s (3.4%). 22 subjects were in university or had gradu-

ated from university (37.9%). The number of people per family was 4 for 28 households (48.3%), and between 5 and 7 for 13 households (22.4%) (Table 1.1).

Looking at demographic characteristics of 29 asthma patients, 16 of them (55.2%) were women, and 8 of them (27.6%) were over 60 years of age. Twelve of them (41.4%) graduated high-school, and all 29 patient subjects had been diagnosed of asthma at least a year ago. (Table 1.2).

## 2. Effectiveness of education about indoor environment management procedures

### 1) Comparison of performance rate before and after correct indoor environment management procedures(N=58)

In indoor environment management, results from analysis of changes in performance rate of correct man-

agement methods (indoor ventilation, cleaning, and bedding management) are as follows.

For indoor ventilation, looking at ventilation frequency, percentage of households ventilating the indoor at least once a day increased from 60% before the education to 96.2% after the education. Looking at the number of hours per ventilation, percentage of households ventilating for more than 2 hours per ventilation increased from 43.6% to 100%. Looking at indoor floor cleaning, households using both vacuum cleaner and a mop increased from 0% to 92.9%.

For bedding management, percentage of households washing beddings at least once a month increased from 0% before the education to 100% after the education. Looking at drying method, percentage of households replying 'dry under the sun and then shake off' increased from 47.8% to 90.5% after the education. These differences in performance rate of correct indoor environment management were all statistically significant (Table 2).

### 2) Comparison of amounts of house dust mite antigen before and after the education(N=58)

Adding the amounts of house dust mite antigen in the dust collected from lounge floor, kitchen, adults' room

**Table 1. 1.** General characteristics of Housewives and House (N=58)

Characteristics	Categories	Frequency	%
Age	20s	3	5.2
	30s	22	37.9
	40s	2	3.4
	50s	7	12.1
	Over 60s	10	17.2
	Missing	14	24.2
Education	Under Middle school	10	17.2
	High school	22	37.9
	Over college	22	37.9
	Missing	4	7.0
Family Size	2-3 persons	17	29.3
	4 persons	28	48.3
	5-7 persons	13	22.4
Type of house	Separate	18	31.0
	Town	12	20.7
	Apartment	28	48.3
Location of house	Residential area	54	93.1
	Commercial area	4	6.9

**Table 1. 2.** General characteristics of Asthma patients (N=29)

Characteristics	Categories	Frequency	%
Gender	Male	13	44.8
	Female	16	55.2
Age	20s	4	13.8
	30s	6	20.7
	40s	5	17.2
	50s	6	20.7
	Over 60s	8	27.6
Education	Under Middle school	7	24.1
	High school	12	41.4
	Over college	10	34.5

**Table 2.** Comparison of Indoor environment managements(N=58)

Area of indoor environment managements	Specific methods	Categories	Pre-Tx. (%)	Post-Tx. (%)	$\chi^2/p$	
Ventilation	Frequency	No attention	40	3.8	7.893/.015	
		Over 1 times per day	60	96.2		
	Duration (1 times)	Under 2 hours	56.4	0		6.622/.012
		Over 2 hours	43.6	100		
Clean method	Use of Vaccum cleaner & wet mop	No	100	7.1	20.893/.000	
		Yes	0	92.9		
Bedding	Frequency	Under 1 times per month	100	0	27.000/.000	
		Over 1 times per month	0	100		
	Dry method of bedding	No attention	52.2	9.5	9.204/.002	
		Dry and shake under sun	47.8	90.5		

and children's room altogether, and then analyzing the average amount of house dust mite antigen of 58 households, revealed that level has been largely reduced from 5.55 µg/g of dust before the education to 1.53 µg/g of dust after the education. However this difference in amount of house dust mite antigen before and after the education was not statistically significant ( $z = -1.562$ ,  $p = .118$ ) (Table 3).

3) Changes in perceived subjective symptoms of allergy patients (N=29)

Perceived subject symptom scores of allergy-related eye symptoms, nose symptoms, daytime breathing difficulty symptoms and nighttime breathing difficulty symptoms were calculated and scores before and after the education were compared. Before the education the score was 8.17, but after the education it was reduced to 5.67, and this difference was statistically significant ( $t = 3.377$ ,  $p = .001$ ) (Table 4).

