

Brief Communication



Time Trends in the Prevalence of Atopic Dermatitis in Korean Children According to Age

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There are no financial or other issues that might lead to conflict of interest.

ABSTRACT

This study aimed to explore time trends in the prevalence of atopic dermatitis (AD) according to age in Korean children. We observed changes in the estimated annual prevalence of AD using data from the Korean National Health Insurance Service (NHIS) and Statistics Korea between 2003 and 2018. In each year, the highest prevalence was evident among children aged 12 to 23 months, and then the prevalence decreased with age. The annual prevalence of AD in Korean children under the age of 18 slightly increased from 4.0% in 2003 to 4.5% in 2018. During this period, the prevalence in children aged 6 to 18 years increased from 1.9% in 2003 to 3.1% in 2018, while that of infants aged less than 24 months substantially decreased. Among children who were born in 1991, 1997, 2000, 2003 and 2006, the slopes of decreasing trend lines over age 6 were similar. Comparing children born in 2009 and 2012 with those born before 2006, the more recent the birth year, the higher the prevalence of AD over age 6. In conclusion, time trends of the annual prevalence of AD in Korean children from 2003 through 2018 were different according to age group. These results suggest that AD development during infancy is decreasing whereas either a late-onset AD or early-onset, persistent phenotype is likely to increase. Different strategies according to age are required for more effective prevention and treatment of AD in Korean children.

Keywords: Atopic dermatitis; eczema; prevalence; child; adolescent; phenotype

INTRODUCTION

Atopic dermatitis (AD) is a complex multifactorial skin disease that is characterized by considerable phenotypic heterogeneity.¹ According to recent studies, phenotypes with different clinical and immunological characteristics exist, and therefore, they manifest different disease courses.²⁻⁴ For the proper management of AD, appropriate prevention and treatment strategies should be implemented in accordance with various AD phenotypes.^{5,6} To evaluate whether those strategies are effective in a specific area or society, regular monitoring of the prevalence rates of AD are necessary.

In Korea, a nationwide population-based epidemiologic survey using questionnaires of the International Study of Asthma and Allergies in Childhood (ISAAC) showed that the

prevalence of “eczema treatment in the last 12 months” in 6–7 and 12–13 year-old children increased from 11.9% in 2000 to 15.3% in 2010 and from 7.4% in 2000 to 8.9% in 2010, respectively.^{7,8} In contrast, data from the Korean National Health Insurance Service (NHIS) demonstrated that the estimated prevalence of AD in 6–18 year-old children and adolescents was lower than that from the questionnaire survey.^{9,10} It is highly likely that AD prevalence based on NHIS data is underestimated, considering the fact that there are patients who receive alternative medicine or cannot receive medical services. Although the diagnostic accuracy of NHIS data is of debate, the estimated prevalence rates from those data could be used to observe changes over time, because they are not only from the whole population but also estimated in a consistent way.

In the present study, we aimed to investigate time trends in the prevalence of AD in Korean children using national statistical data from 2003 through 2018.

MATERIALS AND METHODS

This observational study was performed using data from the Korean NHIS. We collected data about AD from the “Disclosure of Data” section of the NHIS homepage. Data were based on insurance claims made by doctors after examining patients from 2003 to 2018. According to our working definition, AD was diagnosed when the patients visited hospitals for medical management with code L20 (the International Classification of Diseases-10th Revision) at least twice a year. The number of affected patients in each year was determined by this definition to improve data reliability. Information on patients’ age and sex was also obtained. Data regarding the estimated population of all age groups from 2003 to 2018 were collected from Statistics Korea (<http://www.kostat.go.kr>).

The annual prevalence of AD was calculated by dividing the number of patients by the estimated population in each year. After stratifying children with age into 4 groups (0–1 year, 2–5 years, 6–11 years, 12–18 years), we compared the annual prevalence of AD in each age group from 2003 to 2018. We did not provide statistical values such as *P* value or confidence intervals because the total population of Korea, not a randomly selected sample, was evaluated in the present study. In addition, prevalence rates were compared by age not only between each year but also between each birth year.

RESULTS

Table shows the estimated prevalence rates of AD in Korean children by age (0–18 years) from 2003 through 2018. The prevalence was highest in children ages 12–23 months each year, and then the prevalence decreased with age.

