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Associations between home dampness-related exposures and childhood eczema among 13,335 preschool children in Shanghai, China: A cross-sectional study

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ABSTRACT

From April 2011 to April 2012, we conducted a cross-sectional study in Shanghai, China. A total of 13,335 modified ISAAC questionnaires (response rate: 85.3%) were returned by parents or guardians for 4–6 year-old children. Six dampness-related indicators (visible mold spots, visible damp stains, damp bed clothing, water damage, window pane condensation, and moldy odor) were used to evaluate home dampness-related exposures. In the present study, we applied logistic regression model to reveal associations, dose–response relationships, and statistical interaction effects of these dampness-related exposures, with childhood eczema, during lifetime since birth (ever) and in the last 12 months before the questionnaire. The dampness-related indicators were frequently reported in the perinatal and current residences. Prevalences of eczema ever and in the last 12 months were 22.9% and 13.2%, respectively. The dampness-related indicators were robustly associated and dose–response related with increased risk of eczema ever and in the last 12 months in the logistic regression analyses, with adjusted for potential confounders. Specifically, in the perinatal residence, visible mold spots or damp stains could increase 46% (OR, 95% CI: 1.46, 1.29–1.66) odds of childhood eczema (ever); in the current residence, visible mold spots and visible damp stains could increase 34% (1.34, 1.14–1.58) and 38% (1.38, 1.22–1.56) odds of childhood eczema (ever), respectively. Associations were not appreciably different between boys and girls, nor were they different between children with and without parental history of atopy. In conclusion, perinatal and current dampness-related exposures in the residence perhaps are risk factors for childhood eczema.

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1. Introduction

In recent years, the prevalence of childhood eczema in China (Zhang et al., 2013b) and many other countries (Asher et al., 2006; Duggan et al., 2012; Grize et al., 2006; Sun and Sundell, 2013; Weidinger and Novak, 2015) has been rapidly increasing. A national survey, which was conducted in ten cities of China in 2002, found that prevalence of childhood eczema among preschool children in Beijing (4.75%) was the highest, followed by Shanghai (2.78%) (Gu et al., 2004). In 2012, we found that the eczema prevalence in Beijing and Shanghai had increased to 34.7% and 23.4%, respectively (Zhang et al., 2013b).

Several studies have suggested that indoor environmental

exposures may be related to the prevalence of childhood eczema (Miyake et al., 2007; Schafer et al., 2008; Tsakok et al., 2015; Wang et al., 2015; Wegienka et al., 2015; Weinmayr et al., 2013; Weidinger and Novak, 2015; Zhang et al., 2013a, 2013b; Zhao et al., 2013). The cross-sectional studies on home environment and children's health in Sweden (Bornehag et al., 2005), Ireland (Duggan et al., 2012), Bulgaria (Naydenov et al., 2008), USA (Sun and Sundell, 2011), Korea (Choi et al., 2014), and in the Chinese cities Taiyuan (Zhao et al., 2013), Wuhan (Zhang et al., 2013a), and Chongqing (Wang et al., 2013, 2015), using a similar questionnaire, found that home dampness-related indicators (mold spots, damp stains, water damage, windows pane condensation, moldy odor) were associated with childhood eczema. However, several studies found that residential dampness-related exposures had no significant associations of with eczema in childhood (Holme et al., 2010; Pirastu et al., 2009; Tham et al., 2007) nor among young adults (Sun et al., 2011). Therefore, it is still unclear that whether home dampness-related exposures are risk factors for childhood

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eczema. More investigations are required as the recent systematic reviews on associations of environmental exposures and childhood eczema suggested (Flohr and Mann, 2014; Wegienka et al., 2015; Weidinger and Novak, 2015).

Shanghai, a city with a typical subtropical monsoon climate, is located in the Yangtze River estuary in the Chinese East Sea. Hot-moist in summer and cold-moist in winter characterize both its outdoor and indoor environments, since this city's location in China means there is no central heating. Our previous study revealed notably different situations of dampness-related indicators in residences with different building characteristics and lifestyle behaviors in Shanghai (Liu et al., 2015). These differences in Shanghai dwelling dampness give us an excellent chance to study associations between home dampness-related indicators and childhood diseases. As a part of the China, Child, Homes, Health (CCHH) study in Shanghai (Huang et al., 2013, 2015), we aim in the present study to investigate associations, dose–response relationships, and interaction effects (multiplicative and additive) of home dampness-related indicators, in the perinatal residence (at the child's birth) and/or in the current residence (at the time of the questionnaire), on eczema among 4–6 year-old children. We further examined these relations in different subgroups *via* stratifying the sampled children by sex and family history of atopy. We hypothesized that home dampness-related exposures would be related with childhood eczema.