4) Comparison of knowledge about indoor environment management methods before and after the education (N=58)

When subjects' knowledge level of indoor environment was measured at times of baseline, 1 month, 3 months and 6 months after the education, baseline average scores were 14.2, and 16.3 at 1 month after the education, and 16.8 at 3 months after the education. This is a statistically significant increase from the pre-education level score of 14.2. However, average score after 6 months the education was slightly lowered with 15.7 (Table 5).

DISCUSSION

Since nearly 80% of sensitization cases of allergy asthma patients are induced by indoor antigen such as house dust mite, cockroaches and epithelia of pets, it is very important to manage these indoor antigens effectively. For house dust mite, it is advisable to maintain at a level lower than 100 per 1g of house-dust (group I allergen < 2 µg/ 1g of dust). To do this, bedding must be covered with

fabrics which antigen cannot penetrate, bedding and blankets must be washed weekly in warm water (higher than 55°C), and floor must be cleaned with a vacuum cleaner and a wet mop once or twice a week. It is also important to make indoor environment clean through ventilation in order to reduce factors known to worsen asthma symptoms such as smoke from cigarettes, acidic aerosol, nitrogen oxygen.

Researchers provided guidelines to practice such correct indoor environment management by carrying out education program themselves through home-visit. Then by measuring changes in performance rate of correct indoor environment management, level of knowledge and amount of house dust mite antigen in beddings, researchers partially confirmed that education has influence on reducing the environmental factors of allergic asthma.

Education of subjects were shown to be more effective when visual aids such as book, picture and video that participants themselves can explain and refer to are appropriately utilized according to the education level and provided repeatedly, rather than uniform education method (Kim S.G et al., 2000). This research, considering such factors, provided printed materials on ventilation, cleaning and bedding management methods for each of lounge, bedroom and kitchen. Then subjects were educated to understand the material, as well as confirming weaknesses of each household and offering guides for improvements. As a result, performance rate of correct indoor environment management showed statistically significant improvement, and practice was especially improved for indoor ventilation, use of vacuum

Table 3. Comparison of amount of HDM allergen (Der fl) (Unit: µg/ 1 g of dust) (N = 58)

Time	Min	Max	Mean ± SD	Wilcoxon Signed Ranks Test (z/p)
Pre-Tx	.00	57.80	5.55 ± 16.16	- 1.562/.118
Post-Tx	.00	26.40	1.53 ± 3.18	

Table 4. Mean score of perceived subjective allergy symptoms (N = 29)

Time	Min	Max	Mean ± S.D	paired t-test (t/p)
Pre-Tx	.00	74.00	8.17 ± 14.18	3.38/.001
Post-Tx	.00	68.00	5.67 ± 12.35	

Table 5. Knowledge score about Indoor environment managements (N = 58)

Pre-Tx	Post-Tx		
	1 month after	3 month after	6 month after
Knowledge score of baseline	16.3	16.8	15.7
Paired t-test(t/p) (Baseline-post Tx.)	- 5.82/.000	- 6.63/.000	- 3.82/.000

cleaners and appropriate bedding management. Such results are consistent with Song (2002) which offered education through home-visits, supporting the notion that education through home-visits are effective in improving practice of indoor environment management.

When amounts of house dust mite antigen from same bedding dust were compared before and after the education, the difference was not significant. Nevertheless amount of house dust mite antigen were markedly reduced from  $5.55\mu\text{g}$  before the education to  $1.53\mu\text{g}$  after the education, showing an objective result that subjects managed beddings appropriately. If the house dust mite level is higher than  $2\mu\text{g}$  per 1 gram of dust, asthma patients start to be sensitized by house dust mite.

On the other hand, the type and the amount of house dust mite have direct effects on manifestation and aggravation of symptoms in allergic patients (Moon & Choi, 1998). Researchers, considering this point, investigated the changes in perceived subjective symptoms of allergy in subjects' family members before and after the education. The result was lowering of the symptom scores from average of 8.17 to 5.67 after the education, which was statistically significant difference. Although perceived subjective symptoms of allergy are not directly influenced by simple factors such as reduction in amounts of house-dust mite antigen, appropriate indoor environment management, these results can be thought as effects of education having positive influence on the research outcome.

