DETERMINANT FACTORS ASSOCIATED WITH ALLERGIC RHINTIS IN A HOUSING DEVELOPMENT COMMUNITY AT BANG KHEN DISTRICT, BANGKOK, THAILAND

Pattaraporn Piwong, Nutta Taneepanichskul*

College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand

ABSTRACT: One-fourth of people worldwide have suffered from Allergic rhinitis (AR). Allergic rhinitis is caused regularly by exposure to allergens from outdoor and indoor environment. This study aimed to identify the AR risk factors related to home environment among people who resided in housing development community in Bang Khen district, Bangkok, Thailand during April 2014. Self-reported questionnaires were distributed to all households in this community. Twenty persons reported that they had been diagnosed as AR by physician. Based on 200 self-reported questionnaires, our analysis revealed statistical association between 15 risk factors related to home environment and AR. For instance, using perfume/ deodorant spray (OR = 4.43), using cockroach spray (OR = 7.00), growing flower in home environment (OR=1.88) and presenting mold inside house (OR=1.63) were risk factors of AR. Using vacuum and air cleaner (OR=3.12 and 7.76) were protective factors. For personal behavior of people residing in this community, opening windows frequently was a protective risk factor for AR. Moreover, the higher number of windows in the living room was also considered as a protective risk factor (OR=0.26). In addition, respiratory dust in 20 AR cases' houses and 10 non-allergic rhinitis (Non-AR) cases' houses were collected. However, the difference of respiratory dust concentration between AR and Non-AR houses was not found in this study (Mann-Whitney U test; p> 0.05).

Keywords: Allergic rhinitis, Housing development, Home environment factors, Thailand

INTRODUCTION

Allergic rhinitis (AR) affects 10% –25% of people worldwide, therefore this disease has become a universal health problem [1]. AR is the main common in allergic disorder. The standard of symptoms are sneezing, watery eye, runny nose, nasal obstruct and itchy nose or ears [2]. AR is harmful effects for health, daily life activities and quality of life for people who suffered. AR is related with some critical diseases such as asthma. Prevalence of AR in many countries around the world is around 4% to 40% [3]. In 1997 the prevalence of AR among Thai people is 20% [4]. Unfortunately, the prevalence of AR had increased continuously year by year in developed and developing countries. Some factors related to AR came from lifestyle which changed, so this reason may increase the exposure to allergens, irritant (smoke) and pollutant [5]. Previous studies showed that increasing of prevalence of AR around the world, Especially Thailand also should have more demand to conduct research to prevention and treatment of this disease [6]. AR is caused regularly by exposure to the allergens from outdoor and indoor environment such as pollens, pets, house dust and mites. There is accumulating evidence that environmental factors and genetic are important roles in the etiology of AR. The previous study showed that indoor air pollutants exposure is related to the raise of AR risk in children [1]. We can reduce of allergy symptoms by avoidance from

* *Correspondence to: Nutta Taneepanichskul*
E-mail: nutta.t@chula.ac.th

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allergen [7]. Home environment is a potential for people who need a special health such as allergies. To understand cause of AR related with indoor environments can help the household residence to have a better health.

Bangkok is the capital of Thailand where has 5,673,560 residents and 2,459,679 houses approximately [8]. Some houses located in Bangkok area have housing factors such as house dust, mold, pollen which can be caused directly to AR. While many studies have been studied about AR around the world, but had a few studies which related housing factors association with AR in Thailand. So Thailand should have more demand to conduct research to prevention and treatment of Allergic rhinitis. So, this study was conducted to identify housing characteristics, housing factors related to AR of people who lived in a housing development, Bangkok, Thailand. To the greatest of my knowledge, the result of this study would help necessary information for a community to improve an environment of housing resident in Bangkok to decrease exposure with factors related to allergic rhinitis more or less.

MATERIALS AND METHODS

People who residing in Chiyapluek village, Bang Khen district, Bangkok, age between 18-60 years, lived in this village more than 6 months was included in this study.

