

**PREDISPOSING FACTORS FOR THE DEVELOPMENT OF BRONCHIAL  
ASTHMA IN CHILDREN UNDER 15 YEARS OLD IN YEREVAN, ARMENIA  
A CASE-CONTROL STUDY**

Masters of Public Health Thesis Project Utilizing Professional Publication  
Framework

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<b>Table of content</b>	
Summary .....	iii
Background information/Literature review .....	1
<b>Situation in Armenia</b> .....	3
Description of the study .....	5
<b>Objectives of the study</b> .....	5
<b>Research questions</b> .....	5
<b>Study design</b> .....	5
<b>Target and study population</b> .....	6
<b>Definition of cases and controls</b> .....	6
<b>Sample size</b> .....	7
<b>Data collection</b> .....	7
<b>Study instrument</b> .....	8
<b>Study variables</b> .....	9
<b>Data analysis</b> .....	10
<b>Ethical considerations</b> .....	10
Results .....	11
Discussion .....	18
<b>Study strengths and limitations</b> .....	21
Recommendations.....	22
References. ....	24
Appendices.....	27
<b>Appendix 1</b> .....	27
<b>Appendix 2</b> .....	28
<b>Appendix 3</b> .....	35
<b>Appendix 4</b> .....	43
<b>Appendix 5</b> .....	53
<b>Appendix 6</b> .....	54
<b>Appendix 7</b> .....	55

## Summary

The objective of the study was to determine some of the predisposing factors for the development of bronchial asthma in children under 15 years of age in Yerevan and the research questions asked by the study were: are children with family history of bronchial asthma prone to develop the disease in childhood?; is there an association between exposure to indoor allergens and risk of the development of bronchial asthma in childhood?

To answer the research questions a case-control study with one control for each case was chosen. Estimated sample size was equal to 134 participants for cases and controls each. Target population was children of Yerevan, Armenia, suffering from bronchial asthma. Cases were chosen from “Arabkir” Medical Center and controls were chosen by RDD (Random Digit Dialing).

Telephone interviews with the interviewer-administered questionnaire were used for data collection procedures.

Refusal rate was equal to 3% among cases and to 5% among controls.

The outcome (dependant) variable was the confirmed diagnosis of bronchial asthma and the main covariates (independent variables) were family history and environmental factors.

Potential confounders, such as age, gender and family monthly income as well as interactions were considered in the analysis.

Study has revealed statistically significant association between family history on bronchial asthma ((OR=24.66; 95% CI [2.9-282.8]; p-value=0.004); presence of many old books in the library (OR= 4.03; 95% CI [1.7;9.1]; p value= 0.001); and absence of conditioning/ventilation system in the household (OR= 5.66; 95% CI [2.5-12.8]; p value=0.000) and the risk of the development of bronchial asthma.

Main study limitations were: selection, instrumentation, recall and information biases.

Based on the results of the study it is recommended to prepare and provide an educational program for mothers of children with bronchial asthma with the emphasis on indoor allergens and their management strategies at home and conduct broader further research to determine the full list of the indoor allergens contributing to the development of the disease in Yerevan, Armenia.

## **Background information/Literature review**

Numerous attempts have been made to define asthma precisely over the past two decades. The definition proposed by the National Heart, Lung and Blood Institute of the United States of America states that: “asthma is a lung disease manifested symptomatologically with airway obstruction that is reversible, although incomplete in some patients, either spontaneously or with treatment; airway inflammation; and airway hyperresponsiveness” (1). According to the World Health Organization: “bronchial asthma is a respiratory disorder, characterized by recurrent attacks of breathlessness and wheezing, usually of allergic origin, which varies in severity from person to person” (1).

Asthma and allergies can have a major impact on the quality of life of the affected children and their families. Moreover, a severe asthma crisis is a medical emergency (2). Presence of clinical symptoms, such as wheezing, shortness of breath, cough, chest tightness; increased bronchial responsiveness and reduced levels of air-flow parameters on lung function measurements; increased levels of total and allergen-specific immunoglobulin-E creates a basis for the confirmation of the diagnosis of bronchial asthma (2).

The worldwide morbidity and mortality rates due to bronchial asthma are estimated to be 100 -150 million and 180,000 people respectively (1). More recent studies suggest that as many as 300 million people of all ages and all ethnic backgrounds suffer from bronchial asthma and the burden of the disease is increasing significantly worldwide (3). The economic costs associated with bronchial asthma are estimated to be approximately \$14. 5 billion (1). This disease is now number one among chronic diseases in children. In the USA 5 million children suffer from bronchial asthma (1). In Australia, one child in six under the age of 16 is affected and in Brazil the prevalence of asthma symptoms in children ranges from 20 to 30% (1). Asthma is a 25-th leading cause of disability-adjusted life years lost worldwide in 2001 (DAYLs are equal to  $15.0 \times 10^6$  in comparison with the highest of  $98.4 \times 10^6$  for perinatal

conditions and with the lowest of  $12.0 \times 10^6$  for the iron deficiency anaemia) (3). WHO recognizes bronchial asthma as a disease of a major public health importance worldwide.

Development of bronchial asthma is strongly associated with genetic predisposition, individual immune system responses and various environmental exposures, such as dust and dust mites, cockroaches, horse, dog and cat hair, feathers, wool carpets, blankets and clothing, synthetic bedding, molds, pollen, cigarette smoke, diesel exhaust and so forth (4, 5, 6). Indoor air pollution became a factor of great importance since people in industrialized countries spend over 80% of their time indoors (7). It is known that family history is the strongest risk factor for the development of asthma and this fact has been proved by genetic studies on the molecular level (8). But environmental factors and changes in habits and lifestyle are also important in the development of asthma (8). However, “the evidence can be confusing, controversial and even contradictory” (8). Several studies support the hypothesis that asthma and other allergic disorders are multifactorial diseases brought about by various familial and environmental factors (9, 10). However, not everyone agrees with this conclusion as some suggest that genetic predisposition is the strongest risk factor (11, 12). On the other hand, the same scientists consider that environmental influences play a significant role in the development of bronchial asthma and propose this as a new line for investigation. At the same time, many worldwide studies confirm that, due to the development of industrial technologies, the immune system has become more sensitive to the increased number of environmental factors, leading to greater exposures that begin to exceed individual thresholds (13). As a result, individuals with the parental history, who never showed any symptoms of the disease, have acquired bronchial asthma as well (14). It is necessary to recognize risk factors for the development of asthma and to appreciate the role of gene-environment interactions. Preventive measures established at an early age may modify the natural history of asthma and other allergic diseases (15).

Furthermore, some scientists report that in addition to genetic and environmental risk factors socio-economic factors are also associated with bronchial asthma in childhood (16).

Based on these results, various intervention programs are suggested in order to decrease the risk of the development of bronchial asthma, caused by different environmental factors, especially during childhood (17). Some of them propose multifaceted intervention programs, showing a significant reduction in the risk of the development of the disease in high-risk children (18). Some of them suggest individualized, home-based, comprehensive environmental interventions that significantly reduce asthma-associated morbidity (19).

Several worldwide initiatives exist that are aimed to decrease morbidity and disability due to asthma all over the world. WHO collaborates in ISAAC (International Study of Asthma and Allergies in Childhood) and, more specifically, in the implementation of the study in developing countries in the areas of severe air pollution. A primary objective is to obtain information on the prevalence of bronchial asthma and then to find an association between childhood asthma and air pollution in as many countries as possible. First results of this study show the prevalence of asthma symptoms to vary from 1.6% to 36.8% in different countries involved in ISAAC (1).

In 1992, WHO and the US-based National Heart, Lung and Blood Institute jointly formed the Global Initiative for Asthma (GINA) to cut deaths and disability by developing and implementing an optimal strategy for asthma management and prevention. GINA's goal is to build an active network with multiple organizations concerned with asthma to ensure better patient care worldwide (1). Currently, Armenia is not involved in such worldwide initiatives.

### **Situation in Armenia**

In 2002 it was estimated that 10 -12% of all children up to age of 14 in Armenia suffer from bronchial asthma (20). The mortality rate from asthma in the 5 to 34 year olds is



estimated to 0.3 per 100,000 (3). Also, according to available data, proportion of the population with access to essential drugs in Armenia ranges from 50% to 80% without clarification of what sources they are using exactly (3).

Some Armenian public health specialists try to explain high prevalence of respiratory disorders, including asthma, due to the increasing air pollution reported in Yerevan, Armenia in recent years (21). According to the WHO report on air quality and health in different regions of the world, incidence of bronchial asthma as well as congenital malformations in children up to 14 years old is much higher in Yerevan, compared to the republic as a whole (22). It is possible that high air pollution in the city has contributed to this increase. However, additional epidemiological studies are needed to confirm these findings (22).

Although various factors may lead to the development of bronchial asthma in childhood, indoor air pollution remains one of the major problems in Armenia (21). This consideration is supported by different clinicians/allergists working at different clinics/policlinics of Yerevan city (V. B. Akounts, personal communication, September 2001). They believe Armenian population are not open to change their general habits and behaviours, thus contributing to the higher exposures to indoor allergens (A. M. Virabyan, personal communication, May 2005).

There are several educational programs conducted in Armenia regarding general bronchial asthma knowledge and behaviour. In 2002 NGO “Future Family” funded by World Bank, implemented an innovative educational program for physicians who received theoretical and practical knowledge and skills necessary for controlling and assisting people with bronchial asthma (23).

## **Description of the study**

### **Objectives of the study**

The objective of the proposed study was to determine some of the predisposing factors for the development of bronchial asthma in children under 15 years of age in Yerevan. Taking into consideration the lack of such data in Armenia, following study provides great value in the fields of Allergy, Immunology and Public Health. The results can be very useful to develop appropriate recommendations and prevention strategies to decrease asthma morbidity in children. This investigation can also contribute to the advance research in this field.

### **Research questions**

1. Are children with family history of bronchial asthma prone to develop the disease in childhood?
2. Is there an association between exposure to indoor environmental factors and risk of the development of bronchial asthma in childhood?

### **Study design**

To explore predisposing factors in the development of bronchial asthma in children under 15 years of age in Yerevan a case-control study with one control for each case was chosen. This study design was considered more appropriate as it was possible to clearly identify an outcome (presence of bronchial asthma); it was possible to investigate various factors simultaneously and in a very short period of time; there was no risk for study participants; this design required comparatively few subjects; in addition, it was not an expensive study design and it did not require great resources and manpower.

Random sampling methodology by RDD (Random Digit Dialing) chosen for the controls' selection allowed this selection be from the same base population as the cases. Also, this sampling methodology could assure that process of the selection of cases and controls was independent from the approach used to get information about exposure.

### **Target and study population**

Target population of the study was children of Yerevan, Armenia, suffering from bronchial asthma. Study population was children under 15 years of age, residing in Yerevan, Armenia with the diagnosis of bronchial asthma, registered in “Arabkir” Medical Center in the period from January 1995 to September 2005 and those without the disease selected by RDD. Mothers of those children were used as proxies for data collection procedures.

#### *Inclusion criteria*

1. Children born between 1990 and 2004 yy.
2. Yerevan residency.
3. Willingness of the mothers to participate in the study.

#### *Exclusion criteria*

1. Children whose mothers have participated in any educational program regarding management of bronchial asthma.
2. Children who temporarily/permanently live apart from their mothers.
3. Absence of contact information.

### **Definition of cases and controls**

Cases: Children under 15 years of age with the confirmed diagnosis of bronchial asthma, who have undergone treatment at the Allergy Department of “Arabkir” Medical Center during the period from January 1995 to July 2005.

Controls: Children under 15 years of age, residing in Yerevan, whose mothers were chosen by RDD (Random Digit Dialing) during the period from July 15 to September 5.