Since the ultimate purpose of the research is on improving the self management skills by behavioral change, this research checked the immediate understanding of the education material by examining changes in knowledge level. Results showed that scores measured at 1, 3 and 6 months after the education all showed statistically significant improvement, and these results are consistent with results from Cote et al (2001) and Song (2002). To find out how long subjects remember the education material, investigations took place with the same questionnaire at 3 and 6 months after the education. It was shown that knowledge level starts to decrease at 6 months after education, supporting the results of Kim et al (2000) who claimed the necessity for continuously repeated education.

In order to reduce morbidity and mortality due to asthma, sufficient education of the patient and the family are needed (Pyeon, 1996). In an American research by Conway et al. (1999), it was reported that there was

no difference in knowledge on aggravating factors and symptoms of asthma between families with an asthma patient and normal families, making reference to the need for education. Also, a research by Kim et al. (2002) suggested a need for a publicity of detailed prevention and management methods to make the indoor environment pleasant since residential environment characteristics and management methods have an influence on the amount of house dust mite. Starting with this research which proved the effects of educating indoor education management methods on general public for allergic asthma prevention, there will be a need for continuous publicity and education in order to reduce the prevalence of allergic asthma.

Until now, nurses have been extending the role as an educator providing health information in hospitals and local community. Even so, the focus of education is still on subjects' coming to visit' and not on 'going to visit' subjects. For nurses to continue expanding their role and keep a firm place as a medical professional in present world where there are diversification of medical service and increasing desire of subjects to learn, primary prevention level education which will contribute in health improvement of citizens will need to be stressed.

## CONCLUSIONS AND RECOMMENDATIONS

This research is a pre-post single group quasi-experiment that provided an education program about correct indoor environment management to a total of 58 households (29 patient households and 29 normal households) and then compared performance rate of correct indoor environment management procedure, amount of house dust mite antigen, allergy subjective symptoms score and knowledge score about indoor environment management before and after the education, confirming the effectiveness of the education.

Results of the research are as follows.

1) In performance rate of correct indoor environment management procedure, for ventilation frequency households ventilating the indoor at least once a day rose from 60% before the education to 96.2% after the education, and for duration of ventilation households ventilating for at least two hours each time rose from 43.6% to 100%. For floor cleaning, households using both vacuum cleaner and a wet mop increased from 0% to 92.9% after the education. For frequency of washing beddings, households washing beddings at least once a month rose from

0% to 100% after the education, and households' drying under the sun and then shaking off dust rose from 47.8% to 90.5% after the education. All of the changes were statistically significant.

2) Amount of house dust mite antigen reduced from 5.55  $\mu\text{g/g}$  of dust before the education to 1.53  $\mu\text{g/g}$  of dust after the education. However, this difference was not statistically significant. ( $z=-1.562$ ,  $p=.118$ ).

3) When total scores for perceived allergy subjective symptoms were calculated and compared, average score dropped from 8.17 before the education to 5.67 after the education, and this difference was statistically significant. ( $t=3.377$ ,  $p=.001$ ).

4) When level of knowledge regarding indoor environment was measured, average scores were as follows: 14.2 before the education, 16.3 at 1 month after education, 16.8 at 3 months after education, and 15.7 at 6 months after education. These increases from before the education score were statistically significant. However, at 6 months after education there was a drop from the score at 3 months after the education.

In conclusion, home-visit education in this research had effects in improving subject households' performance rate of indoor environment management procedures, reducing the amount of house dust mite antigen - an important inducing factor of allergy, and reducing perceived subjective symptoms of allergy. Also, knowledge about education material showed tendency to decrease, confirming the need for periodically repeated education.

This research can have significance as a research that investigated effects of objective education and showed importance of presenting evidence of behavioral change rather than simply measuring the increase in knowledge through education.

Researchers would like to make a few suggestions on the basis of the research results.

1) We suggest a publicity of indoor environment management methods for allergy-related diseases at a national level.

2) We suggest investigating the effect that indoor environment has on health of general public other than allergy-related diseases.

3) We suggest developing various strategies to reduce environmental factors that can induce allergy.

4) We suggest tracking the households that have performed correct indoor environment management methods and those that have not, and then investigate and compare the prevalence of allergy-related diseases in

these two groups of households.

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