

# Exposure to toxics during pregnancy and childhood and asthma in children: A pilot study



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**Study adds:** The results of this study showed an increased risk of asthma in children with waterpipe smoking in pregnancy and an increased risk of respiratory problems (diagnosed and probable asthma) with alcohol intake during pregnancy, waterpipe smoking during pregnancy and parents respiratory problems. Spreading awareness by health care professionals (doctors and pharmacists) is needed to reduce the prevalence of this disease in children.

### Keywords:

Asthma  
Detergents  
Pesticides  
Alcohol  
Smoking  
Pregnancy  
Infancy

## ABSTRACT

Environmental factors, pesticides, alcohol and smoking are linked to asthma in children. The association of toxic substances exposure with asthma has not been evaluated. Our objective is to assess such associations among children aged less than 16 years old. This is a cross-sectional study, conducted between January and May 2015, using a sample of Lebanese students from private schools in Beirut and Mount Lebanon. Out of 700 distributed questionnaires, 527 (75.2%) were returned to us. Verbal informed consent was also obtained from all parents prior to participating in the study. A significant association was found between waterpipe smoking and diagnosed asthma ( $p = 0.003$ ;  $OR_a = 13.25$ ; 95% CI 2.472–71.026). Alcohol during pregnancy, waterpipe smoking during pregnancy and parents respiratory problems significantly increased the risk of respiratory problems by approximately 5 times, 6 times and 2 times respectively ( $p = 0.016$ ;  $OR_a = 4.889$ ; 95% CI 1.339–17.844,  $p = 0.021$ ;  $OR_a = 6.083$ ; 95% CI 1.314–28.172,  $p = 0.004$ ;  $OR_a = 1.748$ ; 95% CI 1.197–2.554 respectively). Waterpipe smoking, alcohol during pregnancy, recurrent otitis and humidity at home seem to be significantly correlated with asthma in children. Spreading awareness by health care professionals is needed to permit a reduction of the prevalence of these allergic diseases, especially asthma, in children.

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## 1. Introduction

Asthma is a chronic disease characterized by recurrent attacks of breathlessness and wheezing, chest tightness, and cough, which vary in severity and frequency from person to person as defined by the World Health Organization and the Global Initiative for Asthma (GINA) guidelines. Childhood asthma is one of the most important diseases of childhood, causing substantial morbidity [1–3].

The incidence, prevalence and severity of asthma have been increasing in the general population worldwide between 1970s and 80s [4]. There are 14 million people in the USA suffering from asthma. The prevalence of self-reported asthma increased by 75% in the USA from 1980 to 1994 [5]. Asthma prevalence ranged from a low of 0.7% in Macau to 18.4% in Scotland [5–8]. It is also estimated that 300 million people worldwide had asthma, and this number is projected to increase to 400 million by 2025, as countries became more urbanized [6].

The International Study of Asthma and Allergies in Childhood (ISAAC) is a unique worldwide epidemiological research program established in 1991 to investigate asthma, rhinitis and eczema in children due to considerable concern that these conditions were increasing in Western and developing countries [1,2,9]: In 1998,

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research on schoolchildren in Beirut, aged 12 to 14 years was carried out according to the ISAAC program [10], reporting a prevalence of 11.9% for asthma. Using the same method in 2006, the prevalence of physician-diagnosed asthma was 5.3% in 13–14 year-old school children in Lebanon, with high prevalence of ever wheezing (21.4%), wheezing on effort (12.7%) and night cough (22.8%) [11].

However, the natural history and etiology of asthma and allergies remains poorly understood [8], despite a large volume of clinical and epidemiological research within populations which has been directed at explaining why some individuals and not others develop asthma and allergies [2,9–11]. Investigation of the reasons for variations in prevalence between populations may be a more fertile source of new etiological clues, but little is known about worldwide variations in the prevalence of asthma and allergic diseases [2].

Although genetic predisposition and environmental exposure are thought to lead to the development of these conditions, the nature of such associations remains unclear [12,13]. There are many risk factors linked to asthma in children including familial history of asthma in one of the parents or both. Environmental factors exposure during childhood found associated with asthma in the Lebanese population were the public schools' environment, the presence of molds on bedrooms' walls and pets' possession [16]. Salameh et al. also found that exposure to pesticides was associated with chronic respiratory symptoms and asthma [17]. The effect of parents' smoking on children has been shown to be a triggering factor to express asthma in children even in early life [13–15], in addition to active smoking [18]. In Lebanon, similar results were shown in a post hoc analysis, where passive exposure to mother's smoke from cigarettes and from waterpipe was associated with asthma and allergic diseases [19].