### **Sample size**

Sample size for both groups (cases and controls) was calculated according to the following formula for the case-control study designs (24).

$$n = \frac{\{z_{1-\alpha/2} \sqrt{2P_2(1-P_2)} + z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)}\}^2}{(P_1 - P_2)^2}$$

$$P_1 = \frac{(OR)P_2}{(OR)P_2 + (1-P_2)} \quad (\text{Proportion exposed in cases})$$

$P_2$  = Proportion exposed in controls

Based on the range for estimated OR for different risk factors from previous researches (1.78-3.24) and on the particular assumptions (Appendix 1), number of cases and controls was estimated to be equal to 134 each. It was decided to perform replacement of study participants (cases and controls) until reaching the required sample size.

### **Data collection**

Data collection procedure commenced in July 2005 at the “Arabkir” Medical Center – Children’s and Adolescents’ Health Institute. Cases were selected from the Allergy and Immunology Department, the only one in the Republic, where official data regarding bronchial asthma and other allergic disorders of children up to 15 years old from all over the country have to be collected. There was an expectation that obtained data would not create bias in terms of residency and socio-economic situation of the families and will give an opportunity to study these characteristics as independent variables as well.

Controls were selected by RDD (Random Digit Dialing). Number of participants was chosen from twelve hamayncks of Yerevan city that was proportionate to the population in each hamaynck in order to get representative sample of controls.

With the agreement to participate in the study, mothers were requested to answer the questions from the questionnaire with the help of interviewer (graduate student). In case there were more than one children aged up to 15 years in the household, last birthday technique was used for the selection of the participant. Telephone interviews were used for data collection procedure. This method of data collection was chosen due to some advantages: accuracy of selecting the respondent; coverage of population (more than 80% of Yerevan households have telephones). It was anticipated that interviews would take place only once and they would last no more than 10 minutes.

### **Study instrument**

An interviewer-administered questionnaire was presented to the mothers of children under 15 years of age with bronchial asthma (cases), who met all inclusion criteria, and those of healthy children (controls) (Appendix 2, 3). Telephone interviews were used for data collection procedures for cases and controls.

The questionnaire was adapted from the questionnaire, prepared and used by Professor A.D. Ado of the former USSR Academy of Medical Sciences, for the patients with allergic disorders (25). Some questions were derived from the recent studies regarding childhood origins of asthma (COAST) that suggested questionnaires for parents of children with bronchial asthma and for children themselves (26). Some questions were added by the investigator.

The questionnaire includes 27 questions, grouped in the five following sections: demographic characteristics, family history, environmental factors, behavioral factors and socio-economic situation.

## Study variables

The outcome (dependent) variable was the confirmed diagnosis of bronchial asthma. The covariates (independent variables) could be divided into 5 groups: family history, environmental factors, smoking status, behavioral factors, and socio-economic status. Summarized information regarding study variables, its names, types and measurement scales are presented in the table below:

*Table1: Description of variables.*

<b>Variable name</b>	<b>Type</b>	<b>Measure</b>
Outcome- <i><b>Presence of bronchial asthma</b></i>	Dependent/Binary	0-controls 1-cases
<i><b>Family history of bronchial asthma</b></i>	Independent/Nominal	0-negative family history of bronchial asthma 1-positive family history of bronchial asthma
<i><b>Indoor environmental factors</b></i>		
Presence of molds in the house	Independent/Binary	0-absence 1-presence
Presence of cockroaches in the house	Independent/Binary	0-absence 1-presence
Type of fuel used for cooking and heating	Independent/Nominal	0-electricity; natural gas 1-stored gas; kerosene; gasoline; wood
Absence of conditioning/ventilation systems in the house	Independent/Binary	0- presence 1- absence
Presence of carpets in the house	Independent/Binary	0-absence 1-presence
Type of bedding	Independent/Nominal	0-synthetic/cotton 1-wool/mixed
Presence of old books in the home library	Independent/Nominal	0-absence of old books 1-presence of some old books 2-presence of many old books
Presence of pets in the house	Independent/Binary	0-absence 1-presence

<i>Smoking status of family members</i>	Independent/Binary	0-absence of smokers 1-presence of smokers
<i>Cleaning habits in the family</i>	Independent/Ordinal	0-cleaning every day; 4-5 times a week; 1-cleaning once per week; once per month; 2-3 times a week; less than once per month
<i>Monthly family income</i>	Independent/Nominal	0-more than 50,000 drams 1-less than 50,000 drams

Based on the results of previous studies, various factors were considered as being potential confounders: age and gender of the child, smoking status of family members and low family monthly income.

### **Data analysis**

Data were entered into the SPSS 11.5 for Windows, where descriptive statistics were performed (frequency tables, cross-tabulations). After appropriate recoding procedures data were imported into the Intercooled STATA 7. Simple conditional logistic regression was used to assess the relationship between each of the independent variables and the outcome variable. Multiple conditional logistic regression was used for controlling potential confounders and for introduction of possible interactions between variables. All statistically significant variables were included in the different models. Parsimonious model was selected with regards to the research questions by Likelihood Ratio test.

### **Ethical considerations**

The study was approved by the Institutional Review Board/Committee on Human Research (IRB) of the American University of Armenia.

Permission for the implementation of the study was received from the head of “Arabkir” Medical Center, A.S. Babloyan (Appendix 4).

All participants were provided with the oral consent form (Appendix 4). As the topic of the study was not sensitive, it did not possess any risk for participants. No identification information was collected during the study. All information provided by the participants will be kept confidential and will be used only by Public Health Department at American University of Armenia to perform final analysis. Results will be presented as aggregated data.

## **Results**

From 163 cases selected from 10-year period, 64 had wrong/no contact information, 3 cases refused to participate in the study. Finally, data were collected from 96 cases. Main reasons for refusals were lack of trust to such kind of studies and lack of time. Replacement of the cases in order to reach the required sample size was not possible as only 10-year archive at “Arabkir” Medical Center was available.

Thus, success/contact rate for cases was estimated to be equal to 59% and refusal rate for cases to be equal to 3%.

357 attempts were done to reach the required sample size of 134 for controls. Four-digit numbers were generated by random number generator of Microsoft Excel Program and added to two-digit area codes of the 12 hamayncks of Yerevan city proportionate to the number of population in each hamaynck. 216 chosen numbers were replaced due to various reasons: invalid residential addresses; temporary phone outages; constant busy telephone lines. 7 controls refused to participate in the study. Main reasons for refusal were lack of time and unwillingness to complete an interview.

Success/contact rate for controls was estimated to be equal to 37.5% and refusal rate to be equal to 5%.

Backward calculation of the power showed decreased from 80% to 73%.



No questionnaire was considered as incomplete as missing responses did not exceed three questions.

Interviews with the respondents lasted 4.5 minutes on average.

Descriptive statistics was performed by the SPSS 11.5 for Windows.

Most cases were representatives of Arabkir (13.5%), Kentron (13.5%) and Malatiya-Sebastiya (12.5%) regions compared to controls from Mashtots (12.7%), Malatiya -Sebastiya (11.2%), Arabkir (11.2%), Nor Nork (11.2%), and Shengavit (11.2%) regions (Appendix 5). Composition of cases and controls by age and gender is summarized in the table below: Description of the main demographic variables as well as information on housing conditions of cases and controls is presented in Appendices 6, 7.

Results have shown that 100% of cases and 99.2% of controls used wool or mixed bedding in their households. There was no difference in cleaning habits among cases and controls as 84.4% of cases and 93.3% of controls preferred mixed type of cleaning (wet-cleaning and vacuum-cleaning). Moreover, 88% of cases and 96.4% of controls performed mixed cleaning of their household no less than 2-3 times a week.

Logistic regression was performed using Intercooled STATA 7 statistical package. Results for simple conditional logistic regression for different variables are presented in the table below:

*Table 2: Unadjusted OR-s, 95% confidence intervals and p-values for all variables*

Variable name	Number (%)		OR	95% CI	p-value
	Cases	Controls			
Family history on bronchial asthma					
1 - Yes	29 (30.5)	3 (2.2)	19.2	5.6-65.3	0.000
0 - No	66 (69.5)	131 (97.8)	1		
Absence of conditioning/ventilation systems in the house					
1 - Yes	68 (70.8)	49 (36.8)	4.16	2.36-7.31	0.000
0 - No	28 (29.2)	84 (63.2)	1		
Presence of molds in the house					
1 - Yes	32 (43.2)	31 (27.4)	1.4	1.1-1.89	0.008
0 - No	42 (56.8)	82 (72.6)	1		
Presence of cockroaches in the house					
1 - Yes	41 (49.4)	30 (26.8)	1.2	0.86-1.67	0.272
0 - No	42 (50.6)	82 (73.2)	1		
Type of fuel used for cooking and heating					
1 - stored gas; kerosene; gasoline; wood	52 (54.2)	53 (39.6)	1.3	0.76-2.19	0.342
0 - electricity; natural gas	44 (45.8)	81 (60.5)	1		
Presence of carpets in the house					
1 - Yes	56 (70.9)	68 (60.2)	0.5	0.21-1.02	0.056
0 - No	23 (29.1)	45 (39.8)	1		
Presence of old books in the home library					
0-absence of old books	19 (28.8)	69 (55.6)	1		
1-presence of some old books	28 (42.4)	49 (39.5)	2.0	1.04-4.12	0.038
2-presence of many old books	19 (28.8)	6 (4.8)	11.5	4.02-32.82	0.000
Presence of pets in the house					
1 - Yes	15 (15.6)	17 (12.7)	1.3	0.6-2.69	0.526
0 - No	81 (84.4)	117 (87.3)	1		
Smoking status of family members					
1 - Yes	57(59.38)	72(53.73)	0.9	0.73-1.18	0.548
0 - No	39 (40.63)	60(44.78)	1		
Monthly family income					

1 - less than 50,000 drams	52 (58.43)	32 (38.1)	2.3	1.24-4.2	0.008
0 - more than 50,000 drams	37 (41.57)	52 (61.9)	1		
<hr/>					
Age of the child					
1 – (0-8 years old)	41 (42.7)	59 (44.0)	1.2	0.61-1.73	0.93
0 – (8-15 years old)	55 (57.3)	75 (56.0)	1		
<hr/>					
Gender					
1 - Male	54 (56.3)	61 (45.5)	1.54	0.91-2.61	1.54
0 - Female	42 (43.8)	73 (54.5)	1		
<hr/>					

According to the results of simple conditional logistic regression, there is a statistically significant increase in the risk of the development in bronchial asthma for some variables.

The higher estimate of the risk is observed for having family history of bronchial asthma (OR=19.2; 95% CI [5.6-65.3]; p-value=0.000). There is a statistically significant association between presence of many old books in the home library and the risk of development of bronchial asthma (OR=11.5; 95% CI [4.02-32.82]; p-value=0.000). Statistically significant association is also observed for the absence of conditioning/ventilation system in the household and the risk of development of bronchial asthma (OR=4.16; 95% CI [2.36-7.31]; p-value= 0.000). Presence of molds in the house also increases the risk of the development of bronchial asthma (OR=1.4; 95% CI [1.1-1.89]; p-value= 0.008). There is a statistical significant association between low family income and the risk of the development of bronchial asthma (OR=2.3; 95% CI [1.24-4.2]; p-value=0.008).

Not statistically significant protective effect of smoking on the risk of the development of bronchial asthma is observed (OR= 0.9; 95% CI [0.73-1.18]; p-value=0.548).