Looking at the change in the prevalence rates of each age group over time, the prevalence of AD in Korean children under the age of 18 slightly increased from 4.0% in 2003 to 4.5% in 2018 (**Fig. 1**). In particular, the AD prevalence in school-aged children (6–18 years) increased from 1.9% in 2003 to 3.1% in 2018. On the other hand, the prevalence of preschool-aged children (less than 6 years of age) increased from 2003 (9.1%) to 2008 (11.6%) and thereafter, substantially decreased to 8.1% in 2018. Notably, in infants aged less than 24 months, the prevalence markedly decreased from 15.1% to 8.6% during the last 10 years.

Time Trends in the Prevalence of Atopic Dermatitis

Table. The estimated prevalence rate (%) of atopic dermatitis in children and adolescents from 2003 through 2018

Age (yr)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
0	8.4	8.5	8.8	9.3	11.0	9.9	8.5	8.3	8.2	7.7	6.3	6.3	5.5	4.7	5.0	5.1
1	15.0	17.4	17.2	16.5	18.6	20.1	16.8	17.3	17.4	16.8	16.0	13.5	12.9	12.3	11.9	11.6
2	10.3	11.2	12.2	11.2	12.2	14.0	13.6	13.0	12.8	13.2	12.8	12.0	10.0	10.5	10.4	10.0
3	8.7	8.2	8.5	8.6	9.4	10.1	10.3	11.0	10.0	9.6	10.2	9.2	8.7	8.0	8.2	8.4
4	7.3	7.6	7.0	6.5	8.0	8.5	8.1	8.8	8.9	7.9	8.1	7.9	7.3	7.5	6.8	7.1
5	5.9	6.2	6.5	5.3	6.1	7.2	7.0	7.0	7.4	7.2	7.0	6.6	6.6	6.6	6.6	6.1
6	4.6	4.9	5.1	4.8	4.8	5.5	5.9	5.9	5.7	5.9	6.4	5.8	5.5	5.9	5.8	5.8
7	3.4	3.7	3.9	3.6	4.1	4.1	4.1	4.7	4.5	4.3	5.0	5.0	4.5	4.6	4.9	4.9
8	2.7	2.9	3.0	2.9	3.2	3.6	3.3	3.6	3.8	3.5	3.9	4.1	4.2	4.0	4.2	4.3
9	2.2	2.4	2.5	2.4	2.7	3.0	3.1	2.9	2.9	3.1	3.3	3.4	3.5	3.8	3.7	3.7
10	1.9	2.0	2.1	2.0	2.2	2.5	2.5	2.8	2.4	2.4	2.9	3.0	2.9	3.3	3.5	3.3
11	1.7	1.7	1.8	1.7	1.9	2.0	2.1	2.3	2.3	2.0	2.3	2.6	2.6	2.7	2.9	3.1
12	1.5	1.6	1.6	1.5	1.7	1.8	1.8	2.0	2.0	2.0	1.9	2.1	2.4	2.5	2.4	2.6
13	1.3	1.5	1.5	1.4	1.5	1.6	1.6	1.7	1.7	1.8	2.0	1.9	2.0	2.3	2.3	2.2
14	1.2	1.3	1.4	1.3	1.5	1.5	1.5	1.6	1.6	1.6	1.8	2.0	1.8	2.0	2.2	2.2
15	1.1	1.2	1.3	1.4	1.5	1.5	1.4	1.5	1.5	1.6	1.8	1.9	2.0	1.9	2.0	2.3
16	1.1	1.2	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5	1.7	1.9	2.0	2.1	1.9	2.0
17	1.0	1.1	1.2	1.2	1.4	1.6	1.5	1.6	1.5	1.5	1.6	1.8	1.9	2.1	2.2	2.0
18	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.5	1.5	1.6	1.7	1.9	2.0	2.1	2.3