Data were collected during April, 2014. The validity and reliability tested for questionnaire. The content validity for questionnaire was reviewed by 3 experts in related field. Item Objective Congruence Index (IOC) score was 1.00 from the experts. To test reliability, the draft of questionnaire pretested 30 subjects in the other area of housing development community in Bangkok before data collection period. The score of reliability was 0.824. The questionnaire developed from The International Study of Asthma and Allergies in childhood [9] The questionnaire divided in 4 parts consists of; *Part 1:* Personal Characteristics, there are 14 questions to asked participants about their personal profile which include gender, age, education, occupation, exercise, sleep sufficiently and smoking history. *Part 2:* Allergic rhinitis screening, there are 2 questions to asked participants about medical history of allergic rhinitis and pattern of medical care of allergic rhinitis for themselves. *Part 3:* General housing Information and Housing factors related to allergic rhinitis, there are 16 questions to asked participants include characteristic of house such as housing information, factors in the house that related to allergic rhinitis. and *Part 4:* Bedroom, Living room and Kitchen Characteristics, there are 40 questions to asked participants about furniture that they used in each rooms and action of participants to take times in each room.

After distributed a structured questionnaire to all of houses (400 houses) in this village, the researcher got returned of questionnaire were 200 from head of household response, the response rate of returned questionnaires was 50 % [10]. So, the participants of study were 200, divided in 2 groups-allergic rhinitis and non-allergic rhinitis cases. The researcher found that in 200 participants had allergic rhinitis 20 cases and 180 were non-allergic rhinitis cases.

Respiratory dust collection

The personal air pump was collected respiratory dust during bedtime period (8 hours) at 10 pm – 6 am of participants' bedroom on weekday. The bedroom represents an environment where the participants spend a significant portion of time. We collected respiratory dust for 8 hours because participants spent around 8 hours for sleeping period. Totally, 30 respiratory dust samples were collected. Twenty samples were collected from AR cases' bedroom and other 10 samples were collected from non-AR cases' bedroom which was represented for non-AR cases.

To collected respiratory dust was followed National Institute of Occupational Safety and Health (NIOSH) Method No. 0600 [11]. Briefly, the Aluminum Cyclone (37 mm – Cat No. 225-01-02, SKC) with a plastic filter casset loaded with 37mm, 1.6 μm pore size, glass membrane filters was connect to a personal air sampler pump (model AirChek 52, SKC). The air flow rate used for collecting respiratory dust was 2 liters per min. The filter sampling used gravimetric analysis. Pre weighed of filter was done before placed in the filter cassette. After end of sampling period, all of 30 filters were taken to post weighed check at the laboratory.

Data analysis

Data analysis was used SPSS program (Chulalongkorn University's license) for windows and applied Chi-square test, with a level of significant considered (p-value= 0.05, 0.01) to evaluated the relationship between personal characteristics, housing characteristics , bedroom, kitchen, living room characteristics ,housing factors related with AR. In addition, Odd ratio was applied to find an association between home environment factors and AR. The Mann -Whitney U test was

Table 1 Personal characteristics of AR and Non- AR cases (n= 200)

Personal characteristics	AR		Non- AR		χ^2	*P - value*
	n	%	n	%		
Age (years)						
18 – 49	13	65	118	65.6	0.002	0.960
≥ 50	7	35	62	34.4		
(Mean 42.86,SD 10.47						
Min 20,Max 60)						
Gender						
Male	9	45	74	41.1	0.112	0.738
Female	11	55	106	58.9		
Education						
Less than bachelor degree	1	5	10	5.6		
Bachelor degree	12	60	118	65.6	0.323	0.851
Master degree and higher	7	35	52	28.9		
Number of people in house						
2 - 3 people	10	50	72	40	0.744	0.388
4 - 6 people	10	50	108	60		
(Min 2 , Max 6)						
Smoke history						
Yes	2	10	23	12.8	0.127	1.000
No	18	90	157	87.2		
Other member in house smoking						
Yes	2	10	28	15.6	0.436	0.744
No	18	90	152	84.4		
Exercise regularly						
Yes	9	45	115	63.9	2.726	0.099
No	11	55	65	36.1		
Adequate sleep						
Yes	15	75	126	70	0.216	0.642
No	5	25	54	30		

used to find the different of median of respiratory dust between allergic rhinitis's houses and non-allergic rhinitis's houses.

