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## Original article

## Environmental factors associated with childhood eczema: Findings from a national web-based survey

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ISAAC International Study of Asthma and Allergies in Childhood

## ABSTRACT

**Background:** Genetic and environmental factors are known to be related to the development of childhood eczema. Our aim was to assess the environmental factors associated with the prevalence of eczema among children using a web-based survey.

**Methods:** In June 2012, we conducted a nation-wide web-based survey to identify the prevalence and characteristics of allergic diseases among Japanese children. The prevalence of allergic diseases including eczema was assessed using the International Study of Asthma and Allergies in Childhood core questionnaire. The associations between eczema prevalence and environmental factors, as well as those between background characteristics and comorbid allergic diseases among 6–12 year old children were assessed.

**Results:** A total of 28,348 children were included in the analysis. The prevalence of current eczema was 13.0%. Current eczema was significantly associated with a higher prevalence of wheeze, rhinitis, and food allergy. In multiple logistic regression models, birth during autumn (aOR: 1.18 95%CI: 1.06–1.31) or winter (aOR: 1.21 95%CI: 1.08–1.34), duration of exclusive breastfeeding for at least 6 months (aOR: 1.14 95%CI: 1.06–1.23), and ownership of a pet from infancy (aOR: 2.61 95%CI: 1.68–4.07) were also associated with a higher prevalence of eczema. The prevalence was lower in those with a high annual household income (aOR: 0.90 95%CI: 0.81–0.99) and 2 or more siblings (aOR: 0.86 95%CI: 0.76–0.97). **Conclusions:** Duration of breastfeeding, season of birth, pet ownership, household income, and the number of siblings were associated with the prevalence of childhood eczema in a nationwide web survey.

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## Introduction

Eczema/atopic dermatitis (AD) is the most common chronic inflammatory skin disease of childhood. Worldwide epidemiological surveys have reported a high lifetime prevalence of over 15% in many developed countries and a lower but increasing figure in developing countries as well.<sup>1,2</sup> Not only does it place a significant burden on the healthcare system and the quality of life of the

patient and family,<sup>3</sup> it often precedes other allergic diseases such as asthma and allergic rhinitis, known as the “atopic march,” suggesting a causal relationship or a shared mechanism.<sup>4</sup>

While there is a clear genetic predisposition for AD,<sup>5,6</sup> evidence suggests that environmental factors along with genetic ones have an important role in the development of the disease.

In 2012, we conducted a national web-based survey to identify the prevalence and characteristics of allergic diseases among Japanese children. The web-based survey was chosen as a means of gathering data for this study because it enables larger numbers of participants to respond more quickly than conventional methods and may help to obtain a larger quantity of information, provided the sample selection is appropriate.<sup>7</sup>

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The aim of this study was to evaluate the association of childhood eczema with a wide range of environmental factors using a web-based survey.

## Methods

### Study population and participation

This study was conducted using the Macromill online research system (MACROMILL, Inc. Tokyo, Japan), which maintains one of the largest research panels in Japan.

In June 2012, we distributed a questionnaire to evaluate the prevalence and characteristics of allergic diseases among Japanese children to 35,000 randomly selected parents in the research panel who had children aged 6–18 years. Parents filled in the online questionnaire regarding each child. This questionnaire consisted of two major parts: the first pertained to the child's general characteristics (such as age, sex, body weight and height), family history, and various environmental factors; the second was designed to assess the child's allergic status, and included the Japanese version of the ISAAC (International Study of Asthma and Allergies in Childhood) core questionnaire module for wheeze, eczema, and rhinitis.<sup>8</sup> Given the fact that the respondents were the parents and because of the significant increase of missing data concerning their early life factors in older children, 6–12 year old children were included in the current analysis.

The study protocol was approved by the independent review board of the Tokyo Metropolitan Children's Medical Center. All parents were provided with an online explanation of the purpose and the procedure of the study, and gave informed consent by proceeding with the survey. The participants were offered an incentive of 100 yen (equivalent to approximately US\$1.25 at the time of the study) for response.

