Original Article

The Prevalence of Asthma and Allergic Diseases in Middle School Students and Related Environmental Factors

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Abstract

Objectives: As the prevalence of allergic diseases increases proportionately in Turkey, they retain their importance as diseases of childhood. The aim of this study was to determine the prevalence of asthma, allergic rhinitis and eczema in middle school students, and the related environmental factors.

Methods: The sample of this cross-sectional study consisted of 1083 students in the 13-15 age group in Izmir province, Turkey in 2015. In the study, the International Study of Asthma and Allergies in Childhood (ISAAC) form that tested for validity and reliability in Turkish by Bulduk and Esin (2009) was used.

Results: The mean age of the students (n: 1083) was 13.4±0.73 (min: 11, max: 16) years, and 48.9% were female. The rate of asthma diagnosed by a doctor among the students was 3.8%; for allergic rhinitis the rate was 32.4% and for the diagnosis of eczema it was 4.1%. The risk factor for doctor-diagnosed asthma, allergic rhinitis and eczema in the students was smoking in the house, gender, a history of asthma or allergy in the family and the existence of damp in the house.

Conclusions: The frequencies of symptoms of asthma, allergic rhinitis and eczema found in this study were higher than those reported in other epidemiological studies in Turkey. It is recommended that asthmatic and allergic children should be identified by screening tests included in school health services that students should be given information, and referred to health institutions, and that necessary preventive measures should be taken in the school environment.

Keywords: Asthma, eczema, rhinitis, ISAAC, childhood, prevalence.

Introduction

Asthma is a chronic inflammatory lifelong disease of the lungs affecting individuals at any age (World Allergy Organization 2013; The Global Asthma Report 2014). Asthma is the 14th most important disease in the world in terms of duration and degree of disability. According to the latest data, there are 334 million people in the world with asthma (The Global Asthma Report, 2014). The increase in the prevalence of asthma is parallel to that of eczema and other allergic diseases such as allergic rhinitis (Masoli et al, 2004; Yuksel et al, 2008). These three illnesses have been considered together in several epidemiological studies using the ISAAC form (Bulduk and Esin, 2009; Kabir et al, 2011; Arslan et al, 2012; Cetemen and Yenigun, 2012; Solis-Soto et al, 2013; Kamali et al, 2014; Bascioglu et al, 2015).

According to the ISAAC II study, there had been slight increases in the prevalence of asthma, in the 13-14 year age group from 13.2% to 13.7%, and in the 6-7 year age group from 11.1% to 11.6% (World Allergy Organization, 2013). In the world as a whole, asthma prevalence has been found to be 6.4% and 17.6% in Tanzania (Shimwela et al, 2014), 15.3% in Ireland (Kabir et al, 2011), 5.3% in India (Sharma et al, 2012), and 4.9% in Iran (Tavacol et al, 2015).

In Turkey, asthma is a disease commonly encountered in both children and adults, and 3-4 million people are estimated to have asthma in the country. However, the reporting system provides insufficient data, and information on asthma is obtained from research conducted locally (Umut and Saryal, 2010). The prevalence of asthma found in studies conducted in various regions of Turkey using the ISAAC questionnaire found rates of 1.9% in Sanliurfa (Zeyrek et al, 2006), 17.1% in Istanbul (Bulduk and Esin, 2009), 10.1% in Sivas (Arslan et al, 2012), 11.0% in Aydın (Cetemen and Yenigun, 2012), 31% in Izmir (Kamali et al, 2014) and 11.9% in Erzurum (Bascioglu et al, 2015).

Considering that children spend at least six hours a day in school, it plays an important role not only in their academic performance but also in the development of their health. Asthma and its complications may affect a student's health and education performance.

In America it is reported that one child in 11 up to the age of 17, that is seven million children, has a problem with asthma. This resulted in student absences in 2008 to a total of 10.5 million days of absence from school. Students were absent from school for such reasons as going to the doctor, staying in hospital, avoiding environmental triggers at school, night asthma attacks and loss of sleep. In addition, symptoms of asthma and asthma attacks can have negative effects on learning and limit students' participation in class activities, physical education and school events (World Allergy Organization 2013; National Institutes of Health 2014).

This study was conducted with middle school students in the 11-15 year age group in the district of Bornova in Izmir province, with the aim of determining the prevalence of asthma, allergic rhinitis and eczema and related factors.