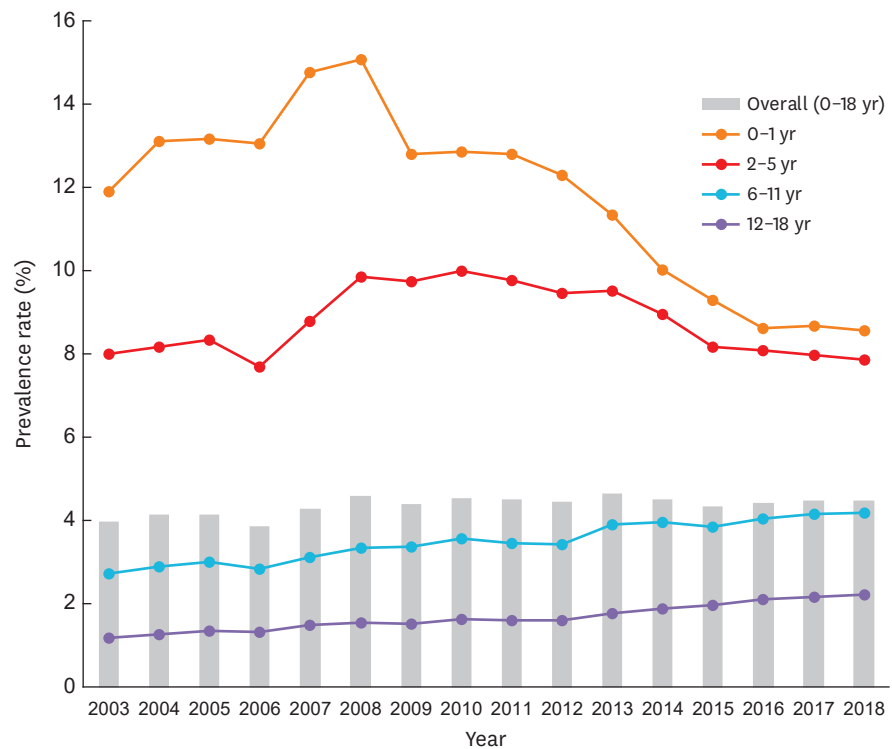


Fig. 1. Time trends in the prevalence of AD in Korean children aged 18 years and under from 2003 to 2018. The change in AD prevalence in each age group from 2003 to 2018 was observed in the following age groups: overall (0–18 years), 0–1 year, 2–5 years, 6–11 years and 12–18 years. AD, atopic dermatitis.

We also examined whether the decreasing pattern of AD prevalence with age was similar for each year. In **Fig. 2**, the estimated prevalence rates were compared among the years 2003, 2008, 2013 and 2018. Of note, the order of high prevalence in the age group under 2 years was 2008, 2013, 2003 and 2018, but in the age group over 8 years it was 2018, 2013, 2008 and 2003. Consequently, it was observed that the prevalence rates of AD in school-aged children over 8 years became higher from 2003 to 2018.

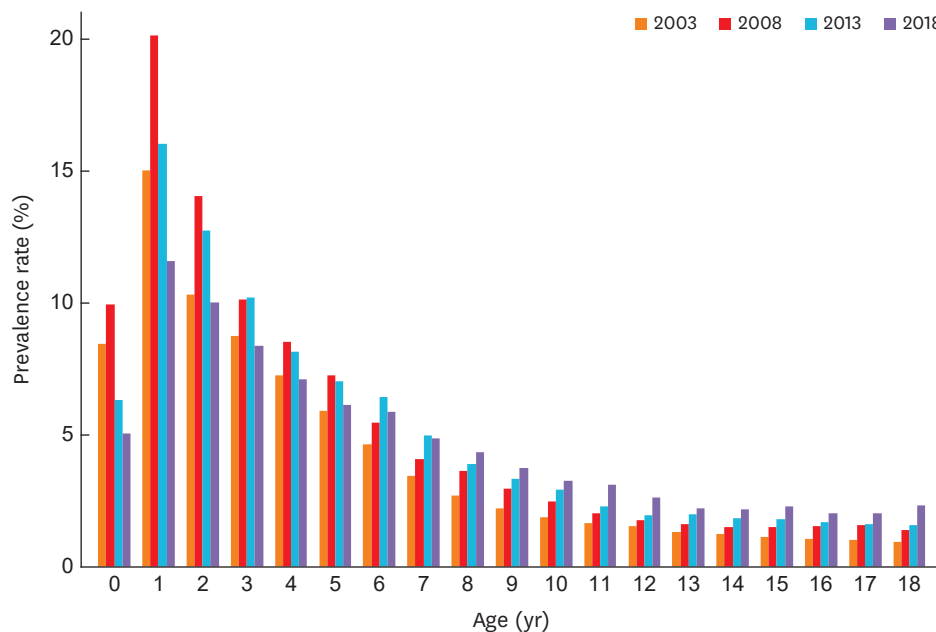


Fig. 2. Comparison of the prevalence of AD by age among the years 2003, 2008, 2013 and 2018. The decreasing rate of AD prevalence by age was different between the years. The prevalence of AD in 2018 was the lowest in infants, whereas it became the highest in school-aged children and adolescents. AD, atopic dermatitis.

