

Original article

Atopic dermatitis in 5–6-year-old Swedish children: cumulative incidence, point prevalence, and severity scoring

Background: This study aimed to evaluate the cumulative incidence, point prevalence, and severity of atopic dermatitis (AD) in a pediatric population. We also aimed to identify differential diagnoses relevant to AD in this population.

Methods: Children scheduled for a health visit at 5.5 years of age were selected consecutively during the period October 1997–March 1998 from two cities in southern Sweden (Göteborg and Kristianstad). Schultz Larsen's questionnaire was used to evaluate the cumulative incidence of AD. Clinical examination was performed by dermatologists (A.B. and Å.S.) for those children with active eczema. The UK working party's criteria were used for the clinical diagnosis of AD. The SCORAD index was used to evaluate the severity of eczema. This index includes evaluation of extent, intensity, and subjective symptoms to a maximum score of 103 points.

Results: In Göteborg 1219 and in Kristianstad 742 questionnaires were answered regarding 1961 children, 1004 boys and 957 girls. The response rate was 89%. According to the answers to Schultz Larsen's questionnaire, the cumulative incidence of AD in the whole material was 20.7% (406/1961) (CI 95% 18.9–22.5). In Göteborg, 104 of the examined children fulfilled the UK working party's criteria, equivalent to a point prevalence of 8.5% (CI 95% 7.0–10.1). In Kristianstad, the corresponding point prevalence was 11.5% (CI 95% 9.2–13.8). The severity of AD was evaluated in all children with visible eczema. SCORAD evaluation was performed in 155 of the 157 children with visible eczema. The majority of children had mild or moderate eczema; mean value 20.5 (CI 95% 18.7–22.3), median 19.6. Of the 96 children who did not fulfil the criteria of AD, other skin disorders were diagnosed in 51 at the clinical examination. Dry skin was by far the most common differential diagnosis.

Conclusions: We have used validated protocols to evaluate the cumulative incidence, point prevalence, and severity of AD in a population-based study in southern Sweden. The present study, involving a rural and urban pediatric population, shows that AD is common, usually classified as mild or moderate, and seems to increase over time.

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Atopic dermatitis (AD) is the most common atopic manifestation in childhood (1). The prevalence has increased in recent decades, especially in countries with a Western lifestyle (2, 3). In the genetically predisposed individual, environmental and lifestyle factors probably play an important role in the development of the disease (4–6). Epidemiologic studies including the prevalence and severity of the disease are thus important to understand the atopic disease, its triggers and promoters, and are a prerequisite for evaluation of the effects of intervention programs (7, 8).

The severity of AD influences the prognosis of the disease and the risk of developing other atopic

manifestations (9, 10). Not only is severe eczema a burden to the affected patient, but it also entails a considerable cost to the family and the community (11, 12). Only a few population-based studies have reported the severity of AD, and the grading of severity was different in each study (13–17). In the present study, 5–6-year-old children were recruited from the child health centers in two cities in southern Sweden. Our main aim was to evaluate the cumulative incidence, point prevalence, and severity of eczema in those children with active AD by commonly used, well-known, and validated protocols. Our secondary aim was to identify differential diagnoses relevant to AD in epidemiologic studies.

Material and methods

Subjects

Children scheduled for a health visit at 5.5 years of age were selected consecutively during the study period. Health care for children in Sweden is organized through child health centers, covering almost 100% of pre-school children, including those with severe chronic diseases and handicaps. In Göteborg, the children were selected from the city, while in Kristianstad they came both from the city and from the rural surroundings. All child health centers except two in the two areas participated, 24 in Göteborg and 36 in Kristianstad. The reason for nonparticipation of two centers was shortage of staff.

The study was performed during the 6-month period October 1997–March 1998. The ethics committees of the medical faculties of Göteborg and Lund universities approved the study.

Questionnaire

The parents were asked to answer a one-page questionnaire in order to evaluate the cumulative incidence of AD (2, 3). This questionnaire consisted of two parts and was translated into English, Arabic, Somali, and Turkish. The first part included two questions:

- 1) Has your child ever had eczema?
- 2) Does your child have active eczema?