### Definitions and classifications

Current eczema was defined as a positive response to the following three questions: "Has your child ever had an itchy rash which was coming and going for at least 6 months?" "Has your child had this itchy rash at any time in the past 12 months?" and "Has this itchy rash at any time affected any of the following places: folds of the elbows, behind the knees, in front of the ankles, under the buttocks or around the neck, ears or eyes?" Current wheeze was defined as a positive response to the question "Has your child ever had wheezing in the chest in the past 12 months?" Current rhinitis was defined as a positive answer to the question "In the past 12 months, has your child had a problem with sneezing, or a runny or blocked nose when he/she did not have a cold or the flu?"

History of food allergy was determined on the basis of whether the child ever received a doctor's diagnosis of the disease. The child's body mass index (BMI) was categorized according to the reference BMI values for Japanese children.<sup>9</sup>

### Statistical analysis

All analyses were performed using the SPSS package version 21 (IBM Corp, Armonk, NY, USA). For comparison, the unpaired *t*-test was used for continuous variables and the chi-square test was used for categorical variables. The association between each variable and the prevalence of eczema was assessed among the children with complete data by simple logistic regression analysis, and was further analyzed by multiple logistic regressions using all study variables. Variables were selected based on literature and on correlations within our data set. A *P*-value of <0.05 was considered statistically significant.

## Results

### Prevalence of eczema and comorbid allergic disease

The survey was distributed to 35,000 parents, and responded to by 32,163 (91.9%) parents on behalf of 49,096 children aged 6 to 18. A total of 28,348 children aged 6 to 12 were included in the analyses (Fig. 1). General characteristics of the study population are shown in Table 1. The prevalence of current eczema was 13.0%.

Among the children with current eczema, 21.5% had current wheeze, 68.4% had current rhinitis, and 28.0% had received a diagnosis of food allergy. The prevalence of comorbid allergic diseases was significantly higher than in children without current eczema (all *P* < 0.01) (Table 2).

### Factors associated with the prevalence of current eczema

Factors associated with the prevalence of current eczema were analyzed using data of 23,662 children (Table 3). Paternal and maternal eczema significantly increased the prevalence of the child's eczema (aOR: 2.46 95%CI: 2.17–2.79 *P* < 0.01, aOR: 2.49 95%CI: 2.24–2.78 *P* < 0.01, respectively).

There was no difference in prevalence with respect to the mode of delivery or birth weight. Children born in autumn and winter reported a slightly higher prevalence of eczema compared with those born in summer (aOR: 1.18 95%CI: 1.06–1.31 *P* < 0.01, aOR: 1.21 95%CI: 1.08–1.34 *P* < 0.01, respectively). The prevalence of eczema was higher in children with a breastfeeding duration of at least 6 months (aOR: 1.14 95%CI: 1.06–1.23 *P* < 0.01), but not associated with daycare attendance during infancy. Regarding the number of siblings, two or more siblings was associated with decreased prevalence (aOR: 0.86 95%CI: 0.76–0.97 *P* = 0.02). The high household income group showed significantly lower prevalence compared with the low household income group (aOR: 0.90 95%CI: 0.81–0.99 *P* = 0.04).

The influence of pets differed between the periods of ownership. Owning a pet from infancy showed significantly increased eczema prevalence (aOR: 2.61 95%CI: 1.68–4.07 *P* < 0.01), while the associations of close contact with pets were not significant for other periods of ownership.

## Discussion

In this nationwide web-based study, the prevalence of eczema among 6–12 year old children was 13.0%. As in previous reports, the comorbidity rate for other allergic diseases was found to be

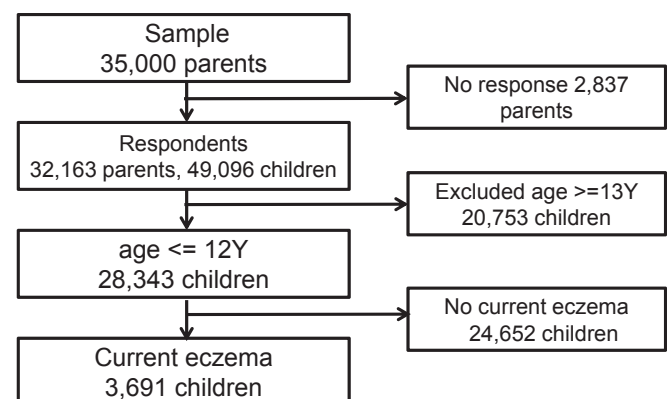


Fig. 1. Flow chart of the study subjects.

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