Methodology

Study Population

The research was planned as a descriptive and cross-sectional study. The population of the study consisted of the 5452 students in the 13-15 year age group in classes 7 and 8 at the 38 middle schools in the centre of the province of Bornova, Izmir.   Five of these schools were included in the sample by a process of simple random sampling. In the literature, the frequency of asthma in children of this age is seen to vary from 2.1% to 17.1%. According to this, it was calculated that the capacity of the sample could be between 168 and 680 (Erdogan et al, 2014), but all 1180 of the students at the schools were included. Finally, the study was completed with 1083 students participating voluntarily with a participation rate of 91.5%. Data collection was performed by handing out the forms in bulk to students in class in 2015 in the period January-March, when symptoms of asthma and allergic diseases are seen to be widespread.

The necessary institutional permission was obtained to conduct the study from the ethics committee of Ege University Nursing Faculty and from the Izmir directorate of the National Education Ministry. The aims and methods of the study were explained in interviews with the heads of the schools where it was to be conducted.   Before collecting data, an explanation was given to the students on the aims of the study. Oral approval was obtained from students who took part voluntarily in the study.

Measurements

A descriptive characteristics form prepared by the researchers according to the literature and the Turkish version of the ISAAC questionnaire developed by Asher et al. (1995) were used in the collection of data (Asher et al., 1995). Validity and reliability testing of the Turkish version of this form, developed for children in the 13-14 year age group, was performed by Bulduk and Esin (2009).

Identifying Characteristics Form: This consisted of questions on age, gender, school class, parents' educational levels, monthly income level of family, type of house, number of rooms in the house, number of people living in the house, smoking, allergies, allergies among family members, type of fuel used for cooking and heating, the presence of damp in the house,

animals kept in the house, and smoking in the house.

The International Childhood Asthma and Allergy Study Data Collection Form: This form consists of three sections and a total of 20 questions assessing symptoms of asthma (eight items), allergic rhinitis (six items) and eczema (six items). Questions on the form are to be answered Yes or No. The total score is calculated for the form, and each question is evaluated separately.

Statistical Analysis

In evaluating the data obtained in the study, the program SPSS (Statistical Package for Social Sciences) for Windows 15.0 was used, and the distribution of the data was calculated using numerical, percentage and mean values and standard deviations. Chi-square tests and logistic regression analysis were used. Results were evaluated with a confidence interval of 95% and the level of statistical significance was taken as $p<0.05$ (Erdogan et al, 2014).

Results

Table 1 shows findings relating to the students' identifying characteristics. The mean age of the students was 13.4 ± 0.73 (min: 11-max: 16); 49% were female and 51% were male. It was found that 46.1% (n: 499) were in class 7, and 53.9% (n: 584) were in class 8. 33.6% of their mothers were educated to middle school level, and 34.8% of their fathers were educated to high school level. More than half of the families of the students had a medium income level. Only 1.9% of the students stated that they smoked, and 28 students left this question unanswered. 19.1% of the students had family members with asthma or allergy problems. 33.7% of the students were allergic to some substance. The environmental factors which caused the most allergies in the students were, in order of importance, pollen (21.9%), house dust (7.9%), and animal hair (4.3%).

Table 2 shows the characteristics of the students relating to the place where they lived. The proportion of students living in a house where an animal (dog, cat or bird) was kept was 29.5%. 40.4% of the students reported that tobacco was smoked in the house, and 16.8% stated that the house had been damp within the last year.74.6% of the students lived in a flat.