Parents were asked to continue to answer the second part of the questionnaire (Schultz Larsen's questionnaire) if the child had ever had eczema. Schultz Larsen's questionnaire is based on the most discriminatory features of the Hanifin–Rajka criteria. It includes statements or questions, each of which is assigned a certain point value. If the responder's score exceeded a certain number of points, the diagnosis of AD would be considered likely (2). In Göteborg, the questionnaire was sent to the parents together with the appointment time for the visit to the child health center. In Kristianstad, the parents received the questionnaire at the visit to the child health center. The questionnaire was collected by the nurse and given to the dermatologist for further evaluation. If parents reported visible eczema lesions when they completed the questionnaire, the child was offered a clinical examination.

Clinical examination

Clinical examination was performed by dermatologists in Göteborg (A.B.) and in Kristianstad (Å.S.) for those children whose parents reported active eczema. The clinical examination was performed with the child dressed in underwear. Five children were examined in their homes, three in Göteborg and two in Kristianstad. Children included in the study were usually examined

within 1 month and in all cases within the study period. The UK working party's criteria were used for the clinical diagnosis of AD (18–20) (Table 1). The SCORAD index was used to evaluate the severity of AD (21, 22). This index was introduced in 1993 by the European Task Force on AD as a standardized protocol mainly to be used in clinical trials. Extent, intensity, and subjective symptoms are included in this scoring protocol, with a maximum score of 103 points. In this study, a score of <15 was defined as mild, while a score of >40 was defined as severe AD. In children with skin problems not diagnosed as AD, other clinical skin conditions were noted.

Statistics

Statistical analyses were done with SPSS 8.0 for Windows. Nonparametric tests were used. The Mann–Whitney test is used for comparison between independent samples, while the Wilcoxon signed ranks test is used for comparison between related/matched samples. *P* values of <0.05 were considered statistically significant with a confidence interval (CI) of 95%.

Results

In Göteborg 1219 and in Kristianstad 742 questionnaires were answered regarding 1961 children, 1004 boys and 957 girls. The response rate was 89%.

Sixteen percent of the parents reported active eczema (Table 2). It may be concluded that there is good agreement between the answers in Göteborg and Kristianstad.

According to the answers to Schultz Larsen's questionnaire, the cumulative incidence of AD in the population was 20.7% (the male/female ratio was 1/1.03) (CI 95% 18.9–22.5). The corresponding figure in Göteborg was 19.4% (CI 95% 18.3–20.6), and in Kristianstad 22.8% (CI 95% 19.8–25.8).

In Göteborg, 197 children were reported by their parents to have active eczema, and 176 (89%) of them underwent clinical examination. The corresponding percentage for Kristianstad was 92% (109/119).

In Göteborg, 104 of the examined children fulfilled the

Table 1. UK working party's diagnostic criteria for atopic dermatitis

Patient must have itchy skin condition (or parental report of scratching or rubbing by child) plus three or more of following:
1) History of involvement of skin creases such as folds of elbows, behind knee, fronts of ankles, or neck
2) Personal history of asthma or hay fever (or history of atopic disease in first-degree relative in those under 4 years of age)
3) History of generally dry skin in last year
4) Visible flexural dermatitis (or dermatitis involving cheeks or forehead and upper limbs in children under 4 years of age)
5) Onset under age of 2 years (not used if child is under 4 years of age)

Table 2. Results of first part of questionnaire among 1961 children answered by parents. Has your child ever had eczema? Does your child have active eczema?

	Göteborg (<i>n</i> = 1219)		Kristianstad (<i>n</i> = 742)	
	%	No.	%	No.
Active eczema	16	197	16	119
Eczema any time	37	447	33	243
Never had eczema	63	772	67	499

UK working party's criteria, equivalent to a point prevalence of 8.5% (CI 95% 7.0–10.1). In Kristianstad, the point prevalence was 11.5% (CI 95% 9.2–13.8). Altogether, 30 children in Göteborg and two in Kristianstad fulfilled the criteria of AD but did not show any visible eczema on clinical examination (Table 3).

The severity of AD was evaluated in all children with visible eczema. SCORAD evaluation was performed in 155 of the 157 children with visible eczema. The severity scores in the 155 children, separated for the two study areas, are shown in Fig. 1. The majority of the children had mild or moderate eczema; mean value 20.5 (CI 95% 18.7–22.3), median 19.6. The SCORAD score was significantly higher in the children investigated in Kristianstad. The median value in Kristianstad was 25.9 and 11.5 in Göteborg ($P < 0.0001$). There was no significant difference in the frequency of severe eczema (score of >40) in the two studied areas. However, a significantly higher number of children with mild eczema (score of <15) was recorded in Göteborg. There was no significant difference in eczema score between girls and boys.