2. Methods

2.1. The CCHH study in Shanghai

From April 2011 to April 2012, we conducted a questionnaire-based cross-sectional study (CCHH phase one) in 72 kindergartens from five districts of Shanghai, and surveyed 17,898 parents or guardians of 1–8 year-old children. We selected the surveyed kindergartens by this approach: five districts (Urban: Hong-Kou, Jing-An, and Zha-Bei; Suburban: Bao-Shan and Feng-Xian) were selected from 18 districts (10 urban districts and 8 suburbs) of Shanghai city, and then about 15 kindergartens were randomly chosen in each district. More details with respect to the chosen kindergartens in each district are described in our previous article

(Huang et al., 2015).

Questionnaires were distributed by two methods: (1) delivered to parents and recovered on-site by us in kindergartens at teacher–parents meetings in the urban districts, and (2) posted to kindergartens where teachers delivered them to parents, and then recovered them and mailed them back to us in the suburban districts. Before the survey, we introduced the CCHH study and questionnaires to parents or the kindergarten leaders and/or teachers, and a questionnaire guidance was distributed to each parent along with the questionnaire. All the data for the present study are from the questionnaire. Early published articles provide more information about the CCHH study in China (Zhang et al., 2013b) and in Shanghai (Hu et al., 2014; Huang et al., 2015; Liu et al., 2014). The study was approved by the ethical committee in the School of Public Health, Fudan University in Shanghai, China.

2.2. Definitions of exposures and outcomes

Questions for home environments were the same as for the CCHH study in other cities of China (Zhang et al., 2013b) and were similar to studies in other countries (Bornehag et al., 2004; Choi et al., 2014; Naydenov et al., 2008; Sun and Sundell, 2011; Tham et al., 2007). Table 1 shows the questions for dampness-related indicators in the perinatal and current residence in Shanghai (Table A.1 shows the questions for dampness-related indicators in Chinese version). Dampness-related exposure was defined as a “yes” answer to any of the questions mentioned in the table. Herein the perinatal residence or perinatal indicators were defined as the household at the child's birth; and the current residence or current indicators were defined as the home the surveyed child currently lives in. To investigate the dose–response relationships of home dampness-related exposures with childhood eczema, the number of dampness-related indicators in the perinatal (three indicators) and current residences (six indicators) were added so as to yield a sum, *n*, of indicators. Thus, for perinatal residence, *n* varied from zero to three, and the current residence, *n* varied from zero to 6. If both the perinatal and current residences did not report any dampness indicators, we considered these families to have had “both no” home dampness exposure; if both the perinatal and current residences reported any one of the damp indicators, we considered these families to have had “both yes”

Table 1
Questions for the home dampness-related indicators.

Indicator	Question	Answer
(1) In the perinatal residence		
1) Visible mold spots or damp stains	Did you notice there was visible mold or damp stains on the floor, walls or ceiling in the perinatal residence at the child's birth?	Yes, often (every week) vs. Yes, sometimes vs. No, never
2) Windows pane condensation	Did you notice there was condensation or moisture occur on the inside, at the bottom, of windows in winter in the perinatal residence at the child's birth?	Yes, often (every week) vs. Yes, sometimes vs. No, never
3) Moldy odor	Have you been bothered by the moldy odor in the perinatal residence at the child's birth?	Yes, often vs. Yes, sometimes vs. No, never
(2) In the current residence		
1) Visible mold spots	Have you noticed any visible mold on the floor, walls or ceiling in the child's room?	Yes vs. No
2) Visible damp stains	Have you noticed any visible damp stains on the floor, walls or ceiling in the child's room?	Yes vs. No
3) Damp bed clothing	Have you noticed your clothing and/or bedding are damp in the last year?	Yes, often vs. Yes, sometimes vs. No, never
4) Water damage	Have there been any flooding or other kinds of water damages in your residence?	Yes, during the last year vs. Yes, before the last year vs. No, never
5) Windows pane condensation	In the winter, does condensation or moisture occur on the inside, at the bottom, of windows in the child's room?	Yes, > 25 cm vs. Yes, 5–25 cm vs. Yes, < 5 cm vs. No, never
6) Moldy odor	Have you been bothered by the moldy odor in your residence during the last 3 months?	Yes, often vs. Yes, sometimes vs. No, never

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