



Associations of household renovation materials and periods with childhood asthma, in China: A retrospective cohort study



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ABSTRACT

Background: Childhood asthma is prevalent in China. However, there is a lack of evidence on whether household renovation, including the materials used and the periods, are associated with the disease.

Objectives: To investigate the associations between household decoration materials and renovation periods, and childhood asthma and its related symptoms.

Methods: During 2010–2012, a retrospective cohort study was initiated in seven cities of China, and 40,010 children, aged 3–6 years, were recruited. Data on demographics, health status, and home decoration conditions were collected using a parent-administered questionnaire. Two-level (city-child) logistic regression analyses with adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were performed to show the target associations. Sensitivity analysis was performed by stratifying data for children in the southern and northern cities.

Results: Children whose homes underwent renovation or the addition of new furniture within 1 year before pregnancy, during pregnancy, at age 0–1 year, and after age 1 year had significantly ($p < 0.05$) higher prevalence of childhood asthma and its related symptoms. The use of solid wood floors and wallpaper had significant associations (cement: AOR, 95% CI: 1.59, 1.17–2.17; lime: AOR, 95% CI: 1.31, 1.00–1.71) with an increased risk of lifetime asthma. Household renovation and the addition of new furniture during pregnancy had significant associations with lifetime asthma (renovation: AOR, 95% CI: 1.23, 1.01–1.51); lifetime wheeze (renovation: AOR, 95% CI: 1.21, 1.05–1.39; furniture: AOR, 95% CI: 1.24, 1.14–1.36), current wheeze (renovation: AOR, 95% CI, 1.21 1.05–1.40; furniture: AOR, 95% CI: 1.23, 1.12–1.34), and current dry cough (renovation: AOR, 95% CI: 1.41, 1.23–1.63; furniture: AOR, 95% CI: 1.28, 1.17–1.41). Similar associations were found between the addition of new furniture during early childhood and lifetime asthma and its related symptoms. Except for the association between lifetime wheeze and flooring materials, the studied associations were generally stronger among children from the northern cities.

Conclusions: We confirmed that using cellulose based materials in home decoration and renovation, and adding new furniture during early childhood and pregnancy could be risk factors for childhood asthma. The association between household decoration during early childhood and childhood asthma may be stronger in the northern cities of China.

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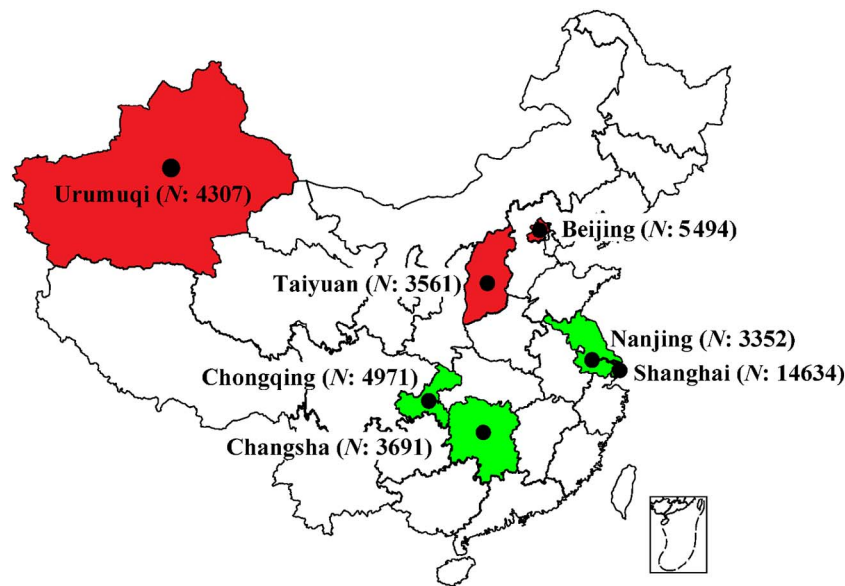


Fig. 1. Location distributions of the seven cities that participated in the China, Children, Home, Health (CCHH) survey and the sample proportions (N) in the different cities (Red: Northern cities; Green: Southern cities). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

1. Introduction

As in many western countries (Asher et al., 2006; Gupta et al., 2007; Hansen et al., 2013; Pearce et al., 2007; Schernhammer et al., 2008), the prevalence of childhood asthma has rapidly increased in China (Zhang et al., 2013a). Several studies, in the last two decades, have reported that this increase in prevalence could be significantly associated with household environmental exposures (Butland et al., 1997; Ponsonby et al., 2000; Zhao et al., 2013). However, the findings of these studies were inconsistent (Bousquet et al., 2008; Gauderman et al., 2005; McConnell et al., 2002).