Of the 96 children who did not fulfil the criteria of AD, other skin disorders were diagnosed in 51 (18%) children at the clinical examination. Dry skin was by far the most common differential diagnosis (Table 4). Thus 45 children had been reported to have active eczema by their parents, but by the time of the investigation the children did not fulfil the UK working party's criteria, nor did the dermatologist make any other diagnosis. In some of these cases, the parents thought that their child had dry skin, a diagnosis which could not be verified by the dermatologist, or that the child had had a skin rash not classified as AD that had disappeared by the time of the investigation.

Discussion

This study involving a rural and urban pediatric population shows that AD is common and is usually classified as mild or moderate. The diagnosis based on parental evaluation could not be verified by dermatologists in one-third of the cases. The most common differential diagnosis was dry skin.

In population-based studies including children with very mild skin changes, there are special problems with disease definition and delineation (7). The difficulty is that there is a continuum between normal and abnormal skin; for example, dry skin could be classified as either normal skin, dry skin, or mild eczema. In our study, in which each child was examined by a dermatologist, dry skin, keratosis pilaris, and eczema around molluscum contagiosum were the most frequent differential diagnoses. In 51 children reported by the parents to have current eczema, we diagnosed skin diseases other than AD. Surprisingly, we could not find eczema or other skin diseases in 45 children reported in the questionnaire to have active eczema. At the time of the investigation, the children did not fulfil the criteria of AD, and we could not discover why the parents reported active eczema in those children. The prevalence of lifetime eczema reported by the parents is much higher than the figure found for the cumulative incidence of AD when several criteria were evaluated with Schultz Larsen's questionnaire. This has also been shown by other investigators and is important to consider when comparing different studies (23, 24). A prerequisite in comparison of the incidence of diseases is that identical or almost identical methods of assessment must be used. Schultz Larsen's questionnaire, which is used in this study, is validated and cost-effective, and is not influenced by investigating physicians. A limitation is that cultural and educational factors may influence the way parents answer a questionnaire (23, 24). Parents may also change their attitude to skin changes over time and this may also influence a questionnaire study (23).

In our study, the cumulative incidence of AD in Kristianstad was 23%, a finding which may be compared with that in a study performed by one of the authors (Å.S.) in the same area in 1992 (2). In that study, with the same high reply rate to the same questionnaire in 7-year-old children, the cumulative incidence of AD was 15% (CI 95% 13.3–17.7). These data clearly show the increase of the cumulative

Table 3. Occurrence of AD and activity of eczema in children reported to have active eczema and examined by dermatologists

	Göteborg	Kristianstad
Number of children reported by parents to have active eczema	197	119
Examined by dermatologist	176	109
Fulfilling criteria of AD (%)	104 (59)	85 (78)
Visible eczema at examination (%)	74 (42)	83 (76)
Fulfilling criteria of AD but without visible eczema (%)	30 (17)	2 (2)

