

Allergic Contact Dermatitis in a Paediatric Population: A 20-year Nationwide Registry-based Study

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Allergic contact dermatitis (ACD) affects people of all ages, even infants (1), but the frequency of ACD increases with age during childhood (2). The prevalence of ACD in children (aged <18 years) is, according to a systematic review and meta-analysis, estimated at 16.5%, which is slightly less than that in the general population (20%) (3). The most common allergens in paediatric ACD are metals, fragrances, and preservatives (4, 5). Most, but not all, studies have reported that girls are more prone than boys to ACD (4). Although children have become more likely over recent decades to be exposed to various chemicals, few epidemiological studies have described trends over time in the incidence of contact allergy in paediatric populations (5–7). We designed our retrospective, nationwide registry-based study to examine the incidence of ACD in children between 1998 and 2022.

METHODS

The Finnish Care Register for Health Care (CRHC) was queried to extract data on all individuals diagnosed in hospital dermatology clinics with the International Classification of Diseases [ICD]-10 code L23 before their 18th birthday. If the patient had multiple same L23 sub-codes registered, the sub-diagnosis was counted only once for study purposes. However, entries for the L23.9 sub-code were counted when they appeared alone in a record, and the totals reported separately, but not included in the overall ACD counts. The total numbers of unique ACD sub-codes were calculated to analyse the presence of multiple simultaneous ACD diagnoses. Analyses were performed separately for children (aged ≤10 years) and adolescents (11–17 years old). The characteristics of the study population are presented as proportions and means with standard deviations. Categorical variables were analysed with the χ^2 test and continuous variables with a *t*-test. The age and sex-standardized incidence rates were calculated using the direct standardization method.

RESULTS

The study population included 1,749 individuals, of whom 1,113 (63.6%) were female. The overall incidence of L23 diagnoses increased from 2011 onwards (Table I and Fig. S1A). An increasing pattern was seen in particular those for “adhesives”, “cosmetics”, “other chemical products”, and “ACD due to the other agents” (Fig. S1A). We found some differences between children and adolescents in terms of incidence patterns for certain allergen categories: the code for “cosmetics” was particularly prominent in adolescents, but alarmingly, in children too (Fig. S1B). In total, “cosmetic allergy” was one of the most identified ACD sub-codes (16.6%) after metal allergy (18.6%) (Table II). There was a rapid increase of ACD attributed to contact with “adhesives” from the year 2014 onwards. The incidence of ACD for “metals” was consistently higher in girls than boys. However, ACDs caused by “drugs in contact with skin” and “other chemicals” affected proportionally more boys than girls (Fig. S1C).

DISCUSSION

This nationwide registry study carried out in Finland covers over 2 decades and demonstrates an increasing incidence of ACD diagnoses in the paediatric population. The sharpest increase was found in cases attributed to “cosmetics”, “adhesives”, “other chemical products”, and “other agents”. Our findings are contrary to those of a UK study, which reported static incidence of contact allergy in a similarly aged population between the years 2005 and 2014 (5) but aligned with those of an Italian and a Greek study, both of which demonstrated an increase in the number of contact allergy diagnoses (6, 7). However,

Table I. Annual incidence of L23 diagnoses per 100,000 individuals in a population under 18 years of age

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Diagnosis code																									
L23	8.83	4.00	4.74	5.22	3.75	5.31	6.50	5.25	5.54	6.65	6.22	6.51	3.13	4.16	5.37	8.17	5.39	5.59	5.50	5.52	8.76	11.29	7.94	8.09	8.34
L230	2.08	1.31	1.14	1.86	0.63	1.62	2.08	2.35	1.18	1.55	1.55	2.11	0.55	0.92	1.30	0.93	0.46	0.74	0.28	0.94	0.75	0.57	0.48	0.87	1.46
L231	0.26	0.26	0.09	0.53	0.18	0.09	0.18	0.09	0.27	0.18	0.18	0.64	0.09	0.28	0	0	0	0.09	0.28	0.37	3.11	3.80	2.10	1.35	1.07
L232	0.69	0.44	0.44	0.62	0.27	0.27	1.17	0.81	0.73	1.18	0.73	0.83	0.64	1.48	1.30	1.48	1.30	1.40	1.96	1.50	1.51	1.23	2.10	1.64	1.16
L233	0.61	0.44	0.70	0.62	0.54	0.72	0.36	0.18	1.09	0.55	0.73	0.83	0.37	0.65	0.83	0.65	0.56	0.37	0.56	0.65	0.38	0.95	0.38	0.96	0.78
L234	0	0.09	0	0.27	0	0.18	0.36	0.46	0.18	0.09	0.28	0.09	0.28	0.09	0.09	0.19	0.09	0.19	0.09	0	0.09	0	0.10	0	0
L235	3.64	1.22	1.67	0.80	1.16	0.90	1.26	0.27	0.36	0.73	0.64	0.46	0.28	0.46	0.74	0.93	0.84	0.56	0.93	0.84	0.66	1.61	1.44	1.25	2.23
L237	0.43	0	0.26	0.09	0.09	0.09	0.09	0	0	0	0	0.09	0	0.18	0	0.09	0.09	0.19	0.09	0.09	0.19	0.38	0	0.19	0.10
L238	0.78	0.17	0.26	0.44	0.18	0.18	0.27	0.72	0.36	0.91	0.82	0.64	0.37	0	0.56	0.19	0.93	1.30	1.12	0.84	2.07	2.66	1.34	1.64	1.55
L239	2.60	3.57	1.58	1.06	0.98	2.34	1.63	2.72	3.18	2.37	3.20	2.02	2.03	1.75	2.31	1.95	0.56	0.84	0.65	0.65	0.19	0.09	0.10	0.96	0.97