Table 3 shows findings relating to symptoms of asthma, allergic rhinitis and eczema in the students. 3.8% of the students had been diagnosed with asthma by a doctor. The three most frequently seen symptoms of asthma were found to be a dry cough in the past 12 months (35.5%), previous shortness of breath or tightness of the chest (35.3%), and shortness of breath or tightness of the chest in the past 12 months (26.3%). The proportion of those who had been woken from sleep by shortness of breath in the previous 12 months was 8.7%. The proportion of students who had had difficulty speaking because of shortness of breath in the previous 12 months was 8.2%, and the proportion of those who had experienced shortness of breath while exercising was 24.0%. It was found that 35.5% of the students had had a dry cough without having a cold or flu etc. in the previous 12 months, and 32.4% had had complaints of blocked nose, running nose and sneezing not arising from a cold, flu, etc. The proportion of students reporting watering eyes with a blocked nose, a running nose or sneezing in the past 12 months was 17.3%. The students reported that they experienced these problems most in October (9.9%), July (8.0%), January (6.7%), and February (6.6%). 24.8% of the students who had experienced blocked nose, running nose or sneezing in the previous 12 months stated that their daily activities had been affected to a great or very great extent. Also, half of the students (50.1%) had experienced a high fever in the previous 12 months. 4.1% of them had received a diagnosis of eczema from a doctor, and 7.3% of the students had had an itchy skin rash lasting for more than six months. 5.6% of the students had had an itchy skin rash in the previous 12 months. 50.8% of these students had had an itchy skin rash in such parts of the body as the elbow, the wrist, the heel, the neck or ears, or around the eye. In 27.9% of these students there had been an intensification of the skin rash. In addition, approximately 34.4% of the students stated that they had been woken from sleep by itching. 61.9% of these students were woken less than once a week, and 31.1% were woken more than once a week.

Logistic regression analysis was carried out to determine the most important factors affecting the symptom of constant wheezing or tightness of the chest from among all the symptoms of asthma (Table 4).

Table 4 gives the results of logistic regression analysis conducted with the aim of determining the effects of individual, family and environmental risk factors on medically diagnosed asthma, allergic rhinitis and eczema. Significant risk factors determined were smoking in the house (p=0.028, OR=0.56, 95% CI=0.30-1.06) for medically diagnosed asthma, gender (p=0.008, OR=1.38, 95% CI=1.07-1.78), smoking in the house (p=0.000, OR=0.64, 95% CI=0.50-0.83), the presence of allergy in the family (p=0.014, OR=0.73, 95% CI=0.53-1.01), and the presence of damp in the house (p=0.031, OR=0.79, 95% CI=0.56-1.12) for rhinitis, and smoking in the house (p=0.046, OR=1.98, 95% CI=0.98-3.93) and a history of asthma or allergy in the family (p=0.012, OR=0.42, 95% CI=0.22-0.81) for eczema.

Table 1. Distribution of Students' Identifying Characteristics (n=1083)

Characteristics	n	%
Class		
Class Seven	499	46.1
Class Eight	584	53.9
Gender		
Female	531	49.0
Male	552	51.0
Mother's education level		
Illiterate	36	3.3
Primary school	304	28.1
Middle school	**364**	**33.6**
High school	319	29.5
University	60	5.5
Father's education level		
Illiterate	13	1.2
Primary school	231	21.3
Middle school	337	31.1
High school	**377**	**34.8**
University	125	11.5
Income level		
Low	45	4.2
Medium	**679**	**62.7**
Good	359	33.1
Smoking		
Yes	21	1.9
No	1034	95.5
No answer	28	2.6
Family history of asthma or allergy		
Yes	**207**	**19.1**
No	876	80.9
Allergy to any substance		
Yes	365	33.7
No	718	66.3
Environmental factor causing allergy		
Pollen	**237**	**21.9**
House dust	**86**	**7.9**
Animal hair	**47**	**4.3**
Sunlight allergy	24	2.2
Classroom chalk	16	1.5
Other (food, medicines, cleaning or makeup substances, processed food, eggs, cigarette smoke, etc.)	83	7.7

**Table 2. Distribution of students' characteristics relating
to their home environment (n=1083)**

Home environment characteristics	n	%
Keeping a pet		
Yes	**321**	**29.6**
No	762	70.4
Smoking in the house		
Yes	**438**	**40.4**
No	645	59.6
Type of house		
Flat	**808**	**74.6**
House with garden	252	23.3
Illegally-built house	23	2.1
Evidence of damp in the house		
Yes	182	16.8
No	901	83.2
Total	**1083**	**100.0**

Table 3. Prevalence of Asthma, Rhinitis, Eczema and Related Symptoms in the Students (n=1083)