In China, with the rapid development of the building industry, an increasing number of new types of building materials are being applied in household decoration (Zhang et al., 2013b). The use of these materials could reduce the air change rate as well as increase the proportion of indoor volatile organic compounds (VOCs) and other pollutants, leading to worse indoor air quality and, consequently, health-related impairments (Wieslander et al., 1997; Huang et al., 2017). A few studies have found that the use of home decorations during early childhood is associated with childhood allergies and airway diseases (Deng et al., 2015, 2016; Li et al., 2014; Lin et al., 2016; Wen et al., 2015; Zhao et al., 2013). A study among 3–6-year-old children from Taiyuan, China, reported that the addition of new large furniture during pregnancy was significantly associated with an increased odds of childhood wheeze, allergic rhinitis and eczema, while renovating the home at age 0–1 year was associated with an increased risk for rhinitis and eczema symptoms (Zhao et al., 2013). A similar study from Changsha, China, found that the addition of new large furniture at age 0–1 year, was a risk factor for the increased odds of childhood eczema and allergic rhinitis, and exposure to household renovation during pregnancy was a risk factor for childhood asthma and eczema (Deng et al., 2016).

In the present retrospective cohort study, we investigated the associations between household renovation periods and decoration materials (wall and floor) with childhood doctor-diagnosed lifetime asthma and parent-reported asthmatic symptoms among 3–6-year-old children, in China. We hypothesized that exposure to household renovation during pregnancy and early childhood, as well as the use of new types of decoration materials (in the place of lime and cement) could be significantly associated with an increase in the risk of childhood asthma and its related symptoms (wheeze and dry cough).

2. Materials and methods

2.1. Study design and participants

The retrospective cohort study, was based on the first phase of the China, Children, Homes, Health (CCHH) study—a large multi-centre study conducted on kindergarten children in China, with the aim of investigating the associations between indoor environment and asthma, eczema, rhinitis and other allergies (Zhang et al., 2013a). Through the use of the same standard and validated parent-administered questionnaire used in that study, we collected data on demographics, residential characteristics, household environment, as well as lifetime-ever and current (within the past 1 year before this survey) health status of the children. Questions on childhood allergic diseases/symptoms were based on the International Study on Asthma and Allergies in Childhood (ISAAC) (Asher et al., 1995). Questions on residential characteristics and household environment were based on the Dampness in Building and Health study (Bornehag et al., 2004) in Sweden, modified for Chinese habits. The CCHH study was approved by the Ethical Committee of the School of Public Health, Fudan University, China. Informed written consent was obtained from all the participants' parents and guardians before the survey.

From October 2010 to April 2012, a total of 59,337 questionnaires for parents of children, from > 200 kindergartens, across seven cities (Shanghai, Chongqing, Nanjing, Changsha, Taiyuan, Urumqi, and Beijing), were randomly distributed (Zhang et al., 2013a) (Fig. 1). We finally collected 42,666 responses (response rate: 71.9%) pertaining to 1–8-year-old children. In the present study, questionnaires from 1784 children younger than 3 years old or older than 6 years old were excluded, as were 872 investigated children in whom information on age was absent. The questionnaires of 40,010 children, aged 3–6 years, were finally included.

2.2. Health outcomes

Lifetime asthma and its related symptoms, including lifetime wheeze, current wheeze and current dry cough, were investigated in the present study. Hereinafter, “lifetime asthma” is defined by the question “Has your child ever been diagnosed with asthma by a doctor? (Yes or No)”; “lifetime wheeze” by “Has your child ever had wheeze or whistling in the chest at any time in the past (Yes or No)”; “current wheeze” by “Has your

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