Moreover, association has been found between in utero exposures to several xenobiotics and increased risk of asthma. There is convincing evidence that maternal smoking during pregnancy and breastfeeding, leading to in utero and perinatal exposures to environmental tobacco smoke, are associated with increased risk of asthma [20]. However, in utero and young childhood exposures to these toxics have not been fully assessed in Lebanon. While we know that these exposures are common during pregnancy among Lebanese women [21], the association of exposure to toxic substances in utero and during infancy (alcohol, tobacco including cigarette and waterpipe smoke, pesticides, and detergents) with asthma has not been evaluated. Our objective is to assess such associations among children aged less than 16 years old in schools in Beirut and Mount Lebanon; this project is considered as a pilot step to be confirmed by further studies.

## 2. Methods

### 2.1. Study design and sample

This is a cross-sectional study that was conducted between January and May 2015 using a sample of Lebanese students from private schools in Beirut and Mount Lebanon, based on the list of schools provided by the Ministry of Education. A sample of 318 students was targeted to allow for adequate power for bivariable and multivariable analyses to be carried out according to the Epi info sample size calculations with a population size of 4 million in Lebanon, an 11.7% expected frequency of asthma, a 5% confidence limits [22]. We decided to distribute 700 questionnaires to take cluster effect and refusals into account.

We contacted the directors of three schools to take the permission to enter classrooms to distribute the questionnaires. Children were given the questionnaire to be filled at home by their parents.

Verbal informed consent was also obtained from all parents prior to participating in the study and completing the self-administered questionnaire. Out of 700 distributed questionnaires, 527 (75.2%) were returned to us.

### 2.2. Data collection and measurement

Data were collected using an Arabic, self-administered questionnaire consisting of 74 questions that assessed socio-demographic characteristics, including age, gender, region, number of rooms and the number of persons living in the house, the level of education for both parents, the family history of asthma, and other known risk factors of asthma (the heating system used inside the house, if the child went to a nursery, etc.). We also took into account potential confounders such as recurrent otitis and humidity by asking about the child's history of recurrent otitis by asking about the frequency of the otitis per year and the presence of humidity and molds in the house as seen on walls; we considered a child as having recurrent otitis media if he had more than 3 episodes within the last 6 months or more than 4 episodes within the last 12 months [23].

The respiratory health status of the child was assessed using the ISAAC questionnaire [2]. The presence of cough was defined by a positive answer to the questions: "In the last 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection?", while the presence of wheezing was defined by a positive answer to the questions "Has your child ever had wheezing or whistling in the chest at any time in the past?". To know if the child had respiratory problems, the questions "Have you found your child bothered to breathe?" and "Currently did you find that your child has difficulty breathing?" were used.

To ask about the presence of bronchial congestion, the following questions "Have you found your child congested?" and "Do you currently see that your child has a chest congestion?" were used. An affirmative answer to these questions as well revealed the presence of the symptom.

A respiratory problem was considered to be present in case of the presence of any of the previously defined symptoms of asthma (wheezing, cough, respiratory bothering, chest congestion), but without physician diagnosis, as stated by the parents.

Diagnosed asthma was defined as a positive answer to the question "Did the doctor tell you that you have asthma?" [2]. The presence of child recurrent otitis and a serious respiratory problem occurrence before 2 years of age were also assessed. We also assessed the parental history of asthma by asking both parents about the presence physician diagnosed asthma.

Questions about smoking or alcohol intake during pregnancy and during breastfeeding, the kind of smoking or alcohol along with the quantity were included, in addition to the use of any drug during pregnancy or lactation, occupational, regional, local, and domestic pesticides exposures and cleaning products use. For pesticide exposure, information was recorded using the following questions: "Have you ever used pesticides in your work?" "Have you ever used pesticides out of your work (for house or garden treatment...)?" "Do you live in a region heavily treated by pesticides?" "Do you live in the proximity of a heavily treated field by pesticides?" along with the duration of exposure during work and the number of times the house or the garden get sprayed by pesticides per week or per year. Active smoking was determined by several questions (number of daily cigarettes or weekly waterpipes smoked), categorizing subjects in non-smokers or current smokers. Passive smoking will be characterized by the number of smokers at home.

Detergents use was determined by questions about who uses these products at home, the type of detergents and if there is any

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