Asthma and related symptoms	n	%
Shortness of breath or tightness of the chest in the past	382	35.3
Shortness of breath or tightness of the chest in the past 12 months	285	26.3
Waking up because of shortness of breath in the past 12 months	95	8.7
Shortness of breath enough to hinder speaking in the past 12 months	89	8.2
Doctor's diagnosis of asthma	41	3.8
Shortness of breath while exercising in the past 12 months	260	24.0
Dry coughing without a cold, flu, etc. in the past 12 months	384	35.5
Symptoms relating to rhinitis		
Blocked nose / running nose / sneezing not related to a cold, flu, etc.	351	32.4
Blocked nose / running nose / sneezing not related to a cold, flu, etc. in the past 12 months	283	26.1
Watering eyes with blocked nose, running nose or sneezing in the past 12 onths	187	17.3
Daily activities affected by blocked nose, running nose or sneezing in the past 12 months	234	82.7
Fever in the past 12 months	543	50.1
Symptoms relating to eczema		
Itchy skin rash on the body lasting more than six months in the past	79	7.3
Itchy skin rash on the body in the past 12 months	61	5.6
Itchy skin rash on the elbow, wrist, heel, neck, ear or around the eyes in the past	31	50.8*
Intensification of these skin rashes in the past 12 months	17	27.9*
Waking from sleep because of this itching in the past 12 months	21	34.4
Doctor's diagnosis of eczema	44	4.1

*Calculated from students who reported itchy skin rash on the body in the previous 12 months.

Table 4. Distribution of Risk Factors Relating to Students' Allergic Illnesses in the Previous 12 Months

	Asthma				Allergic Rhinitis				Eczema			
	Yes	(%)	No	(%)	Yes	(%)	No	(%)	Yes	(%)	No	(%)
Gender												
Female	20	3.8	511	96.2	191	36.0	340	64.0	24	4.5	507	95.5
Male	21	3.8	531	96.2	160	29.0	392	71.0	20	3.6	532	96.4
OR (95%CI)*	0.99(0.53-1.85)				1.38(1.07-1.78)				1.26(0.69-2.31)			
p**	0.551				**0.008**				0.277			
Smoking in the house Yes No	23 18	5.3 2.8	415 627	94.7 97.2	169 182	38.6 28.2	269 463	61.4 71.8	12 32	2.7 5.0	426 613	97.3 95.0
OR (95%CI)*	0.56(0.30-1.06)				0.64(0.50-0.83)				1.98(0.98-3.93)			
p**	**0.028**				**0.000**				**0.046**			
Pets in the house Yes No	14 27	4.4 3.5	307 734	95.6 96.5	103 248	32.1 32.6	218 513	67.9 67.4	10 34	3.1 4.5	311 727	96.9 95.5
OR (95%CI)*	0.89(0.46-1.73)				1.09(0.82-1.45)				1.45(0.70-2.99)			
p**	0.315				0.466				0.196			
Allergy in the family Yes No	12 29	5.8 3.3	195 847	94.2 96.7	81 270	39.1 30.8	126 606	60.9 69.2	15 29	7.2 3.3	192 847	92.8 96.7
OR (95%CI)*	0.61(0.30-1.23)				0.73(0.53-1.01)				0.42(0.22-0.81)			
p**	0.074				**0.014**				**0.012**			
Damp in the house Yes No	11 30	6.1 3.3	170 872	93.9 96.7	70 281	38.7 31.2	111 621	61.3 68.8	11 33	6.1 3.7	170 869	93.9 96.3
OR (95%CI)*	0.61(0.29-1.26)				0.79(0.56-1.12)				0.55(0.27-1.14)			
p**	0.066				**0.031**				0.101			

*OR:Odds ratio (at 95% Confidence Interval)   p Chi-square test, p<0.05**

Discussion

Asthma is a serious and universal health problem, affecting all age groups (GİNA, 2015). Asthma, as a widespread childhood health problem, has been the subject of a large number of studies in Turkey and other countries. In our country, asthma rates have varied from 1.9% to 31% (Zeyrek et al, 2006; Yuksel et al, 2008; Bulduk and Esin, 2009; Arslan et al, 2012; Cetemen and Yenigun, 2012; Kamali et al, 2014; Bascioglu et al, 2015). In studies in other countries on the topic, the prevalence of medically diagnosed asthma has been reported as 4.9% in Iran (Tavacol et al, 2015), 6.4% in Tanzania (Shimwela et al, 2014), 7.2% in Thailand (Sritipsukho et al, 2015) and 5.3% in India (Sharma et al, 2012). In this study the prevalence of medically diagnosed asthma was found to be 3.8%. The prevalence of asthma found in this study was low compared to that found in some other studies (Bulduk and Esin, 2009; Kabir et al, 2011; Arslan et al, 2012; Cetemen and Yenigun, 2012; Kamali et al, 2014; Shimwela et al, 2014; Bascioglu et al, 2015), and similar to others (Zeyrek et al, 2006; Tavacol et al, 2015). It is thought that the reasons for these differences may arise from regional differences, as well as a large number of cultural, environmental and behavioral factors.