There is no statistically significant association between some environmental risk factors and the risk of the development of bronchial asthma: presence of cockroaches in the household (OR=1.2; 95% CI [0.86-1.67]; p-value=0.272); type of fuel used for cooking and heating

(OR=1.3; 95% CI [0.76-2.19]; p-value=0.342); presence of pets in the household (OR=1.3; 95% CI [0.6-2.69]; p-value=0.526).

Possible interactions and potential confounding between different variables were examined.

Based on the descriptive results of the study (Appendix 6, 7) and the results of the simple logistic regression (Table 2), five factors were considered for potential confounding: gender of the child (male), age of the child (younger), monthly family income (low income), smoking status of the family members (presence of smokers) and family history of bronchial asthma (positive family history).

Distribution of these factors by exposure status was examined among the main environmental exposures that have shown statistically significant association with the outcome in the simple linear regression (Table 2). The results are presented in the Table 3.

*Table 3: Distribution of potential confounders by exposure status among main environmental exposures*

<b>Potential confounders</b>		<b>Main statistically significant environmental exposures</b>					
		Absence of air - conditioning/ventilation system in the house		Presence of many old books in the home library		Presence of molds in the library	
		Number (%)		Number (%)		Number (%)	
		Exposed	Not exposed	Exposed	Not exposed	Exposed	Not exposed
Gender of the child	Male	65 (55.6)	50 (44.6)	54 (52.9)	37 (42.0)	35 (55.6)	80 (47.9)
	Female	52 (44.4)	62 (55.4)	48 (47.1)	51 (58.0)	28 (44.4)	87 (52.1)
Age of the child	0-8 years old	63 (53.8)	56 (50.0)	53 (52.0)	41 (46.6)	37 (58.7)	82 (49.1)
	8-15 years old	54 (46.2)	56 (50.0)	49 (48.0)	47 (53.4)	26 (41.3)	85 (50.9)
Monthly family income	Less than 50,000 drams	59 (62.1)	25 (32.5)	32 (43.2)	26 (41.3)	27 (51.9)	57 (47.1)
	More than 50,000 drams	36 (37.9)	52 (67.5)	42 (56.8)	37 (58.7)	25 (48.1)	64 (52.9)
Yes		60 (51.3)	70 (62.5)	65 (63.7)	46 (52.3)	38 (60.3)	92 (55.1)

Smoking status	Yes	60 (51.3)	70 (62.5)	65 (63.7)	46 (52.3)	38 (60.3)	92 (55.1)
	No	57 (48.7)	42 (37.5)	37 (36.3)	42 (47.7)	25 (39.7)	75 (44.9)
Family history on bronchial asthma	Yes	17 (14.7)	15 (13.4)	16 (15.8)	7 (8.0)	13 (20.6)	19 (11.4)
	No	99 (85.3)	97 (86.6)	85 (84.2)	81 (92.0)	50 (79.4)	147 (88.6)

According to the results age, gender and family monthly income are not equally distributed by exposure status. That is why, it was decided to control for these factors in the further analysis.

Evaluation of crude association between gender and family history on bronchial asthma in controls (OR= 0.38) and association between gender and the risk of development of bronchial asthma in unexposed persons (here, without family history; OR=1.46) as well as comparison with the crude OR (OR= 19.2) of the association between family history on bronchial asthma and risk of the development of bronchial asthma in cases and controls showed that gender modifies the effect of family history on the risk of the development of bronchial asthma. Interaction term was created and was included in the model with other statistically significant variables and confounders.

For the identification of parsimonious regression model, all possible models were tested by Likelihood Ratio test. First model included only family history of bronchial asthma, while in the second model the main environmental exposures were present as well. Interaction term was included in the third model in addition to variables from the previous model. Potential confounders were added to the fourth model.

Table 4. Different multiple logistic regression models: results of Log Likelihood Ratio Test

	Variables included in the model	OR	SE	z	P (z)	95% CI	Log Likelihood test
Model 1	- Family history on bronchial asthma	19.1868	11.99	4.73	0.000	5.636651 65.3111	Chi <sup>2</sup> 39.63 p 0.0000 ?2InL= - 135.57921
	- Family history on bronchial asthma - Presence of many old books in the library - Absence of conditioning/ventilation system in the household	24.78 3.75 5.03	16.62 1.34 1.73	4.79 3.70 4.69	0.000 0.000 0.000	6.6580 92.2733 1.8635 7.5813 2.5620 9.8960	Chi <sup>2</sup> 64.11 p 0.000 ?2InL= -112.803 Compared with Model 1
Model 3	- Family history on bronchial asthma	11.77	8.71	3.33	0.000	2.761 50.2054	Chi <sup>2</sup> 58.52
	- Presence of many old books in the library	3.69	1.33	3.61	0.000	1.8198 7.5182	p 0.000
	- Absence of conditioning/ventilation system in the household	4.99	1.73	4.64	0.000	2.5322 9.8519	?2InL= -110.6364
	- Gender	1.09	.37	0.25	0.008	0.5577 2.1317	Compared with Model 2
	- Interaction between family history and gender						
Model 4	- Family history on bronchial asthma	24.66	33.47	2.67	0.004	2.9043 282.8811	Chi <sup>2</sup> 78.61 p 0.000
	- Presence of many old books in the library	4.03	1.67	3.36	0.001	1.7894 9.1116	
	- Absence of conditioning/ventilation system in the household	5.66	2.35	4.17	0.000	2.5054 12.8046	?2InL= -79.1494
	- Gender	1.2	.048	0.47	0.639	.5490 2.6568	Compared with Model 3
	- Interaction between family history and gender						
	- Age of the child (0-8 years old)	.69	.027	0.91	0.360	.3192 1.5147	
	- Monthly family income	1.44	.057	0.91	0.361	.6573 3.1680	

According to the results of likelihood ratio test ( $\chi^2$  78.61;  $p$  0.0000;  $-2\ln L = -79.1494$ ), the parsimonious model was considered the last one, which included following variables: family history of bronchial asthma, presence of many old books in the library and absence of conditioning/ventilation system in the household. In this model interaction between gender and family history and confounders, such as younger age and low monthly family income were taken into consideration.

According to the best fitting model, risk of the development of bronchial asthma was higher among children who have family history on bronchial asthma in comparison to those without family history, controlled for other variables (OR=24.66; 95% CI [2.9-282.8];  $p$ -value=0.004). Also presence of many old books in the library versus their absence, controlled for other variables was a risk factor for the development of bronchial asthma (OR= 4.03; 95% CI [1.7;9.1];  $p$  value= 0.001). Absence of air-conditioning/ventilation system in the household, controlled for other variables, also increased the risk of the development of bronchial asthma (OR= 5.66; 95% CI [2.5-12.8];  $p$  value=0.000).

This interpretation of the results represents only one approach for data analysis and can not be considered as the best or the final one. There are various approaches to data analysis procedures that can be incorporated in further analysis of obtained data.

## **Discussion**

Study aimed to determine some of the predisposing factors for the development of bronchial asthma in children under 15 years of age in Yerevan revealed that the main risk factors for the development of the disease are family history of bronchial asthma, presence of many old books in the library, and absence of air-conditioning/ventilation system in the household.

Results showing significant association between the risk of development of bronchial asthma and family history were consistent with the results from other studies, conducted in

New Zealand (OR=2.67, 95% CI 1.42-5.02); Iraq (father: OR=3.86, 95% CI=2.54-5.87; mother: OR=8.27, 95% CI=5.21-13.15; sibling: OR=4.33, 95% CI=3.24-5.8) (27, 28).

Moreover, study revealed consistent with other studies fact that gender can modify the effect of family history on the risk of the development of bronchial asthma.

According to the results of the study, presence of many old books in the library was considered as risk factor for the development of bronchial asthma. Sometimes, it is not possible to directly assess presence of such indoor environmental factor such as dust at home and dust-mites in the dust. In such situations, presence of old books in the library can be used as a proxy to determine the approximate level of dust at home as the old books are considered the main source of dust (25). Taking into consideration such a pathway, it could be concluded that findings from current study, showing significant association between presence of many old books in the library and the risk of the development of bronchial asthma, were consistent with the other studies that proved that presence of dust and dust-mites are very strong risk factors for the asthma development. In the literature review report conducted to identify the factors in the indoor environment that have an evidence-based link with the development of bronchial asthma, as a main finding it was stated that “there is currently only reasonable evidence for one causative factor for asthma in the indoor environment and that is house dust mite allergen” (29).

One of the controversial findings was a statistically significant association between absence of conditioning/ventilation system in the house and the risk of the development of bronchial asthma. According to some studies, poor ventilation brings to the great increase in the concentrations of indoor allergens, such as dust mites, cockroaches, and cat and dog allergens, consequently making an influence on the development of bronchial asthma (30). Results from this study were consistent with the opposite point of view, reporting that use of air-conditioning (OR=15.0; 95% CI=1.3-166) can become one of the risk factors for cases of



near-fatal asthma (31). There were many studies indicating strong evidence of causal relationship between exposure to certain indoor allergens and the development of bronchial asthma suggesting controlling proper maintenance of heating, ventilation and air conditioning systems as being major factors increasing the concentrations of allergens in indoor environment (32, 33).

Results of the study regarding socio-economic situation were consistent with other studies (OR=2.32, 95% CI 1.22-4.44) indicating that this factor contributes to the development of bronchial asthma (OR=2.3; 95% CI [1.24-4.2]; p value=0.008) (16). However, while included in the model and being adjusted for other variables, this particular factor showed no significant association.

According to previous studies, presence of visible cockroaches (odds ratio [OR]: 1.30; 95% confidence interval [CI]: 1.07–1.59), mold on walls at home (OR: 1.20; 95% CI: 1.01–1.41) is considered a risk factor for the development of the disease. However, this study revealed an association only with the molds at home (OR=1.4; 95% CI [1.1-1.89]; p-value=0.008).

Another interesting finding was related to the cleaning habits of mothers of children aged up to 15 years. No difference was revealed across cases and controls in cleaning habits as 84.4% of cases and 93.3% of controls prefer mixed type of cleaning (wet-cleaning and vacuum-cleaning). Moreover, 88% of cases and 96.4% of controls perform mixed cleaning of their household no less than 2-3 times a week. These findings were consistent with the results of pilot study conducted in Alaverdi, Armenia, aimed to assess the lead concentrations in dust and soil (34). According to the authors, one of the explanations of low interior lead loading was a cultural factor related to housekeeping habits. It is likely that heavy frequent cleaning of the houses cannot be associated with the risk of the development of bronchial asthma.

## **Study strengths and limitations**

The main strengths of the study can be considered a fact that there were no similar studies conducted in Yerevan, Armenia aimed to explore predisposing factors for the development of bronchial asthma in children under 15 years of age.

The response rates among cases (97%) as well as among controls (95%) were high that also is one of the strengths of the study.

The results of the study showing significant association between the risk of the development of bronchial asthma and some environmental factors can have great practical significance.

However, there are some limitations of the study.

### **1. Selection bias**

“Arabkir” Medical Center – Children’s and Adolescents’ Health Institute is the only one in the country that has an Allergy and Immunology Department, where official data on bronchial asthma and other allergic disorders cases of children up to 15 years old from all over the country have to be collected. Despite this specialized facility many children with bronchial asthma can receive treatment in non-specialized departments at other hospitals. These hospitals were not included in the study and this exclusion can create selection bias.

Also, since cases are representatives of Yerevan city, thus generalizability of the study results to children population of Armenia would be limited.

### **2. Recall bias**

Some questions included in the questionnaire required good memory to be answered correctly, thus, problem of recall bias could arise during data collection procedure and further analysis of the results. In order to minimize recall bias, after pre-testing of the questionnaire, the number of questions requiring good recall was minimized.