For respiratory dust concentration calculation, the equation was modified from NIOSH method 006 [11], as following:

$$C = \frac{(W_2 - W_1)}{V}.10^3, \text{mg/m}^3$$

Where: C = concentration of respiratory dust (mg/m3); W1 = pre-weight of filter before sampling (mg); W2 = post-weight of sample filter after sampling (mg); V= air volume as sampled at the flow rate 2 lite/min for 8 hours.

Ethical aspects

This research project obtained an approval to conduct a study in human by the Ethical review Committee of Chulalongkorn University (COA. No. 051/2557)

RESULTS

Personal characteristics

Personal characteristics of AR and Non-AR cases in the study were distributed and AR cases were female 55%, male 45% ,age between 18-49 years 65% and Non-AR cases were female and male 58.9%, 41.1%, age 18-49 years 65.6%,more than 60 % of both cases were bachelor degree. There was no association between personal characteristics and AR in Table 1.

Hosing factors and housing characteristics related to AR

The results of housing factors and housing characteristics which association with AR in this study were found in Table 2. There were 15 variables of housing factors and housing characteristics which related to AR among people who living in a housing development community. The odds ratio used to determine whether a particular exposure as a risk factor of AR in this study. Others variables that were not statically significant were showed in Table 1 and 2.

Housing factors related to AR

Majority of AR cases use perfume or deodorant spray in their house (85%) and Non-AR cases use only 56.1%. The result shows there was association between AR and use perfume or

Table 2 Housing factors and housing characteristics related to AR

Factors	AR		Non-AR		*P-value*	Odds ratio	95% CI	
	n	%	n	%			lower	upper
Housing factors								
1. Use perfume or deodorant spray								
Yes	17	85	101	56.1	0.013*	4.43	1.25	15.66
No#	3	15	79	43.9		1		
2. Use cockroach insecticide spray								
Yes	15	75	54	30	0.000**	7.00	2.42	20.22
No#	5	25	126	70		1		
3. Flower								
Yes	16	80	73	40.6	0.001**	5.86	1.88	18.24
No#	4	20	107	59.4		1		
4. Mold inside house@								
Yes	16	80	3	30	0.015*	9.33	1.63	53.20
No#	4	20	7	70		1		
Housing characteristics								
5. Use vacuum in house								
Yes#	16	80	101	56.1	0.040*	1	1.01	9.72
No	4	20	79	43.9		3.12		
6. Use air cleaner in house								
Yes#	3	15	4	2.2	0.023*	1	1.60	37.60
No	17	85	176	97.8		7.76		
7. Frequency of use air cleaner in house per month								
1-5 times#	3	100	2	50	0.008**	1	2.45	100.59
>5 times	0	0	2	50		15.70		
8. Number of windows in bedroom								
1-5 windows#	11	55	159	88.3	0.001**	1	0.06	0.43
> 5 windows	9	45	21	11.7		0.16		
9. Use air cleaner in bedroom								
Yes#	3	15	2	1.1	0.008**	1	2.45	100.59
No	17	85	178	98.9		15.70		
10. Clean air cleaner in bedroom lately (months ago)								
1-3 months ago#	2	66.7	1	50	0.027*	1	1.71	230.22
>4 months ago	1	33.3	1	50		19.88		
11. Number of windows in living room								
1-5 windows#	7	35	122	67.8	0.004**	1	0.09	0.67
>5 windows	13	65	58	32.2		0.256		
12. Frequency of open windows in living room								
≥ 3 times per week#	17	85	100	55.6	0.011*	1	1.28	16.10
< 3 times per week	3	15	80	44.4		4.53		
13. Open windows when stay in living -room (hours)								
1-5 hours#	17	85	100	55.6	0.011*	1	1.28	16.10
>5 hours	3	15	80	44.4		4.53		
14. Type of windows in kitchen								
Single and double glazing*	15	75	86	47.8	0.021*	1	1.14	9.40
Secondary windows	5	25	94	52.2		3.27		
15. Open windows when stay in kitchen (hours)								
1-6 hours#	16	80	93	51.7	0.016*	1	1.20	11.63
>6 hours	4	20	87	48.3		3.74		