In some studies conducted in the western regions of Turkey, higher rates of asthma were reported than in eastern areas (Bulduk and Esin, 2009; Kamali et al, 2014). Among the reasons for this high prevalence of asthma may be a differing

sociocultural structure, living conditions, and increasing levels of environmental and especially air pollution.

Allergic rhinitis is a common complaint in schoolchildren and one of the diseases which accompanies asthma (Bascioglu et al, 2015; Sritipsukho et al, 2015). In this study, the self-reported rate of constant blocked nose, running nose and sneezing of the students was 32.4%. In similar studies, rates of allergic rhinitis were found to be 36.2% in Erzurum (Bascioglu et al, 2015), 15.08% in Kayseri (Ozkiris, 2010), 25.2% in Sivas (Arslan et al, 2012), 14.5% in Manisa (Yuksel et al, 2008), 42.4% in Aydın (Cetemen and Yenigun, 2012), 22.2% in Bolivia (Solis-Soto et al, 2013) and 32.8% in Thailand (Sritipsukho et al, 2015). In this study as in the literature, the months with the most complaints of allergic rhinitis in children were January, February, September and October. In the study by Bulduk and Esin (2009), the months when the most symptoms of allergic rhinitis were seen were reported to be January, February and March (Bulduk and Esin, 2009).

The fact that the present study was conducted in winter is thought to be the reason for the significantly high rate of allergic rhinitis found. Also, Izmir is at a low altitude near the sea and has a large amount of agricultural land, so that environmental factors such as humidity and plant cover may have contributed to the variety and amounts of allergens.

Eczema is one of the most commonly seen skin diseases, which starts in early childhood and has a negative effect on the quality of life of children and their families. Studies have shown it to be a widespread problem of school-age children. The rate of prevalence of eczema in Turkey has been found to be 4.7% in Manisa (Yuksel et al, 2008), 3.6% in Erzurum (Bascioglu et al, 2015), 4.1% in İstanbul (Bulduk and Esin, 2009), 28.3% in Sivas (Arslan et al, 2012) and 2.8% in Aydın (Cetemen and Yenigun, 2012).

In studies conducted in other countries, rates have been found of 9.2% in Bolivia (Solis-Soto et al, 2013) and 13.2% in Ireland (Kabir et al, 2011). In the present study, the rate of medically diagnosed eczema in the children was 4.1%, and this is similar to the results of many studies conducted in this country (Yuksel et al, 2008; Bulduk and Esin, 2009; Cetemen and Yenigun, 2012; Bascioglu et al, 2015).

In studies conducted in Turkey it is reported that the commonest allergic disease accompanying asthma is allergic rhinitis, and that this occurs at a rate of approximately 60% (Turan et al, 2013). One of the individual risk factors for childhood asthma is male gender.   The prevalence of asthma in boys below the age of 14 is reported to be approximately twice that of girls. The gap closes with increasing age, and in adults, asthma is more frequently seen in women (GİNA, 2015).

Analyses have not shown a difference in the prevalence of eczema and asthma according to gender, but the prevalence of allergic rhinitis is reported to be higher in girls. In a study by Arslan et al. (2012) in Sivas, it was similarly found that there was no difference in the prevalence of asthma between boys and girls.

Different from these results, a higher prevalence of asthma was found in boys in Manisa (Yuksel et al, 2008) and in Iran (Tavacol et al, 2015), and in girls in Aydın (Cetemen and Yenigun, 2012). In the present study, similar to the results of the study conducted by Yuksel et al. (2008) and Cetemen and Yenigun (2012), the prevalence of allergic rhinitis was found to be significantly higher in girls than in boys. Different from the present study, the studies conducted in Manisa (Yuksel et al, 2008) and in Aydın (Cetemen and Yenigun, 2012) found the prevalence of eczema to be higher in girls. It is thought that these differences may arise from the effect of gender and environmental factors together, and from the way the students perceived their problems.