### **3. Instrumentation bias**

The study instrument was adopted from the questionnaire suggested by A. D. Ado in 1976 that has been widely used for case histories of patients with allergies throughout former USSR Republics and still is used in some of them (25). Some questions were derived from the recent studies regarding childhood origins of asthma (COAST) that recommended questionnaires for parents of children with bronchial asthma and for the children themselves (26). Some questions were added by the investigator. There is a valid expectation that the adopted questions from existing questionnaires and those included to reflect the situation in Armenia are valid for this investigation.

#### 4. Information bias

Misclassification of the exposure can take place while asking the question regarding family history on bronchial asthma. In order to minimize bias, clear definition of bronchial asthma and explanation of the term - confirmed diagnosis of bronchial asthma, was provided by the interviewer.

### **Recommendations**

The study demonstrated evidence that family history is of prime significance in the risk of the development of bronchial asthma. At the same time, exposure to some indoor environmental factors plays an important role in the development of the disease.

Those who are involved in the care of young children should be prepared to recognize risk factors for the development of bronchial asthma and to appreciate the role of gene - environment interactions. Preventive measures established at an early age may modify the natural history of asthma.

Taking into consideration study limitations and controversial points in comparison with other study results broader further research in this field is necessary to determine the full and precise list of the indoor allergens contributing to the development of bronchial asthma in

Yerevan, Armenia. The main focus of the further research have to be put on more narrow list of exposures, accompanied by some diagnostic measurements (concentration of dust). Also it is necessary to include in the study more prevalent cases to minimize recall bias as well as residual confounding. Broad selection of the study participants would help to get more representative sample and to make the results of the study generalizable.

The results of that study can become a basis for the inclusion of the Republic of Armenia in such worldwide initiatives as ISAAC and GINA. However, nowadays, it can be recommended to prepare and provide an educational program for mothers of children with bronchial asthma with the emphasis on indoor allergens and their management strategies at home.

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## Appendices

### Appendix 1

#### *Sample size calculations*

Estimated sample size for two-sample comparison of proportions (equal samples).

Assumptions:

Alpha=0.05 (two-sided)

Power=0.80

Assumption	OR = 1.78		OR = 2.51		OR = 3.24	
P <sub>2</sub> = proportion exposed in controls	P <sub>1</sub> = proportion exposed in cases	N = estimated sample size	P <sub>1</sub> = proportion exposed in cases	N = estimated sample size	P <sub>1</sub> = proportion exposed in cases	N = estimated sample size
0.05	0.09	<b>687</b>	0.12	<b>276</b>	0.15	<b>160</b>
0.10	0.17	<b>401</b>	0.22	<b>162</b>	0.26	<b>102</b>
0.15	0.24	<b>325</b>	0.3	<b>134</b>	0.36	<b>76</b>



## **Appendix 2**

### ***English version of the questionnaire***

Questionnaire ID \_\_\_\_\_

Date \_\_\_\_\_

### ***Questionnaire for mothers of children under 15 years old***

#### **1. In what region of Yerevan do you live?**

/1/ Avan

/2/ Arabkir

/3/ Davitashen

/4/ Erebouni

/5/ Kanaker-Zeytun

/6/ Kentron

/7/ Malatiya-Sebastiya

/8/ Mashtots

/9/ Nork-Marash

/10/ Nor Nork

/11/ Nubarashen

/12/ Shengavit

#### **2. In what floor do you live?**

\_\_\_\_\_

#### **3. How many rooms do you have in your house/apartment?**

/1/ 1

/2/ 2

/3/ 3

/4/ 4

/5/ 5 and more

**4. What kind of fuel do you use for cooking and heating?**

	<i>Activity</i>	
Type of fuel	<i>A. Cooking</i>	<i>B. Heating</i>
/1/ Electricity		
/2/ Natural gas		
/3/ Stored gas		
/4/ Kerosene		
/5/ Gasoline		
/6/ Other		

**5. Have you noticed molds or cockroaches in your house?**

/1/ No

/2/ Molds

/3/ Cockroaches

/4/ Both

**6. Do you have a conditioning/ventilation system in your house?**

/1/ No [Go to the question 8]

/2/ Yes

**7. What type of conditioning/ventilation system do you have in your house?**

/1/ Central conditioning system

/2/ Modern conditioners

/3/ Old conditioners

/4/ Fans

**8. Do you have carpets in your house?**

/1/ No [Go to the question 10]

/2/ Yes

**9. Please, specify what kind and how many carpets do you have in your house?**

/1/ Synthetic

/2/ Wool

\_\_\_\_\_

\_\_\_\_\_

**10. What kind of bedding do you use?**

/1/ Wool

/2/ Synthetic

/3/ Mixed

/4/ Other, specify \_\_\_\_\_

**11. Do you have library in your house?**

/1/ No [Go to the question 13]

/2/ Yes

**12. Do you have old books in your library?**

/1/ No

/2/ Yes, some

/3/ Yes, many

**13. Do you have any pets in your house now?**

/1/ No [Go to the question 14]

/2/ Yes [Go to the question 15]

**14. Have you ever had any pets in your house?**

/1/ Yes [Go to the question 15]

/2/ No [Go to the question 16]

**15. Please specify how much and for how many years do you take care of them?**

[Mark for all pets]

	Number of pets	Time period
/1/ Dogs		
/2/ Cats		
/3/ Fish		
/4/ Birds		
/5/ Other		

**16. How many hours does your child spend inside the house per day?**

/1/ 19-24 hours

/2/ 13-18 hours

/3/ 7-12 hours

/4/ 1-6 hours

**17. How many people live in your household on a permanent basis?**

/1/ 1-2

/2/ 3-4

/3/ 5-6

/4/ 7 and more

**18. Does any member of your family smoke?**

/1/ No [Go to the question 20]

/2/ Yes

/3/ Don't know/Difficult to answer [Go to the question 20]

**19. How many people and how much do they smoke?**

[Mark for each smoker]

	<b>B. Number of cigarettes smoked during a day</b>				
<b>A. Number of smokers in the family</b>	<b>/1/ Less than 5</b>	<b>/2/ 5-10</b>	<b>/3/ 11-15</b>	<b>/4/ 16-20</b>	<b>/5/ More than 20</b>
<b>/1/ 1</b>					
<b>/2/ 2</b>					
<b>/3/ 3</b>					
<b>/4/ 4</b>					
<b>/5/ 5 and more</b>					

**20. How often do you perform «vacuum-cleaner» or damp cleaning of your house?**

	<b>A. Vacuum-cleaning</b>	<b>B. Damp cleaning</b>
<b>/1/ Every day</b>		
<b>/2/ 4-5 times a week</b>		
<b>/3/ 2-3 times a week</b>		
<b>/4/ Once per week</b>		
<b>/5/ Once per month</b>		
<b>/6/ Other</b>		

**21. What is your level of education?**

- /1/ incomplete secondary
- /2/ complete secondary
- /3/ professional technical
- /4/ institute/university
- /5/ scientific degree

**22. What is your approximate monthly family income?**

- /1/ less than 25 000 drams
- /2/ 25 000 - 50 000 drams

- /3/ 51 000 – 75 000 drams
- /4/ 76 000 – 100 000 drams
- /5/ more than 100 000 drams

**23. Is there anybody in your family other than children with the confirmed diagnosis of bronchial asthma?**

- /1/ nobody
- /2/ mother
- /3/ father
- /4/ grandmother/grandfather
- /5/ sister/brother
- /6/ aunt/uncle

**Bronchial asthma** is a chronic, inflammatory lung disease characterized by recurrent breathing problems. People with asthma have acute episodes when breathing becomes more difficult. Sometimes episodes of asthma are triggered by allergens, such as dust, pollen, food, tobacco smoke, infection, exercise, cold air, stress.

Presence of clinical symptoms, such as wheezing, shortness of breath, cough, chest tightness; increased bronchial responsiveness and reduced levels of air-flow parameters on lung function measurements; increased levels of total and allergen-specific immunoglobulin-E creates a basis for the confirmation of the diagnosis of bronchial asthma.

**24. Is there anybody in your family, other than children, suffering from different allergic disorders?**

	<i>Allergic disorders</i>							
	<i>A.</i> <i>Atopic</i> <i>dermatitis</i>	<i>B.</i> <i>Allergic</i> <i>rhinitis</i>	<i>C.</i> <i>Pollino</i> <i>sis/</i> <i>hay</i> <i>fever</i>	<i>D.</i> <i>Food</i> <i>allergy</i>	<i>E.</i> <i>Drug</i> <i>allergy</i>	<i>F.</i> <i>Insect</i> <i>allergy</i>	<i>G.</i> <i>Non-</i> <i>classified</i> <i>(urticaria,</i> <i>edema)</i>	<i>H.</i> <i>Other</i>
<b>Family members</b>								
<b>/1/ Nobody</b>								

/2/ Mother								
/3/ Father								
/4/ Grandmother/ Grandfather								
/5/ Brother/ Sister								
/6/ Aunt/Uncle								

***Allergic dermatitis/atopic dermatitis** is an inflammation of the skin, usually causing itching and sometimes accompanied by crusting, scaling or blisters.*

***Allergic rhinitis** is an inflammation of the mucous membrane of the nose, accompanied by runny nose, sneezing and cough, often due to, dust, perfumes, cosmetic means, and tobacco smoke.*

***Pollinosis/Hay fever** is a seasonal allergic rhinitis caused by the pollen. It usually starts in spring and can continue up to the late autumn.*

***Food allergy** is sensitivity to different food, such as honey, milk, eggs, oranges, chocolate and so on that mostly is expressed by skin reactions with general symptoms.*

***Drug allergy** is sensitivity to a drug or other chemical that can be expressed starting from light skin reactions and going up to the serious anaphylactic shock.*

***Non-classified: Urticaria** is a skin condition, common known as hives, characterized by the development of itchy, raised white lumps surrounded by an area of red inflammation without specific identified cause.*

***Edema** is the swelling of the parts of the body, usually in the face area without specific identified cause.*

**25. How many children do you have?**

\_\_\_\_\_

**26. What is the gender of your child?**

1. Male                      2. Female

**27. How old is your child?**

\_\_\_\_\_

## Appendix 3

### Armenian version of the questionnaire

իմ \_\_\_\_\_

ՀՀ ԱԳՆ \_\_\_\_\_

Եթե ոչ ոք չի համաձայնում, ապա 15 րոպեի ընթացքում հարցազրույցի արդյունքները կարող են փոխանցվել հետազոտողին:

1. Եթե ոչ ոք չի համաձայնում, ապա 15 րոպեի ընթացքում հարցազրույցի արդյունքները կարող են փոխանցվել հետազոտողին:

1/ չի համաձայնում

2/ չի համաձայնում

3/ չի համաձայնում

4/ չի համաձայնում

5/ չի համաձայնում

6/ չի համաձայնում

7/ չի համաձայնում

8/ չի համաձայնում

9/ չի համաձայնում

10/ չի համաձայնում

11/ չի համաձայնում

12/ չի համաձայնում

2. Եթե ոչ ոք չի համաձայնում, ապա 15 րոպեի ընթացքում հարցազրույցի արդյունքները կարող են փոխանցվել հետազոտողին:

3. Եթե ոչ ոք չի համաձայնում, ապա 15 րոպեի ընթացքում հարցազրույցի արդյունքները կարող են փոխանցվել հետազոտողին:

1/ 1

2/ 2

3/ 3

4/ 4

5/ 5-Չի համաձայնում





**9 Ê Ýñ»Ù Ýß»ù Çá ÇÇ± Çá³ ±ÝË³ ÊÝñ, áõáõÝ»ù Òñ³ ÝÁ:**

1/´ ñ¹ Û³ \_\_\_\_\_

2/êÇÝÃ»ï ÇĬ \_\_\_\_\_

**10 Êá ÇÇÝ Ç Òñ³ Ý áÕÝÁ**

1/´ ñ¹ Û³

2/êÇÝÃ»ï ÇĬ

3/Ê³ éÁ

4/à õÇß, Ýß»ù \_\_\_\_\_

**11, áõáõÝ»ù Òñ³ ÝÁ. ñ³¹³ ñ³ Ý:**

1/ à ã(³ Ýó»ù Ñ³ ñó 13-ÇÝ)

2/² Ûă

**12, áõáõÝ»ù Òñ³ Ý. ñ³¹³ ñ³ ÝáõÙÑÇÝ. ñ»ñ**

1/à ã

2/² Ûă, áñáß

3//² Ûă ß ĭ

**13, áõá³ ÑáõÙ»ù Òñ³ ÝÁĬ»Ý¹³ ÝÇÝ»ñ**

1/à ã[² Ýó»ù Ñ³ ñó 14-ÇÝ]

2/² Ûă[² Ýó»ù Ñ³ ñó 15-ÇÝ]

**14, áõ»ñµ Çó»á³ Ñ±É»ù Òñ³ ÝÁĬ»Ý¹³ ÝÇÝ»ñ**

1/à ã [³ Ýó»ù Ñ³ ñó 16-ÇÝ]

2/² Ûă[³ Ýó»ù Ñ³ ñó 15-ÇÝ]

**15 ÊÝñ»ÙÝÁ»ù»³ ÝÇĬ»Ý¹³ ÝÇ³ Û»Ýĭ»ë³Ĭ Çó¹ áõáõÝ»ù Çá³ ÝÁ³ Û³ Ý³Ĭ Ç¹ áõá³ ÑáõÙ»ùÝñ³ Ýó**

[Ûß»ù µáñĬĬ»Ý¹³ ÝÇÝ»ñÇ Ñ³ Û³ ñ]

	Î»Ý¹³ÝÇÝ»ñÇù³Ý³ÍÁ	Ä³Û³Ý³Í³Ñ³íí³ÍÁ
/2/ ÞáǾ		
/3/ Î³í áõ		
/4/ ĪÝ»ñ		
/5/ Âé ãáõÝÝ»ñ		
/6/ / à ãñÇ Û³ù		

16 úñ³ ÛçÇáur³ ±ÝÁ³ Û³ Ý³Í ç³Ýól³ óÝáðÙ»ñ»ñ»Ë³Ýí³ÝÝ»ñéáðÙ

1/19-24 Á³Û

2/13-18 Á³Û

3/7-12 Á³Û

4/1-6 Á³Û

17.ø³ÝÇ±Ñ Çç Û³³³Ý³μÝ³Í í áðÙ»ñí³ÝÁ:

/1/ 1-2

/2/ 3-4

/3/ 5-6

/4/ 7³³í »ĪÇ

18 ÒñÁÝ³ÝÇùÇ³Ý³ÛÝ»ñÇóañ ç Û³ÍÁ ÍÉáðÙç

/1/ à á(³Ýó»ùÑ³ñó 20-ÇÝ)

/2/² Īá

/3/ , Áí³ñ³ÝáðÙ» Ûá³í³ëË³Ý»É/ã Ç » Û(³Ýó»ùÑ³ñó 20-ÇÝ)

19 ÊÝñ» Û³Û³ù³ÝÇÑá Ç³³ añ³Ý»ÝÝñ³ÝùÍÉáðÙ

[Û³Û³ù³ÉáñÍÉáðÙ»ñÇÑ³Û³ñ]

	B. úñ³ ÁÝÁ³ óááðÙĪË³Í ëÇ³ñ»íÝ»ñÇù³Ý³ÍÁ				
A.	/1/	/2/	/3/	/4/	/5/
ÌÉáðÙ»ñÇ	5 á³Í³ë	5-10	11-15	16-20	20-Çó³í »ĪÇ

ũ³ Ý³ Ĩ Á					
/1/ 1					
/2/ 2					
/3/ 3					
/4/ 4					
/5/ 5" ³ í » Ĩ Ç					

**20. AñáÇÇÛ³ ùñáĬ»ù¹ áõũ Ĩ³ Ĩ³ ñáõ ÛÓñ Ĩ³ ÝÁ**

/1/ öáß» Ĩ áõĒ

/2/ Ā³ ó Û³ ùñáĬ

/3/ °ñ Ĩ áõĒ ĨĒ

**21. ø³ ÝÇ³ Ý³ Û»ù, áõũ Ĩ³ Ĩ³ ñáõ ÛÓñ Ĩ³ Ý ãñ/÷ áß ĨáĒ / Ĩ³ ÛÃ³ ó Û³ ùñáĬ**

	A. öáß ĨáĒ	B. Ā³ ó Û³ ùñáĬ
/1/ Û³ Û» Ý ũñ		
/2/ 3-4³ Ýù³ Û ß³ µ³ Ā Ĩ³ Û» Ç		
/3/ 2-3³ Ý³ Û ß³ µ³ Ā Ĩ³ Û» Ç		
/4/ ß³ µ³ Ā Ĩ³ Ý Û» Ĩ³ Ý³ Û		
/5/ Û» Ĩ³ Ý Û» Ĩ³ Ý³ Û		
/6/ áõñ Çß		

**22. Añá Ĩñáõ ĨáõÝ»ù, áõũ**

/1/ ã Ĩ³ ñ Ĩ Ĩ³ Ĩ³ ÛÇÇ Ý³ Ĩ³ ñ.

/2/ Ĩ³ Ĩ³ ñ Ĩ Ĩ³ Ĩ³ ÛÇÇ Ý³ Ĩ³ ñ.

/3/ áõñáõ Û³ ñ³ ÝĀ »ĒÝÇ ĨáĬ

/4/ ÇÝĒ Ĩ Ĩ áõ / Ñ Û³ Ĩ³ ñ³ Ý

/5/ Ñ Ĩ³ Çá Ĩ Û³ Ĩ³ Ĩáõ

**23. añũ³ ±ÝĒ ÒñĀ Ĩ³ ÝÇÇ Ĩá Ĩ³ añ³ Û» Ĩ³ Ý» Ĩ³ Ûáõ Á:**

/1/ 25000¹ ñ³ ÛÇó á³ Ĩ³ Ē

/2/ 26000-50000¹ ñ³ Û

/3/ 51000-75000¹ ñ³ Û

- /4/ 76000-100 000<sup>1</sup> ñ<sup>3</sup> Û
- /5/ 100 000<sup>1</sup> ñ<sup>3</sup> Ûó<sup>3</sup> í » Ĳ
- /6/ , Áí<sup>3</sup> ñ<sup>3</sup> Ýáđ» Ûá<sup>3</sup> ï<sup>3</sup> ë Ē<sup>3</sup> Ý» É

**23** ÒñÁí<sup>3</sup> ÝÇùÇ<sup>3</sup> Ý<sup>1</sup> ÛñÇóáñ<sup>3</sup> Ì ÛİÁáđÇ± μñáÛÇ<sup>3</sup> É ëĀÛ<sup>3</sup> ÛÇÑ<sup>3</sup> ëï<sup>3</sup> í<sup>3</sup> Í<sup>3</sup>  
<sup>3</sup> Ēi áñáđáđ ì<sup>3</sup> óÇ»ñ»Ē<sup>3</sup> Ûç

- 1/à ã àù
- 2/Û<sup>3</sup> Ĵ
- 3/Ñ<sup>3</sup> Ĵ
- 4/ï<sup>3</sup> ï /à<sup>3</sup> à
- 5/» Ĳ<sup>3</sup> Ĵñáđñ
- 6/Ûáñ<sup>3</sup> ùáđñ»ñÇÑáñ<sup>3</sup> ùáđñ/Ñáñ»Ĳ<sup>3</sup> Ĵ

ñáÛÇ<sup>3</sup> É ëĀÛ<sup>3</sup> Ý<sup>1</sup> ùñáÝÇİ μáñμáù<sup>3</sup> ÛÝĀáù<sup>3</sup> ÛÝÑÇ<sup>3</sup> Ý<sup>1</sup> áđĀđđÇ, áñÝ<sup>3</sup>  
<sup>3</sup> ñi<sup>3</sup> Ñ<sup>3</sup> Ĵ í áđÇ İ ñİ Ý áđđá<sup>3</sup> İ<sup>3</sup> Ý<sup>1</sup> Áí<sup>3</sup> ñáđĀ<sup>3</sup> Û<sup>2</sup> ëĀÛ<sup>3</sup> Ĵáí ÑÇ<sup>3</sup> Ý<sup>1</sup> Û<sup>3</sup> ñ<sup>1</sup> Çù  
 áóÝ»ÝáđÛ»Ýéáđñđá<sup>3</sup> Ñ ĴááđĀ<sup>3</sup> Ý Ýáá<sup>3</sup> Ý»ñ: , ñ<sup>3</sup> Ýù İ<sup>3</sup> ñáđ» Ý á<sup>3</sup> Ĵ<sup>3</sup> Ý<sup>3</sup> í áñi<sup>3</sup> Í<sup>3</sup>  
 ĲÝ» Ýi<sup>3</sup> ñμ»ñ Ñ<sup>3</sup> İ<sup>3</sup> Í ÇÝÝ»ñáí , Çáá ÇèÇÝ» Ýi<sup>3</sup> Ý÷áßÇÝ, Í<sup>3</sup> Ĵ»÷áßÇÝ, ëÝáđÝ<sup>1</sup> Á  
 Í Ē<sup>3</sup> Ēáí Á, ÇÝÝ»İ óÇ<sup>3</sup> ÝñÁ ýÇİÇİ<sup>3</sup> İ<sup>3</sup> Ý<sup>1</sup> ñÁáđĀáđá<sup>3</sup> ë<sup>3</sup> éÁù<sup>1</sup> Áİ<sup>3</sup> Ûëi<sup>3</sup> é»éÁ  
 Î ĒÇÇİ<sup>3</sup> İ Ý<sup>3</sup> Ý<sup>3</sup> Ēi<sup>3</sup> ÝÇßÝ»ñÇ<sup>3</sup> éİ<sup>3</sup> ĴáđĀáđá ÇááÇèÇÝ» Ýßá<sup>3</sup> Ñ ĴááđĀáđá Ñ<sup>3</sup> 1/Á, ..  
 İ ñİ ù<sup>3</sup> í<sup>3</sup> Ý<sup>1</sup> İ Ç Ēi<sup>3</sup> Í áđĀáđá đá<sup>3</sup> İ<sup>3</sup> ÝýáđÝí óÇÝ<sup>3</sup> É óáóó<sup>3</sup> ÝÇß»ñÇÇÇ»óáđĀ  
 ëá»óÇÇİ .. ÁÝ<sup>1</sup> Ñ<sup>3</sup> Ýáñ<sup>0</sup> -Çáđđá. ÉááđĒÇÇÛ<sup>3</sup> İ<sup>3</sup> ñ<sup>1</sup> İ ÇÇÇ»óáđĀÑÇù Ç Ñ<sup>3</sup> Ý<sup>1</sup> Çè<sup>3</sup> Ýáđ  
 Ñ<sup>3</sup> ëï<sup>3</sup> í » ÉμñáÛÇ<sup>3</sup> É ëĀÛ<sup>3</sup> Ĵ<sup>3</sup> Ēi<sup>3</sup> áñáđáđĀ

**24** ÒñÁí<sup>3</sup> ÝÇùÇ<sup>3</sup> Ý<sup>1</sup> ÛñÇóáñ<sup>3</sup> Ì ÛİÁí<sup>3</sup> é<sup>3</sup> ááđÛ<sup>3</sup> Éñ Ĵİ  
 ÑÇ<sup>3</sup> Ý<sup>1</sup> áđĀáđáñá<sup>3</sup> ì<sup>3</sup> óÇ»ñ»Ē<sup>3</sup> Ûç