P-value from Chi-square test, ** significant at 0.01 probability level,* significant at 0.05 probability level, @ Data of observation form, # Reference group

deodorant spray (p=0.013). We found that use perfume or deodorant spray associated positively with AR as increases risk of this disease OR 4.43 (95% CI 1.25 to 15.66). Concerning use cockroach insecticide spray 75% of AR cases used it but Non-AR cases use 30%. There was association between use cockroach insecticide spray and AR (p=0.000) and found use cockroach insecticide spray in a house increase risk to be AR OR = 7.00 (95% CI 2.42 to 20.22).

Table 3 Association between respiratory dust concentration of AR and Non-AR cases (n= 30)

Median of respiratory dust (0.14 µg/m^3)	AR n (%)	Non-AR n (%)	*P-value**	Odds ratio	95% CI	
					Lower	Upper
< 0.14 µg/m^{3*}	8 (40)	7(70)	0.121	1	0.69	17.71
> 0.14 µg/m^3	12(60)	3(30)		3.50		

* *P-value* from Chi-square test, * Reference group

Eighty percent of AR cases had flower in their house area, a statically significant p=0.001 of association between flower and AR. The result shows had a flower in house area as increase risk of AR OR = 5.86 (95% CI 1.88 to 18.24).

Concerning of mold inside house area of AR, most of them had mold 80% inside their house. In Non-AR cases had mold inside house area only 30%, when compared of both cases we found an association between mold inside house and AR (p=0.015). As a mold inside house can increase risk of people who exposure with it to be AR OR = 9.33 (95% CI 1.63 to 53.20).

Housing characteristics related to allergic rhinitis

In general housing characteristics, AR cases use vacuum in their house 80% and did not use 20%, in Non-AR cases did not used vacuum 43.9%. The statically significant of AR and use vacuum in house p = 0.040. The result shows that did not used vacuum in a house as a risk of AR 3.12 times than used vacuum (OR 3.12, 95% CI 1.01 to 9.72). Use air cleaner in a house also association with AR (p=0.023). To AR and Non-AR cases, did not use air cleaner in house increase risk of AR 7.76 times than used it (OR 7.76, 95% CI 1.60 to 37.60). All of AR cases used air cleaner 1-5 times per month, half of Non-AR cases used air cleaner more than 5 times per month. There was association between frequency of use air cleaner in house per month and AR (p=0.008, OR 15.70, 95% CI 2.45 to 100.59). The results show more likely to increase risk of AR when used air cleaner more than 5 times per months (number 7 in Table 2). According to the previous number 6 in Table 2, there are 7 of 200 participants answer "YES" on using cleaner question. So, this question has only 7 participants who can answer.

Regarding to bedroom characteristic, there was significant association between a number of windows in bedroom and AR at p=0.001 respectively. The result found that the number of windows in bedroom more than 5 windows can less risk to be AR when we compared in both cases (OR 0.16 95% CI 0.06 to 0.43). Use air cleaner in bed room also associated with AR (OR 15.70, 95% CI 2.45 to 100.59) which the result same solution as frequency of used air cleaner in house per month (number 7 in Table 2). We found a positive association of clean air cleaner in bedroom lately (months ago) and AR (p=0.027). There was increased risk to be AR 19.88 times when clean air cleaner more than 4 months ago (OR 19.88, 95% CI 17.1 to 230.22).