The reason for the high prevalence of AD in school-aged children in recent years is not clear. Therefore, we investigated whether the slopes of decreasing patterns of AD prevalence with age were similar among children with different birth years. Interestingly, the slopes of the decreasing trends with age by birth years were different (**Fig. 3**). Among children who were born in 1991, 1997, 2000, 2003 and 2006, the slopes of decreasing trend lines over age 6 were similar. In other words, the prevalence of the group with high prevalence before age 2 continued to be high even after age 6. In contrast, in children born in 2009 and 2012, the degree of decline in prevalence with growth decreased and eventually the decreasing trend lines in children over age 6 crossed those of children born before the year 2009. Comparing children born before 2006 with those born after 2009, the more recent the birth year, the higher the prevalence of AD over age 6.

DISCUSSION

This study found that in infants aged 1 year or less, the prevalence of AD increased from 11.9% in 2003 up to 15.1% in 2008, and thereafter it significantly decreased to 8.6% in 2018. Although the exact reason needs to be investigated, this decrease in AD prevalence during infancy may be related to increased awareness and implementation of more aggressive preventive intervention by the parents. However, the study also found that the overall change in the estimated prevalence of AD among children aged 18 years and younger between 2003 and 2018 increased from 4.0% to 4.5%, and this trend was due to the rising prevalence from 1.9% in 2003 to 3.1% in 2018 in children aged 6 to 18 years. Then we compared prevalence rates by age among children born in the years 1991 to 2012. We hypothesized that each group by birth year would outgrow the disease over time at a similar rate and thus, the difference in the prevalence among each group during infancy would remain even as children grew up.

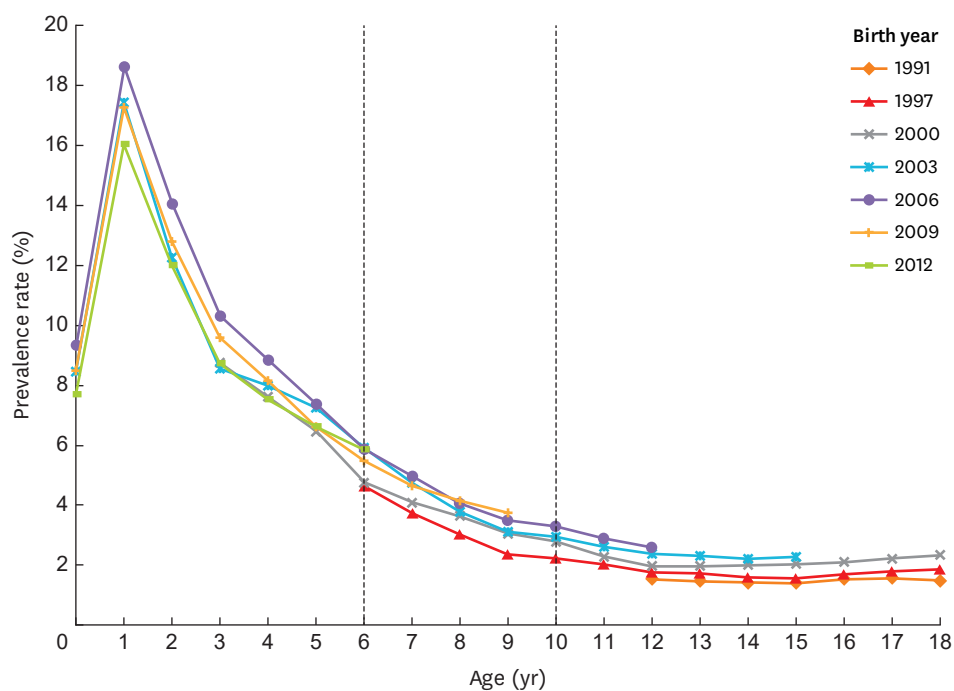


Fig. 3. Comparison of the prevalence of AD by age among children born in 1991, 1997, 2000, 2003, 2006, 2009 and 2012. The prevalence of AD during infancy was different according to the birth year, whereas this difference changed at school age. The decreasing rate of AD prevalence in recently born children was slower than that in children born before 2006. AD, atopic dermatitis.