Cigarette smoking is the most widespread trigger of asthma.   Passive and active smoking are among the most important variables playing a role in asthmatic diseases with a mixture of particles and gases (CDC, 2016). In the study, 1.9% of the students stated that they smoked, and 40.4% that cigarettes were smoked in the house.

However, no difference was found between the prevalence of asthma in children according to whether smoking took place in the house, but the prevalence of allergic rhinitis and eczema was significantly raised. In a study conducted in Iran by Tavacol et al. (2015), smoking in the house was found to be a risk factor for asthma (Tavacol et al, 2015).

Also, it has been established in various other studies that smoking in the house is a risk factor

for allergic rhinitis (Solis-Soto et al., 2013) and eczema (Cetemen and Yenigun, 2012).

It is thought that these different results may arise from the levels at which children are exposed to the smoke and smell of cigarettes in relation to the amount, place, time and duration of smoking.

The literature shows that the hair of domestic animals may be a risk factor for allergic diseases (Turan et al, 2013; GİNA, 2015). In the present study, it was established that 29.6% of the students had animals in their houses. However, no difference was found in the prevalence of asthma, allergic rhinitis or eczema between those with animals and those without.

In Turkey (Zeyrek et al, 2006) and in Iran (Tavacol et al, 2015), studies have similarly shown no significant difference in the frequency of occurrence of asthma with regard to animal keeping.

Different from this, Solis-Soto et al. (2013) found that keeping animals in the house increased the frequency of occurrence of allergic rhinitis. It is felt that in this study, inquiry into possible related variables such as the length of time and frequency of family members' contact with animals and the place where the animals are kept might have affected the results in this way.

Asthma is a chronic disease in which genetic susceptibility plays a part (Turan et al, 2013). In a wide-ranging epidemiological study conducted in Turkey, family atopic history was found to be a risk factor in the occurrence of asthma (Turktas et al, 2001). In the present study, 19.1% of the students had a history of asthma or allergic disease in their families, but this was found not to affect the occurrence of asthma.

The reason for this may be that it is under the control of environmental factors. On the other hand, it was found, in accordance with the literature, that a family history of allergy was a risk factor for eczema (Zeyrek et al, 2006; Cetemen and Yenigun, 2012; Kamali et al, 2014; Tavacol et al, 2015), and allergic rhinitis (Cetemen and Yenigun, 2012).

The presence of mold connected with a high level of damp in the house may be a cause of asthma (Turan et al, 2013). It was stated by 16.8% of the students participating in the study that there had been damp in their houses in the previous 12 months, and it was found that the prevalence of allergic rhinitis was higher in these students, but that there was no significant difference in asthma and eczema. Cetemen and Yenigun (2012) similarly found that the presence of damp in the house affected the frequency of occurrence of allergic rhinitis.

It is thought that the fact that this study was a questionnaire study relying on self-reporting and that the amount of damp in the houses was not measured may have affected the results in this way. This study has some limitations. Data collected in the study relied on the students' self-reporting, and because the students were in the period of puberty, the way they perceived their health may have affected the accuracy of the responses which they gave. Another limitation of the study may be that the students' reports were not supported by medical examination or laboratory results.

In conclusion, in this study the prevalence of asthma and allergic diseases were frequently found. Significant risk factors were smoking in the house for medically diagnosed asthma, gender, smoking in the house, the existence of allergy in the family and damp in the house for rhinitis, and smoking in the house and a family history of asthma or allergy for atopic dermatitis.

Because allergic diseases are a health problem which has a negative effect on students' health, success at school and school attendance, students should be periodically screened for early diagnosis as part of school health programs.

These should be conducted in the months when the symptoms are at their most noticeable. Particular attention should be paid to those with a history of allergy, girl students, students from houses where cigarettes are smoked, and those from lower socioeconomic backgrounds whose houses may be thought to be damp, as risk groups.

Public health nurses and school health nurses should inform students and their parents about allergic diseases and passive smoking. Cross-sectional studies for the early diagnosis of allergic diseases in school-age children and research to evaluate the factors affecting allergic diseases in the school environment should be planned. Evidence-based studies could be conducted on the development of disease management skills in students with allergy problems.

Acknowledgements

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