Living room characteristics, there was association between number of windows in living room and AR (p=0.004).We found the number of windows in living room more than 5 windows can less risk to be AR when we compared in both cases (OR 0.25, 95% CI 0.09 to 0.67). For frequency of open windows in living room, AR cases they opened ≥ 3 times per week 85% and Non-AR cases 55.6%. When compared cases who had frequency of open windows ≥ 3 times per week, cases who open windows less than 3 times per week are more likely to be risk of AR with OR 4.53 (95% CI 1.28 to 16.10). And association between open windows when stay in living room (hours) and AR was found p= 0.011, OR 4.53, 95% CI 1.28 to 16.10. Also Open windows when stay in a kitchen (hours) was associated with AR (p= 0.016, OR 3.74, 95% CI 1.20to 11.63.

The difference of Mean of respiratory dust concentration of AR and Non-AR cases

After collected respiratory dust form bedroom of 30 participants' houses (AR 20 cases and Non-AR 10 cases), for AR cases Mean of concentration of respiratory dust was 0.17±0.10µg/m3 and Non-AR cases Mean of concentration of respiratory dust was 0.13 ±0.16µg/m3. Test the difference of mean of concentration of respiratory dust in AR and Non-AR cases by used Mann- Whitney U test the results show that there was no difference between respiratory dust concentration of in both case.(p-value = 0.146)

Association between respiratory dust concentration of AR and Non-AR cases

The following Table 3 showed the details of median of respiratory dust concentration of AR and Non-AR cases was 0.14 µg/m3, so we found that there was no association between respiratory dust concentration and AR (p=0.121, OR 3.50, 95% CI 0.69 to 17.71). The researcher used the median value to be criteria for investigating as a risk factor

because the respiratory dust concentrations data is non-parametric, the median is needed to be use. So, we assumed the median figure to be a cut-point for the concentrations to separate to 2 groups.

DISCUSSION

Mainly purpose of this study was to find an association between housing factors, housing characteristics and AR in a housing development community, Bang Khen district, Bangkok, Thailand. The presented of discussion divided in 4 parts

1. Personal characteristics

In the study after analysis personal characteristics the data, almost of AR cases age 41-60 years (60 %) and gender was female (55%) more than male (45%) and no association between age, gender with AR. The results consistent with study in Bangkok [12], from that gender wasn't risk factor of AR disease. And in this community found less of smoker both of AR and Non-AR cases less than 13% which that's the reason why we found less AR case in the study because they had a healthy practice for their life when people not exposure with smoke that can decrease the factor develop to AR. The same as previous study [13] in Brazils and Higgins [14], the results suggest that if avoidance secondhand smoking we can reducing AR. Also we found an association between use perfume or deodorant spray and AR ($p< 0.05$) these was consistent with the study in Vietnam [15] perfume as a risk factor to be AR. Because when people exposure to perfume or spray many times that substances can trigger of illness.

2. Housing factors related to AR

Housing factors was important factors that many affected to AR cases. As study about housing factors related to AR of all participants, more than 60% had a cockroach in their house but in AR cases 75% of them used cockroach insecticide spray to get rid of cockroach. So that found used cockroach insecticide spray related to AR in strongly significant ($p <0.001$) this result same as study of [15] that exposure to fume or spray can cause of AR. From now that easier to buy a cockroach insecticide spray in supermarket or anywhere in Bangkok, so when people in this community wanted get rid of cockroach problem, used cockroach insecticide spray that easy way to do it. On the other hand that increases a chance to exposure with factor related to AR as they are not considerable (OR 7.00 95% CI 2.42 to 20.22). Even finding from this study cockroach was not association with AR as normally cockroach as one factor related with AR. However might have possible confounder such as participants did not exposure with body and feces of cockroach as an allergen of AR directly which this study not look at this problem.