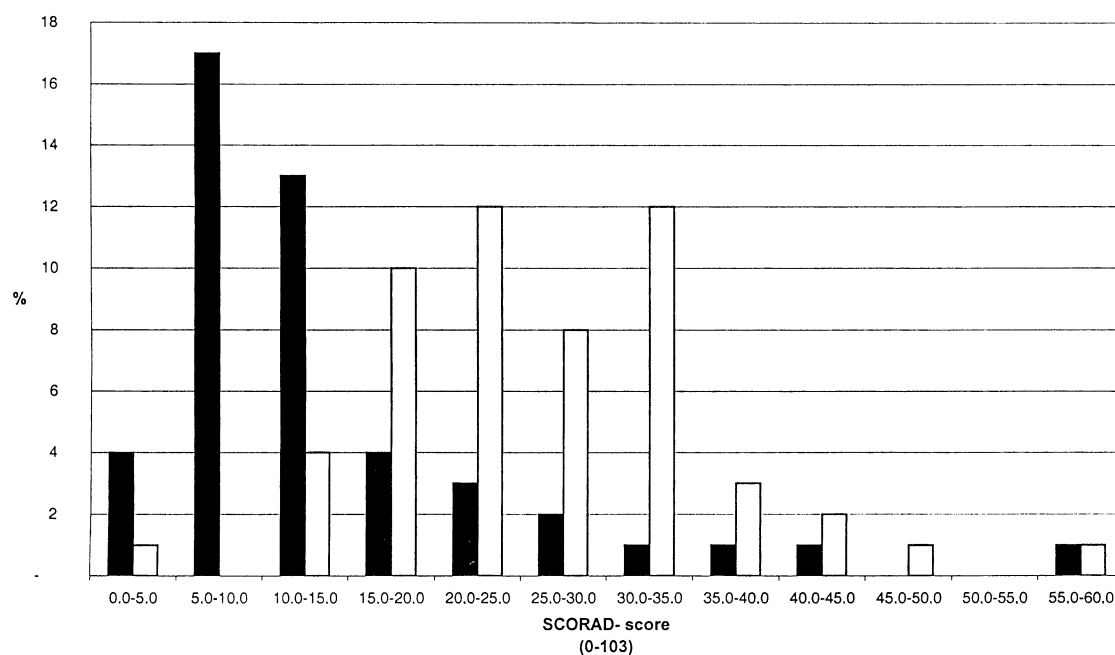


Figure 1. Severity scoring in 155 children separated for two study areas. Göteborg ($n=72$) ■; Kristianstad ($n=83$) □.

incidence of AD over time in the area. In our study, we adhered strictly to the UK working party's criteria in our clinical examination of those children reported to have active eczema at the time the parents completed the questionnaire. Seventeen percent of the children fulfilling the criteria did not have visible eczema at the clinical examination; in many cases, this was mainly due to active treatment (emollients and/or topical steroids).

There was a significantly higher point prevalence of eczema in Kristianstad (12%) than Göteborg (8%). This may be a true difference, but we cannot exclude the possibility that differences in treatment, and in the dermatologist's assessment, may have influenced this result. It can be questioned, however, how relevant point prevalence is for a fluctuating skin disease such as AD, which is influenced by unstable factors in the physical and social environments.

Many studies have reported an increase of AD, but only a few of these have reported the severity of the eczema (13–17). In our study, by using the SCORAD index, we were able to evaluate the severity of eczema in 155 children presenting active lesions during clinical examination. The majority of the children were judged to have mild or moderate eczema, which is in accordance with earlier reports. The median SCORAD value

in our study was 20. Schäfer et al. (14) have used SCORAD in a multicenter cross-sectional study in East and West Germany and found the median SCORAD score to be 21. Although SCORAD has the advantage of being easy to use, interobserver variability has to be taken into consideration (22). In our study, children in Kristianstad had higher SCORAD scores than children in Göteborg. Differences in treatment and dermatologic assessment may explain some of the difference.

Dotterud et al. used Rajka & Langeland's protocol for severity of AD, and the majority of the children were judged to have mild eczema (13). Sugiura et al., in Japan, used the extent of eczema as the basis for evaluating severity of the disease in five different age groups of children (15). In their study, the majority of the children in the different age groups were judged to have mild eczema (81–87%).

In conclusion, we have used validated protocols to evaluate the cumulative incidence, point prevalence, and severity of AD in a population-based study in southern Sweden. In spite of the high prevalence of AD, especially in countries with a Western lifestyle, only a few epidemiologic studies have evaluated the severity of the disease. There are difficulties not only in the definition and delineation of AD but also in the question

Table 4. Diagnoses among 51 children reported to have active eczema but not fulfilling UK party's diagnostic criteria

Dry skin	29
Keratosis pilaris	5
Eczema around molluscum contagiosum	5
Lichen striatus	2
Psoriasis	2
Dermographism, head lice, herpes simplex (labialis), impetigo contagiosa, lichen nitidus, lichen spinulosus, pityriasis rosea, urticaria	1 each

of how to score severity. We are aware that the protocols used in this study have shortcomings, and we must improve these instruments in collaboration with other groups. Until we have shown that these new instruments are better than the old ones, we are convinced that we should use validated instruments with known pitfalls.