- /1/ à ã[<sup>3</sup> Ýó» ù Ñ<sup>3</sup> ñó 25-ÇÝ]
- /2/ <sup>2</sup> Ĵ [Ýß»ù]

	<sup>2</sup> Éñ Ğ Ĩ Ğ <sup>3</sup> Ý áóÃŁóÝñ							
	A	B	C	D	E	F	G	H
	<sup>2</sup> Éñ Ğ <sup>1</sup> »ñŮ <sup>3</sup> ĩ Ğ ĩ	<sup>2</sup> Éññ Ğ éÇÝÃ	ääĬÇ Ýá <sup>1/2</sup>	éÝÝ <sup>1 3</sup> ŮÇÝ <sup>3</sup> Éñ Ç <sup>3</sup>	, »Ŭá ñ <sup>3</sup> ŮŮ ŮÇÝ <sup>3</sup> Éñ · Ç <sup>3</sup>	ŬÇÇ <sup>3</sup> ĩ Ý »ñÇ á <sup>3</sup> ĩ × <sup>3</sup> éái <sup>1/2</sup> ñ . <sup>3</sup> Éñ .	àã <sup>1 3</sup> ë <sup>3</sup> Ĩ <sup>3</sup> ñ ĩ <sup>3</sup> Ĩ <sup>3</sup> <sup>3</sup> Ĩĩ <sup>3</sup> ÝÇßÝ »ñ Ĭĩ ÇÝ»Ç <sup>3</sup> Ů áó, »Ŭ»ñ <sup>3</sup> ó <sup>3</sup> Ý/	à ãŮß
/1/ à ã áù								
/2/ Ů Ů								
/3/ Ñ Ů								
/4/ ĩ <sup>3</sup> ĩ /á <sup>3</sup> á								
/5/ »Ŭ <sup>3</sup> ŮŁáóŮ								
/6/ ŁáŮ ù áóŮ/ ù »éÇ/ ÑáŮ ù áóŮ/ ÑáŮ»Ŭ <sup>3</sup> Ů								

<sup>2</sup> Éñ Ğ<sup>1</sup> »ñŮ<sup>3</sup> ĩ Ğ Ĩ<sup>3</sup> ááĬ<sup>1</sup> »ñŮ<sup>3</sup> ĩ Ğ Ů Ů<sup>3</sup> Ĭ<sup>3</sup> ĬáŮŁ, áñÁ<sup>3</sup> ñ<sup>3</sup> Ñ<sup>3</sup> Ů ĩ áóŮ ù áñái,  
<sup>1</sup> Ĩ ñŮ áóŮ ŮŁ, ĬÉÇÝñÇ<sup>3</sup> é<sup>3</sup> Ç<sup>3</sup> óŮ ŮŁ  
<sup>2</sup> Éñ Ğ éÇÝÃ ù ÁÇ ĨñŮ<sup>3</sup> Á<sup>3</sup> Ů<sup>3</sup> ÝÁÇ ĬáŮŁ áóŮŮ, áñÇ ÑŮŮ<sup>3</sup> Ĩ<sup>3</sup> Ý<sup>3</sup> Ĩĩ<sup>3</sup> ÝÇßÝñÝ»Ý  
ù ÁÇó<sup>3</sup> ñĩ<sup>3 1</sup> ñáóŮŁ áñßĩ áóÝ<sup>3</sup> Ñ<sup>3</sup> Á<sup>3</sup> Ů<sup>3</sup> Ñ<sup>3</sup> ×<sup>3</sup> Ĩ<sup>3</sup> é<sup>3</sup> Ç<sup>3</sup> ÝáóŮ ù áßÇÝñÇó,  
ú Ĩ<sup>3</sup> Ý»ĬÇó, Ĭ áéŮ ĩ Ğ á<sup>3</sup> ñ<sup>3</sup> ·<sup>3</sup> Ý»ñÇó<sup>3</sup> Ĩ Ĩ<sup>3</sup> Éái Çó  
ääÉÇÝÁ<sup>1</sup> »<sup>1/2</sup> Ý<sup>3</sup> ŮÇÝ ĬáóŮ ĬáŮ<sup>3</sup> Éñ Ğ éÇÝÃÝ, áñÁ<sup>3</sup> Ů<sup>3</sup> Ý<sup>3</sup> ĩ áñĩ<sup>3</sup> Ĩ  
Ĩ<sup>3</sup> Ĭ<sup>3</sup> » áßÇÝñái ; Ů<sup>3</sup> ÑŮŮ<sup>3</sup> Ĩ<sup>3</sup> ÝáóŮ Ĩĩ áóŮ Ĩ<sup>3</sup> Ů<sup>3</sup> ñÝ<sup>3</sup> ÝÁ<sup>3</sup> Ĩ<sup>3</sup> ñáŮ<sup>3</sup> ß<sup>3</sup> ñáŮ<sup>3</sup> Ĩ<sup>3</sup> »É  
ŮÇÝ áóß<sup>3</sup> ŁáŮ  
éÝÝ<sup>1 3</sup> ŮÇÝ<sup>3</sup> Éñ Ç<sup>3</sup> ·. »ñ<sup>1/2</sup> ŮŁóÝáóŮŁóÝ áñáß éÝÝ<sup>1 3</sup> Ů<sup>3</sup> ñŮÇÝ Ĩ<sup>3</sup> Ů<sup>3</sup> ŮŁ, ÇÝáÇéÇÝ»Ý  
Ů Ů<sup>3</sup> Á Ĩ<sup>3</sup> Á Ĩ<sup>3</sup> Ĩ<sup>3</sup> ÇÁ Ý<sup>3</sup> ñÇÝÁ Łáí áÉ<sup>3 1</sup> Á<sup>3</sup> Ů<sup>3</sup> Ů<sup>3</sup> éÝÝ<sup>1 3</sup> ŮÇÝ<sup>3</sup> Éñ Ç<sup>3</sup> ÝŮŮŮ<sup>3</sup> Ĩ<sup>3</sup> ÝáóŮ  
<sup>3</sup> ñĩ<sup>3</sup> ÑŮ Ĩ<sup>3</sup> áóŮ Ů<sup>3</sup> Ů<sup>3</sup> ŮÇÝñ<sup>3</sup> áóŮŁ áñáÝũ Ĩ<sup>3</sup> ñáŮ<sup>3</sup> ÝáóŮ Ĩ<sup>3</sup> »É ÁÝ<sup>1</sup> Ñ<sup>3</sup> ÝáŮ  
<sup>3</sup> Ĩĩ<sup>3</sup> ÝÇßÝñái:

, »**Öñ³ Ū³ ŪÇ³ Éñ Ç³** `· »ñ<sup>1/2</sup>³ ũáôŷãŨãŷáñáß¹»**Ö³ ŪÇçáóÝ»ñÇÝÍ³** i Û³ Ûµ, áñÝ  
 Ĩ³ñáŒ³ ññ³ Ñ³ Ũí ÇÃ»Ã³ Û³ßĨ³ ŪÇÝ³ Ēi³ ³ ŸÇßŸ»ñái, Ĩ³ Ûµ»ñÇÍ³ Ýñ  
 ³ Ý³ ýÇÉĨi ÇĨ BáĨ Ç<sup>1/2</sup>ñ· ³ óÛ³ ÝÁ  
**àã¹³ ë³ Ĩ³ ñ· í³ Ĩ³** ÝÑ³ Ū á³ i ×³ éái <sup>1/2</sup>ñ· ³ ó³ Í Û³ ßĨ³ ŪÇÝ»ñ· áóŨŒ³, áñÝ  
 ³ ññ³ Ñ³ Ũí áóŒ³ Û³ ßĨ Çó í »ññ³ ñµ»ñã³÷ë»ñÇµŒŒŸ»ñÇ³ é³ ç³ óÛ³ Ûµ, áñáÝù  
 ßñ³ á³ i í³ Í »Ý í³ ñ¹³· áóŸ/Ĩ³ñŪñµñµáù³ ŪÇÝßñç³ Ýái  
**² Ũ áó³** ÝÑ³ Ū á³ i ×³ éái <sup>1/2</sup>ñ· ³ ó³ Í ³ Ũ áŸ Û³ ñŪÝÇi³ ñµ»ñ ßñç³ ÝÝ»ñáŒ³ í »ŒÇ  
 Ñ³ ã³ Ē³ »ñ»ëÇßñç³ ÝáŒ

**25. ø³ ÝÇ±»ñ»Ē³** , áŒüáŸŸù

---

**26. Ūß»ùŒñ»ñ»Ē³ Ūë»éÁ**

1/Æ³ Ĩ³ Ý /2/² ñ³ Ĩ³ Ý

**27. ø³ ÝÇ±i³ ñ»Ĩ³ Ý ŒŒñ»ñ»Ē³ Ý:**

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**Appendix 4**  
***English version of the letter of permission***

**LETTER OF PERMISSION**

Dear Pr. Babloyan!

As a part of Master of Public Health Program at American University of Armenia graduate student, Irina Papiyeva, is going to perform a case-control study in the field of Allergy/Public Health. The main purpose of the study is to investigate possible predisposing factors for the development of bronchial asthma in children under 15 years of age in Yerevan.

Mothers of children under 15 years of age with the confirmed diagnosis of bronchial asthma, who have undergone or will undergo treatment at the Allergy Department of Children's Republican Hospital during the period from January 1995 to September 2005 have been selected to participate in the study as cases.

In case of agreement to participate in the study, mothers will be asked to answer the questions from the questionnaire with the help of interviewer (graduate student). The interview will take place only once and will last no more than 10 minutes.

Study is intended to start on May 25 and will last about 4 months.

Graduate student of Masters of Public Health Program at AUA, Irina Papiyeva, former resident of Allergy Department at Children's Republican Hospital, is asking for your permission to perform all necessary for the study procedures at Allergy and other departments of the hospital.

Your collaboration and support are of great value.

Thank You in advance.

With respect,  
Irina Papiyeva, MD,  
MPH 2-nd year student  
AUA

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### ***English version of the consent forms***

#### **CONSENT FORM (for cases)**

##### **Introduction**

Hello, my name is Irina Papiyeva and I am a graduate student of Master of Public Health Program at American University of Armenia.

I am performing a study with the purpose to investigate possible predisposing factors for the development of bronchial asthma in children under 15 years of age in Yerevan.

##### **Procedures**

You have been selected to participate in the study, because your children have the confirmed diagnosis of bronchial asthma and undergo treatment at the Allergy Department of Children's Republican Hospital

In case you agree to participate in the study, I will ask you to answer the questions from the questionnaire. The interview will take place only once and will last no more than 10 minutes. I can stop the interview if I would realize that you are not eligible for the study. You are free to ask questions and stop the interview any time you want.

Your participation in this study is of great value. The information given by you will be very useful for this study.

##### **Risks/Discomforts**

There is no risk associated with the participation in this study.

##### **Benefits**

You will not get any specific benefits from this study. However, information provided by you will help to explore possible predisposing factors for the development of bronchial asthma in children. Moreover, the results of this study will contribute to the further researches in this field and to the development of appropriate educational programs in order to decrease asthma morbidity in children.

##### **Confidentiality**

There is no need for your personal data as names and surnames, telephone numbers and addresses. All information provided by you will be kept confidential and will be used only by Public Health Department at American University of Armenia in performing final analysis.

##### **Voluntariness**

Your participation in the study is voluntary. You can refuse to participate in the study at any time you want.