Pollen [16], the study result revealed 80% of AR cases have a flower in their house area as a risk factors to AR ($p=0.001$,OR 5.86 95% CI 1.88 to 18.24). Pollen as one potential cause of AR and effect from pollen depends on a humidity and weather condition. As Thailand has hot, humidity weather as placed in the tropical zone which had many kind of pollen from various kind of flower and plants might be found in the air all of the year. So we can suggests to people in this community that they can avoid pollen by stay in indoors if as possible when the wind blows and try to close the windows during the wind blows. Also mold as visible mold which researcher's observation shows the result there was association between mold inside house and AR ($p<0.05$). We found 80% of AR cases in house area found visible mold in their house. Accordingly this study consistent with previous study [17] which the result shows significant ($p<0.05$) association between visible mold and AR. Same as one the study in USA [18] which reported 10% of participants in the study were positive with mold allergen and 34% of participants had dampness/mold in their home. So give a knowledge to people in this community about improve their home environment and get rid of mold problem such as clean up the mold and fix the water leakage in the house because mold can growth in moisture indoors.

3. Housing characteristics

From the association point of AR and general housing characteristics, we found 80% of AR cases used vacuum and association between AR and used vacuum statically significant at ($p<0.05$). Because most of AR case always used vacuum to reduced dust in their house [19]. Which difference from Non-AR cases used vacuum only 56.1%. While AR cases known how to reduce the factors of AR from their houses but Non-AR cases not realized as expected could lead to be risk of AR in the future (OR 3.12, 95% CI 1.01 to 9.72). Therefore give knowledge and suggestion for people about decrease exposure to house dust in the housing development community is necessary to do soon as possible. Also did not use air cleaner in house more likely to be risk of AR as OR 7.76 (95% CI 1.60 to 37.60). Because use air cleaner with highly effective at particle removal can decrease house dust or particular in a house and good ventilation.

From frequency of used air cleaner in house of this study, used more than 5 times per months associated positively with AR as OR 15.70, 95% CI 2.45 to 100.59. Normally, less times of used air cleaner can increase risk to be AR such as studied of [20] that people use air cleaner every day in their home more than 70% to improved indoor air quality but the result showed used air cleaner more than 5 times as increase risk of AR . Nevertheless, people who used air cleaner more than 5 times might have more risk of AR such as they did not clean air filter of air cleaner less 4 times per years [21] as a possible confounder that researcher did not mention in this study. In association point of clean air cleaner in bedroom lately (month ago) there was positive significant with AR (OR 19.88 95% CI 1.71 to 230.22). People who clean air cleaner in bedroom more than 4 month ago as high risk to be AR because they did not clean the filter every 3 months. Type of windows in kitchen was other one factor that we found an association between AR with OR 3.27, 95 %CI 1.14 to 9.40, because single and double glazing window did not have space between primary window and secondary window as the secondary windows which possibly to collected area of dust or pollen if an occupant did not clean it that could lead to be AR.

4. Respiratory dust in bedroom and AR

From the respiratory dust concentration which collected in bed rooms house of AR and Non-AR cases. The result was not found a difference of mean of respiratory dust concentration in AR and Non-AR (p-value =0.146). An association of respiratory dust and AR was not found from this study also, respiratory dust concentration was lower than the standards when collected in a housing resident [22]. However, the study might have possible confounding factor such as location of the housing area, number of occupants and their activity, ventilation system in a house such as we collected respiratory dust in air conditioning system in bed room all time of collected period. So that affected respiratory dust concentration in a housing resident. The result was consistent with previous study in Malaysia [23] which no difference of respiratory dust concentration between each houses which collected in the study and respiratory dust concentration was below the recommended indoor air quality standard (150µg /m^3 in 8 hours).

CONCLUSION

Concerning the hypothesis test of the study, there was an association between housing factors, housing characteristics and AR in people who living in a housing development in Bang Khen district, Bangkok, Thailand. But the difference of Mean of respiratory dust concentration of AR and Non-AR, association between AR and respiratory dust concentration in this study was not found. The results of this study suggested that health knowledge and suggestions for improve of house environment to occupants in this community that important to help an occupants avoid to exposure with AR factors in a house area. Moreover, community awareness should be considered to decrease risk to be AR in the future.

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