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References

- ÅBERG N, HESSELMAR B, ÅBERG B, ERIKSSON B. Increase of asthma, allergic rhinitis and eczema in Swedish schoolchildren between 1979 and 1991. *Clin Exp Allergy* 1995;**25**:815–819.
- SCHULTZ LARSEN F, DIEPGEN T, SVENSSON Å. The occurrence of atopic dermatitis in north Europe: an international questionnaire study. *J Am Acad Dermatol* 1996;**34**:760–764.
- SCHULTZ LARSEN F, HANIFIN J. Secular change in the occurrence of atopic dermatitis. *Acta Derm Venereol (Stockh)* 1992;**Suppl 176**:7–12.
- M McNALLY N, PHILLIPS D, WILLIAMS H. The problem of atopic eczema: aetiological clues from environment and lifestyles. *Soc Sci Med* 1998;**46**:729–741.
- HIDE D. Early intervention for the prevention of atopic dermatitis. *Pediatr Allergy Immunol* 1997;**8**:7–10.
- RING J, THEWES M. The clinical expression of allergy in the skin. *Allergy* 1999;**54**:192–197.
- WILLIAMS H. On the definition and epidemiology of atopic dermatitis. *Derm Clin* 1995;**13**:649–657.
- SVENSSON Å. Atopic dermatitis – epidemiology. In: *Treatment of atopic dermatitis*. Oslo: Norwegian Medicines Control Authority, Vol. 2. 1999:37–50.
- RYSTEDT I. Prognostic factors in atopic dermatitis. *Acta Derm Venereol (Stockh)* 1985;**65**:206–213.
- LINNA O, KOKKONEN J, LAHTELA P, TAMMELA O. Ten-year prognosis for generalized infantile eczema. *Acta Paediatr* 1992;**81**:1013–1016.
- HERD R, TIDMAN M, PRESCOTT R, et al. The cost of atopic eczema. *Br J Dermatol* 1996;**135**:20–23.
- SU J, KEMP A, VARIGOS G, et al. Atopic eczema: its impact on the family and financial cost. *Arch Dis Child* 1997;**76**:159–162.
- DOTTERUD K, KVAMMEN B, LUND E, FALK E. Prevalence and some clinical aspects of atopic dermatitis in the community of Sør-Varanger. *Acta Derm Venereol (Stockh)* 1995;**75**:50–53.
- SCHÄFER T, DOCKERY D, KRÄMER U, BEHRENDT H, RING J. Experiences with the severity scoring of atopic dermatitis in a population of German pre-school children. *Br J Dermatol* 1997;**137**:558–562.
- SUGIURA H, UMEMOTO N, DEGUCHI H, et al. Prevalence of childhood and adolescent atopic dermatitis in a Japanese population. Comparison with the disease frequency examined 20 years ago. *Acta Derm Venereol (Stockh)* 1998;**78**:293–294.
- POPESCU C, POPESCU R, WILLIAMS H, et al. Community validation of the United Kingdom diagnostic criteria for atopic dermatitis in Romanian schoolchildren. *Br J Dermatol* 1997;**138**:436–442.
- EMERSON R, WILLIAMS H, ALLEN B. Severity distribution of atopic dermatitis in the community and its relationship to secondary referral. *Br J Dermatol* 1999;**139**:73–76.
- WILLIAMS H, BURNEY P, HAY R, et al. The UK working party's diagnostic criteria for atopic dermatitis. I. Derivation of a minimum set of discriminators for atopic dermatitis. *Br J Dermatol* 1994;**131**:383–396.
- WILLIAMS H, BURNEY B, PEMBROKE A, HAY R. The UK working party's diagnostic criteria for atopic dermatitis. III. Independent hospital validation. *Br J Dermatol* 1994;**131**:406–416.
- WILLIAMS H, BURNEY P, PEMBROKE A, et al. Validation of the UK diagnostic criteria for atopic dermatitis in a population setting. *Br J Dermatol* 1996;**135**:12–17.
- STALDER J, TAIEB A. European Task Force on Atopic Dermatitis. Severity scoring of atopic dermatitis. The SCORAD index. *Dermatology* 1993;**186**:23–31.
- KUNZ B, ORANJE A, LABREZE L, et al. Clinical validation and guidelines for the SCORAD index: consensus report of the European Task Force on Atopic Dermatitis. *Dermatology* 1997;**195**:10–19.
- KRÄMER U, SCHÄFER T, BEHRENDT H, et al. The influence of cultural and educational factors on the validity of symptom and diagnosis questions for atopic eczema. *Br J Dermatol* 1998;**139**:1040–1046.
- WILLIAMS H, ROBERTSON C, STEWART A, et al. Worldwide variations in the prevalence of symptoms of atopic eczema in the international study of asthma and allergies in childhood. *J Allergy Clin Immunol* 1999;**103**:125–138.