Of note, the difference in prevalence among the groups by birth year became smaller as they grew older. Eventually, at age 6, the prevalence among children born in 2012 became higher than that in children born in 2009 or earlier. The prevalence of AD in school-aged children born in 2009 and 2012 is higher than that in school-aged children born before 2006. These results indicate that children who were born more recently are less likely to develop AD during infancy, but more likely to have persistent AD or develop AD later at school age.

Many cases of AD develop early in infants and young children, and resolve over time. It appears that approximately 40%–70% of childhood AD resolves when children reach the age of 6 to 7 years.¹¹ However, recent studies about the persistence of AD beyond childhood and adult-onset AD suggest that the number of patients with AD increases beyond childhood. A systematic review and meta-analysis of 45 studies including 110,651 subjects from 15 countries demonstrated that approximately 20% of childhood AD persisted beyond 8 years and persistence was greater in female patients or more severe cases.¹² It was also reported that 26.1% of AD in adults was adult-onset disease.¹³ Indeed, an investigation that reviewed several recent cohort studies has classified AD phenotypes into 3 groups: “early-onset, resolving,” “late-onset, resolving,” and “early-onset, persistent.”¹⁴ These phenotypes may reflect different pathogenesis and subsequently different courses. Our observation of the recent increase in the prevalence of AD in Korean school-aged children indicates that among several AD phenotypes, the early-onset, persistent type or late-onset type is increasing.

AD presents a chronic relapsing-remitting disease course.¹¹ For this reason, the point prevalence survey could be affected by the frequency of relapsing and the increase in the risk factors. It is not yet known whether the prevalence of late-onset or adult-onset AD is

increasing in Korea, but at least the persistence of early-onset AD associated with disease severity is noteworthy because the environment has been changing over time. AD severity is related to recurrent flares due to various host and environmental factors that include allergens, skin infection or colonization, meteorological factors, environmental pollution, and emotional stress.^{2,1548} Although the direct causal relationship was not investigated in the present study, several changes Korean children have faced over the past decades should be noted. According to the Korean climate change assessment report 2020,¹⁹ climate change is under way in the Korean peninsula as the concentration of greenhouse gases, especially CO₂, has increased between 2008 and 2018. The annual average temperature in the 2010s was 13.0°C, which was the highest compared to previous years, and this trend of warming clearly appeared in large cities. The precipitation tended to increase especially in summer, and the tendency for extreme weather has been increasing since the mid-2010s. Since symptoms of AD are highly affected by temperature, humidity and season, it is likely that climate change in the Korean peninsula also influenced the prevalence rates during the school year.²⁰⁻²⁴ AD symptoms may exacerbate or persist as the chances of exposure to inhalant allergens such as house dust mites and pollen become greater than before.²⁵⁻²⁹ Indeed, in Korea, it was reported that grass pollen counts, as well as pollen sensitization, are gradually increasing and are likely due to climate change.³⁰ In addition to allergens, an increase in exposure to indoor air pollutants such as formaldehyde may be the reason why AD prevalence in Korean school-aged children increased recently.³¹ Besides, a recent increased prevalence of obesity in Korea may be another possible cause for the increasing prevalence of AD. It has been reported that obesity in North America and Asia is associated with an increased prevalence of AD.^{32,33} With socioeconomic improvements, the prevalence of obesity in Korean children increased from 6.8% in 1998 to 10.0% in 2013,³⁴ and the prevalence of extreme obesity increased significantly among boys from 2001 to 2014.³⁵

One of the limitations in research using the NHIS data is diagnostic accuracy. In addition, since the prevalence of AD is estimated based on patients' hospital visits, it can be affected by differences in accessibility to the clinics, patients' socio-economic status, disease perception, or behavioral pattern. That is, even if AD has developed or if AD symptoms persist, there may be cases where medical service is not available. Therefore, the analysis using NHIS data should be interpreted with caution. Obviously, nationwide epidemiologic studies using different research methods are necessary to confirm the time trends of AD prevalence in Korean children.

In conclusion, the time trends of the annual prevalence of AD in Korean children is different according to age group. The prevalence of AD from 2003 through 2018 appeared to increase in Korean children, especially in children aged 6 to 18 years, while the prevalence in preschool-aged children tended to decrease substantially. These results suggest that AD development during infancy is decreasing whereas either late-onset AD or an early-onset, persistent phenotype is likely to increase. Different strategies according to age are required for more effective prevention and treatment of AD in Korean children.

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