You are free not to answer to the questions if you consider them sensitive or inappropriate. Your refusal to participate or your withdrawal from the study at any time will not have negative consequences and will not affect medical care your child receives.

##### **Whom to contact**

You can ask the person in charge listed below any questions you may have about this research study. You can ask questions in the future if you do not understand something about the study. The person in charge of the study will answer your questions.

She will tell you anything new she learned that she thinks will affect you/your child.

Yelena Amirkhanyan (3741) 51 25 68

If you want to talk to anyone about the research study because you feel you have not been treated fairly or think you have been hurt by joining the study you should contact the American University of Armenia at (374 1) 51 26 71.

If you agree to participate in the study, let's start.

## CONSENT FORM #2 (for controls)

### **Introduction**

Hello, my name is Irina Papiyeva and I am a graduate student of Master of Public Health Program at American University of Armenia.

I am performing a study with the purpose to investigate possible predisposing factors for the development of bronchial asthma in children under 15 years of age in Yerevan.

### **Procedures**

Your phone number has been selected randomly for the study. If you have child/children aged up to 15 years without confirmed diagnosis of bronchial asthma and if you agree to participate in the study, I will ask you to answer the questions from the questionnaire. The interview will take place only once and will last no more than 10 minutes.

I can stop the interview if I would realize that you are not eligible for the study. You are free to ask questions and stop the interview any time you want.

Your participation in this study is of great value. The information given by you will be very useful for this study.

### **Risks/Discomforts**

There is no risk associated with the participation in this study.

### **Benefits**

You will not get any specific benefits from this study. However, information provided by you will help to explore possible predisposing factors for the development of bronchial asthma in children. Moreover, the results of this study will contribute to the further researches in this field and to the development of appropriate educational programs in order to decrease asthma morbidity in children.

### **Confidentiality**

There is no need for your personal data as names and surnames, telephone numbers and addresses. All information provided by you will be kept confidential and will be used only by Public Health Department at American University of Armenia in performing final analysis.

### **Voluntariness**

Your participation in the study is voluntary. You can refuse to participate in the study at any time you want.

You are free not to answer to the questions if you consider them sensitive or inappropriate.

Your refusal to participate or your withdrawal from the study at any time will not have negative consequences and will not affect medical care your child receives.

### **Whom to contact**

You can ask the person in charge listed below any questions you may have about this research study. You can ask questions in the future if you do not understand something about the study.

The person in charge of the study will answer your questions.

She will tell you anything new she learned that she thinks will affect you/your child.

Yelena Amirkhanyan (3741) 51 25 68

If you want to talk to anyone about the research study because you feel you have not been treated fairly or think you have been hurt by joining the study you should contact the American University of Armenia at (374 1) 51 26 71.

If you agree to participate in the study, let's start.

### *Armenian version of the consent forms*

$$A_0^{2 \times 1/p} \hat{I} \otimes^2 \mathcal{O}^2 \otimes^2 \mathcal{U} \otimes^2 \mathcal{A} \otimes^2 (1 \otimes \text{à} \otimes \tilde{N} \otimes \tilde{N}^3 \otimes \tilde{Y}^1 \otimes \tilde{Y} \otimes \tilde{N} \otimes \tilde{N}^3 \otimes \tilde{U}^3 \otimes \tilde{n})$$

Ü»ñ³ ÜóáõÜ

[illegible]
$$\tilde{A} \tilde{Y} \tilde{A}^3 \tilde{O}^3 \tilde{I}^3 \tilde{n}.$$

áòù ÁÝ ní »Éù Ù ÈY<sup>3</sup> Ĭ ó» Éáo Ñi<sup>3</sup> ¼áí áó Ñ<sup>3</sup> Ý Ù»ç, áñái Ñi<sup>3</sup> ò Ññ»ñ»É<sup>3</sup> Ý ñÇ Ùáí  
 Ñ<sup>3</sup> èi<sup>3</sup> Ĭ í »É; ñáÝÉÇ<sup>3</sup> É<sup>3</sup> è Ñ<sup>3</sup> Ù<sup>3</sup> Ù<sup>3</sup> Èi áñá Ñáo Ñ<sup>3</sup> . áòù ñáo Ñáo Ù<sup>3</sup> uèi<sup>3</sup> ó »É

[illegible]

Òñ Û ëÝ³ Í óáóÃ ãóÝÑ ï³ ¼ ãí áóÃ Û Ý Û ç ß³ ï³ ñÃ ù³ í áñ ç: Òñ ï áóÃ ó  
ï ñ³ Û ß¹ ñí³ Í ï³ » Ì óáóÃ ãóÝÑ ñÃ ß³ ï ù ï³ Í³ ñ Ì ÉÝ³ Ý³ Û Ñ ï³ ¼ ãí áóÃ Û ÝÑ ß³ Û ß ñ:

ì ï ³ Ý. /² ÝÑ³ ñÛ³ ñáõÃâäÝ

áòùáâÛCii<sup>3</sup>Ý. Çã»ù»ÝÃ<sup>3</sup>ñĩíáoŮ Û<sup>3</sup>ěÝ<sup>3</sup>Īó»Ĥĩ Ñĩ<sup>3</sup>1/2ĩáoŮ<sup>3</sup>ÝÁ:

**P<sup>3</sup> Ñú. áõ**

[illegible]

¶<sup>3</sup> Ồi ÝCáoẤuỖ

[illegible]

**Î<sup>3</sup> Û<sup>3</sup> í áñáçÑláçÝ**

Òñ Û³ ëÝ³ Ĩ óáó ÑāóYÑñĩ ³ ¼āĩ ááŨ³ÝÙ»ç ĒĆáĩ ĊYĨ³ Û³ Ĩ āñĴ , áóũĨ³ ñāŒ³ũñ  
Ññ³ Ā³ ñĩ »ĒŨ³ ëÝ³ Ĩ óáó ÑāóYÑñĩ ³ ¼āĩ ááŨ³ÝÙ»ç ĒĆáĩ ĊYĨ³ Û³ Ĩ āñĴ

İ̇ ăōũİ̇³ năŌũ ù Ññ³ Ā³ nī »É³ Ū̇Ñ³ ñó» ñÇYă³ İ̇³ ẽĒ³ Ẏ» ĒăŌă, ăñăYũİ̇³ İ̇³ Ẏ» ù ½³ ŪăŌẎ» Ẏ  
İ̇³ Ū³ ẎÑ³ ñŪ³ ñ:

Đi<sup>3</sup> 1/2 ai áo<sup>3</sup>Ũ<sup>3</sup> YÁ<sup>3</sup>Ũ<sup>3</sup>ēY<sup>3</sup>Ĭ<sup>3</sup>ó»Ē<sup>3</sup>ò<sup>3</sup>ñ<sup>3</sup> YN<sup>3</sup>Ũ<sup>3</sup> Ó<sup>3</sup> Ũ<sup>3</sup>áo<sup>3</sup>Ũ<sup>3</sup>YÁ<sup>3</sup>Ĭ<sup>3</sup> Ũ<sup>3</sup>ñ<sup>3</sup> Á<sup>3</sup>ñ<sup>3</sup>Ĭ<sup>3</sup> YÁ<sup>3</sup>áá<sup>3</sup> Ũ<sup>3</sup>  
 μ<sup>3</sup>ó<sup>3</sup>ē<sup>3</sup>Ĭ<sup>3</sup> YN<sup>3</sup>Ĭ<sup>3</sup> Yù<sup>3</sup> áÇ<sup>3</sup>áo<sup>3</sup>Y<sup>3</sup> áá<sup>3</sup> Ũ<sup>3</sup>Ó<sup>3</sup>ái<sup>3</sup> áÇ<sup>3</sup> Yñ<sup>3</sup> 1/2 ēY<sup>3</sup> Ò<sup>3</sup>ñ<sup>3</sup>ñ<sup>3</sup>Ē<sup>3</sup> Ũ<sup>3</sup>Ĭ<sup>3</sup>áo<sup>3</sup>Ũ<sup>3</sup>ó<sup>3</sup>  
 ěi<sup>3</sup> ó<sup>3</sup>Ĭ<sup>3</sup> μ<sup>3</sup>áo<sup>3</sup>Ũ<sup>3</sup> ũ<sup>3</sup> Yáo<sup>3</sup>Ũ<sup>3</sup> Yí<sup>3</sup>ñ<sup>3</sup>:

### à<sup>3</sup>Ũ<sup>3</sup>ñ<sup>3</sup>Ĭ<sup>3</sup>Ĭ<sup>3</sup>áY<sup>3</sup>»É<sup>3</sup>

á<sup>3</sup>ò<sup>3</sup>Ũ<sup>3</sup>Ĭ<sup>3</sup>ñá<sup>3</sup>Ũ<sup>3</sup>»<sup>1</sup>Ũ<sup>3</sup>Ē<sup>3</sup>Ĭ<sup>3</sup>áñ<sup>3</sup> YBí<sup>3</sup>Ĭ<sup>3</sup> á<sup>3</sup>Ĭ<sup>3</sup>ē<sup>3</sup>Ē<sup>3</sup> Y<sup>3</sup>Ĭ<sup>3</sup> á<sup>3</sup>ó<sup>3</sup> YÓ<sup>3</sup>Y<sup>3</sup>ó<sup>3</sup>YĬ<sup>3</sup> ó<sup>3</sup>Ĭ<sup>3</sup> Ñ<sup>3</sup>ñó<sup>3</sup>ái<sup>3</sup>, á<sup>3</sup>Á<sup>3</sup>  
 Ĭ<sup>3</sup>ñ<sup>3</sup>μ<sup>3</sup>ñ<sup>3</sup>í<sup>3</sup> á<sup>3</sup>Ũ<sup>3</sup> Ĭ<sup>3</sup> 1/2 ai áo<sup>3</sup>Ũ<sup>3</sup> YÁ:

á<sup>3</sup>ò<sup>3</sup>Ũ<sup>3</sup>Ĭ<sup>3</sup>ñá<sup>3</sup>Ũ<sup>3</sup>»<sup>1</sup>Ũ<sup>3</sup>Ē<sup>3</sup>Yñ<sup>3</sup> Y N<sup>3</sup>Ĭ<sup>3</sup> 3. 3 Ũ<sup>3</sup>áo<sup>3</sup>Ũ<sup>3</sup> »Á<sup>3</sup> Ç<sup>3</sup>ááñ<sup>3</sup> μ<sup>3</sup> Y<sup>3</sup> YN<sup>3</sup>ē<sup>3</sup>Ĭ<sup>3</sup> Y<sup>3</sup> Ĭ<sup>3</sup>É<sup>3</sup>Y<sup>3</sup>Ũ<sup>3</sup>ñ<sup>3</sup>  
 Ũ<sup>3</sup>Ũ<sup>3</sup>ñ<sup>3</sup>: á<sup>3</sup>Ĭ<sup>3</sup>ē<sup>3</sup>Ē<sup>3</sup> Y<sup>3</sup>Ĭ<sup>3</sup> á<sup>3</sup>ó<sup>3</sup> YÓ<sup>3</sup>Ĭ<sup>3</sup> á<sup>3</sup>Ĭ<sup>3</sup>ē<sup>3</sup> Y<sup>3</sup>Ũ<sup>3</sup>ñ<sup>3</sup> μ<sup>3</sup>á<sup>3</sup>ñ<sup>3</sup>ñ<sup>3</sup>ñó<sup>3</sup>ñ<sup>3</sup>Ç<sup>3</sup> Ĭ<sup>3</sup>Ũ<sup>3</sup>Ũ<sup>3</sup> Y<sup>3</sup>Ũ<sup>3</sup>Ũ<sup>3</sup>  
 Yáñ<sup>3</sup>ē<sup>3</sup> ó<sup>3</sup>Ĭ<sup>3</sup>Ĭ<sup>3</sup>»Ĭ<sup>3</sup>áo<sup>3</sup>Ũ<sup>3</sup>Y<sup>3</sup>ñ<sup>3</sup> á<sup>3</sup>ñ<sup>3</sup>Ũ<sup>3</sup> Yñ<sup>3</sup> Ĭ<sup>3</sup>ñ<sup>3</sup>Ç<sup>3</sup>ái<sup>3</sup>, Ĭ<sup>3</sup>ñá<sup>3</sup>Ũ<sup>3</sup>Y<sup>3</sup> 1/2»áo<sup>3</sup>Ũ<sup>3</sup>áo<sup>3</sup>Y<sup>3</sup>  
 á<sup>3</sup>ó<sup>3</sup>Y<sup>3</sup>É<sup>3</sup>Ũ<sup>3</sup>ñ<sup>3</sup>»ñ<sup>3</sup>Ē<sup>3</sup> (Yñ<sup>3</sup>)Ç<sup>3</sup>é<sup>3</sup>áo<sup>3</sup>Ũ<sup>3</sup>Yí<sup>3</sup>ñ<sup>3</sup>:

°É<sup>3</sup>Y<sup>3</sup> 2 Ũ<sup>3</sup>ñ<sup>3</sup>Ē<sup>3</sup> YŨ<sup>3</sup>Y (3741) 51 25 68

°Á<sup>3</sup>» á<sup>3</sup>ò<sup>3</sup>Ũ<sup>3</sup>áo<sup>3</sup>Ũ<sup>3</sup>»<sup>1</sup>Ũ<sup>3</sup>áo<sup>3</sup>»É<sup>3</sup> Ũ<sup>3</sup>ñ<sup>3</sup>Ĭ<sup>3</sup> 1/2 ai áo<sup>3</sup>Ũ<sup>3</sup>YŨ<sup>3</sup>ēY<sup>3</sup>áñ<sup>3</sup> Ũ<sup>3</sup>Ĭ<sup>3</sup>Ç<sup>3</sup>ñ<sup>3</sup>Ĭ<sup>3</sup>, »Á<sup>3</sup> Ò<sup>3</sup>ñ<sup>3</sup>  
 Ĭ<sup>3</sup>ñ<sup>3</sup>Ç<sup>3</sup>ái<sup>3</sup> Ò<sup>3</sup>ñ<sup>3</sup>ñ<sup>3</sup>Ĭ<sup>3</sup>í<sup>3</sup>ñ<sup>3</sup>»É<sup>3</sup>Yá<sup>3</sup>ñ<sup>3</sup>ñ<sup>3</sup>ñ<sup>3</sup>ó<sup>3</sup>Ç<sup>3</sup>áñ<sup>3</sup>YĬ<sup>3</sup>Ũ<sup>3</sup>í<sup>3</sup>Y<sup>3</sup>ē<sup>3</sup>/í<sup>3</sup>Ç<sup>3</sup>ñ<sup>3</sup>í<sup>3</sup>áñ<sup>3</sup>Yù<sup>3</sup>»<sup>1</sup>ē<sup>3</sup>í<sup>3</sup>ó<sup>3</sup>»É<sup>3</sup>  
 Ũ<sup>3</sup>ēY<sup>3</sup>Ĭ<sup>3</sup>ó<sup>3</sup>É<sup>3</sup>Ũ<sup>3</sup>ñ<sup>3</sup>Ĭ<sup>3</sup> 1/2 ai áo<sup>3</sup>Ũ<sup>3</sup>YÁ á<sup>3</sup>Ũ<sup>3</sup>Ĭ<sup>3</sup>ñá<sup>3</sup>Ũ<sup>3</sup>»<sup>1</sup>Ũ<sup>3</sup>Ē<sup>3</sup>Ũ<sup>3</sup>ē<sup>3</sup>Y<sup>3</sup>Ũ<sup>3</sup>ñ<sup>3</sup>Ç<sup>3</sup>Ĭ<sup>3</sup>Ũ<sup>3</sup>Y<sup>3</sup>  
 Ũ<sup>3</sup>Ũ<sup>3</sup>Ē<sup>3</sup>ñ<sup>3</sup>Y N<sup>3</sup>Ĭ<sup>3</sup> Ũ<sup>3</sup>É<sup>3</sup>Ũ<sup>3</sup>é<sup>3</sup>É<sup>3</sup>á<sup>3</sup>ē<sup>3</sup>Ũ<sup>3</sup>Ũ<sup>3</sup>ñái<sup>3</sup> (374 1) 51 26 71.

°Á<sup>3</sup>» á<sup>3</sup>ò<sup>3</sup>Ũ<sup>3</sup>Ũ<sup>3</sup> Ó<sup>3</sup> Ũ<sup>3</sup>Y»<sup>1</sup>Ũ<sup>3</sup>ēY<sup>3</sup>Ĭ<sup>3</sup>ó<sup>3</sup>É<sup>3</sup> Ũ<sup>3</sup>ñ<sup>3</sup>Ĭ<sup>3</sup> 1/2 ai áo<sup>3</sup>Ũ<sup>3</sup>YÁ Ē<sup>3</sup>Y<sup>3</sup>ñ<sup>3</sup>Ũ<sup>3</sup>ē<sup>3</sup>ē<sup>3</sup>Yù<sup>3</sup>:





à ð Ñ i İ³ á Ý »É

„ á ò ù İ³ ñ á Õ » ù¹ Ç Û » È ï á ñ ·· Ý B í³ Í á³ ï³ ë È³ Ý³ ï á ò³ Ý Ó Ç Ý ó³ Ý İ³ ó³ Í Ñ³ ñ ó á í , á ñ Á í » ñ³ µ » ñ í á ð Û ÷ Ñ ï³ ¹/á ï á ò Æ³ Ý Á :

„ á ò ù İ³ ñ á Õ » ù Ý³ ··¹ Ç Û » È ÿ ñ³ Ý Ñ » ï³ ·³ Û á ò Û » Æ Ç Ý á á ñ µ³ Ý³ Ý Ñ³ ë İ³ Ý³ Ç É Ç Ý Ç Ò ñ Ñ³ Û³ ñ : ä³ ï³ ë È³ Ý³ ï á ò³ Ý Ó Á İ á³ ï³ ë È³ Ý Ç Ò ñ µ á Æ ñ Ñ³ ñ ó » ñ Ç Ý ·· İ Ñ³ Û ï Ý Ç³ Æ Ý á ñ ë ï³ ó³ Í ï » Ò İ á ò Æ á ò Ý » ñ Á á ñ á ÿ Û Ý ñ³ İ³ ñ í Ç á í , İ³ ñ á Õ » Ý³ ¹/² » ó á ò Æ á ò Ý á ò Ý³ Ý³ É Ò ñ » ñ » È³ (Ý ñ) Ç³ é á Ç á ò Æ Û³ Ý í ñ³ :

° È³ Ý³² Û Ç ñ È³ Ý Û³ Ý (3741) 51 25 68

° Æ » „ á ò ù á ò Æ á ò Û » ù¹ á á ò » È³ Æ Ñ ï³ ¹/á ï á ò Æ Û³ Ý Û³ ë Ç Ý á ñ ·· ÷ Û İ Ç Ñ ï , » Æ Ò ñ İ³ ñ í Ç á í Ò ñ Ñ ï í³ ñ í » É » Ý á á³ ñ¹³ ñ³ ó Ç á ñ » Ý İ³ Û í Ý³ ë / í Ç ñ³ í á ñ³ Ý ù » ù ë ï³ ó » É Û³ ë Ý³ İ ó » È á í³ Æ Ñ ï³ ¹/á ï á ò Æ Û³ Ý Á „ á ò İ³ ñ á Õ » ù¹ Ç Û » È ð³ Û ë ï³ Ý Ç³ Û ñ Ç İ Û³ Ý Ñ³ Û³ È³ ñ³ Ý Ñ ï ·· Æ È Ñ³ é³ È á é³ Ñ³ Û³ ñ á í · (374 1) 51 26 71.

° Æ » „ á ò ù Ñ³ Û³ Ó³ Û Ý » ù Û³ ë Ý³ İ ó » È³ Æ Ñ ï³ ¹/á ï á ò Æ Û³ Ý Á È Ý¹ ñ » Û ë İ ë » Ý ù :

## Appendix 5

### *Distribution of cases and controls across Yerevan hamaynks*

<b>Hamaynks of Yerevan</b> N=12	<b>Number (%)</b>			
	<b>Cases</b> N=96		<b>Controls</b> N=134	
Avan	8	(8.3)	5	(3.7)
Arabkir	13	(13.5)	15	(11.2)
Davidashen	3	(3.1)	4	(3.0)
Erebouni	7	(7.3)	13	(9.7)
Qanaker-Zeytun	10	(10.4)	8	(5.9)
Kentron	13	(13.5)	14	(10.5)
Malatiya-Sebastiya	12	(12.5)	15	(11.2)
Mashtots	11	(11.5)	17	(12.7)
Nork-Marash	4	(4.2)	12	(8.9)
Nor Nork	3	(3.1)	15	(11.2)
Nubarashen	4	(4.2)	1	(0.8)
Shengavit	8	(8.3)	15	(11.2)

*Note: Distribution of controls is proportionate to the population of a particular hamaynk  
[Information is taken from Yerevan Municipality data basis, 2004]*

## Appendix 6

### Demographic variables

Description of variables		Number (%)	
		Cases N=96	Controls N=134
Gender of the child	Females	42 (43.8)	73 (54.5)
	Males	54 (56.3)	61 (45.5)
Age of the child (0-14 years old)	Mode	14	12
	Mean	8.3	7.7
Family size	1-2 persons	5 (5.2)	6 (4.5)
	3-4 persons	45 (46.9)	66 (49.3)
	5-6 persons	35 (36.5)	43 (32.1)
	7 and more persons	11 (11.5)	19 (14.2)
Number of children in the family	1 child	15 (15.6)	39 (29.1)
	2 children	70 (72.9)	65 (48.5)
	3 children	7 (7.3)	22 (16.4)
	4 children	4 (4.2)	7 (5.2)
	5 children	0 (0.0)	1 (0.7)
Family monthly income	25,000 drams and less	21 (21.9)	16 (11.9)
	26,000-50,000 drams	31 (32.3)	16 (11.9)
	51,000-75,000	18 (18.8)	20 (14.9)
	76,000-100,000	9 (9.4)	14 (10.4)
	100,000 and more	10 (10.4)	18 (13.4)
Mothers' education	Incomplete secondary	3 (3.1)	0 (0.0)
	Complete secondary	29 (30.2)	41 (30.6)
	Professional technical	32 (33.3)	34 (25.4)
	Institute/University	32 (33.3)	59 (44)
	Scientific degree	0 (0.0)	0 (0.0)

## Appendix 7

### *Housing conditions and time spend at home by child/children*

		Number (%)	
		Cases N=96	Controls N=134
Number of rooms at house/apartment	1 room	11 (11.5)	14 (10.4)
	2 rooms	30 (31.3)	40 (29.9)
	3 rooms	37 (38.5)	47 (35.1)
	4 rooms	14 (14.6)	23 (17.2)
	5 rooms	4 (4.2)	10 (7.5)
Floor of the apartment/house	1	28 (29.2)	47 (35.1)
	2	18 (18.8)	17 (12.7)
	3	10 (10.4)	14 (10.4)
Time spend at home	19-24 hours	8 (8.3)	5 (3.7)
	13-18 hours	65 (67.7)	45 (33.6)
	7-12 hours	23 (24.0)	82 (61.2)
	1-6 hours	0 (0.0)	1 (0.7)