Table II. Distribution of use of ICD-10 codes for allergic contact dermatitis, stratified by sex

Item	Male (n = 636)	Female (n = 1,113)	Total (n = 1,749)	p-value
Allergic contact dermatitis due to metals (L23.0)				< 0.001
Yes	90 (14.2%)	236 (21.2%)	326 (18.6%)	
Due to adhesives (L23.1)				0.174
Yes	68 (10.7%)	97 (8.7%)	165 (9.4%)	
Due to cosmetics (L23.2)				< 0.001
Yes	65 (10.2%)	225 (20.2%)	290 (16.6%)	
Due to drugs in contact with skin (L23.3)				0.003
Yes	79 (12.4%)	89 (8.0%)	168 (9.6%)	
Due to dyes (L23.4)				0.819
Yes	13 (2.0%)	21 (1.9%)	34 (1.9%)	
Due to other chemical products (L23.5)				0.077
Yes	116 (18.2%)	167 (15.0%)	283 (16.2%)	
Due to plants, except food (L23.7)				0.728
Yes	10 (1.6%)	20 (1.8%)	30 (1.7%)	
Due to other agents (L23.8)				0.274
Yes	72 (11.3%)	146 (13.1%)	218 (12.5%)	
Allergic contact dermatitis, unspecified cause (L23.9)				0.019
Yes	182 (28.6%)	262 (23.5%)	444 (25.4%)	

Most subjects (87.7%) had only 1 registered specific L23 sub-diagnosis. Males and females did not differ in terms of the numbers of diagnoses.

the direct comparison between previous studies and ours is challenging due to differences in study methodology; in the Greek study the information concerning relevance of findings was mentioned to be incomplete, and thus incidence rates refer to contact sensitization rates and not to ACD rates (7).

Various factors could contribute to such an increase. Over time, physicians may have gained greater awareness of ACD in children, resulting in greater numbers of referrals for patch testing. Another possible factor is a combination of an increase over time in the numbers of allergens to which children are exposed, with a reduction in the age of first exposure (8).

The incidence of ACD to “cosmetics” clearly increased during the study period. The finding is understandable as it is difficult to avoid sensitizers used widely in personal care products (e.g., preservatives and fragrances). In children, the common sources of “cosmetic allergens” include sunscreens, shampoos, and wet-wipes (4). Moreover, children can be exposed to preservatives via glues (e.g., hand-made slimes) (9), paints, or sporting equipment (8). Furthermore, heavy use of cosmetics has become more common among pre-teens, probably driven by the influence of social media platforms.

It is reasonable to assume that the increase in “adhesives” results mainly from contact with acrylates used in the adhesive components of insulin infusion sets and glucose sensors (10). Children can also be exposed to acrylates through the use of nail cosmetics (11). Acrylic nails and gel nail polish (GNP) have become increasingly popular among adults and teens since GNP kits for home use became readily available for purchase. We found a slight increase in the incidence of the code for “ACD to other chemical products including rubber”. By contrast, the UK study found the number of children diagnosed with rubber allergy had decreased between 1999 and 2011 (12). Albeit not frequently, children may

be sensitized to rubber from nappies, rubber shoes, sports equipment, or by playing with rubber toys (13).

Interestingly, this study found an increase in the use of L23.8 (ACD due to other agents). It has been speculated that increasing numbers of novel allergens are appearing over time that do not belong to any existing specific L23 group. This possibility has prompted a re-evaluation of the L23 classification system. The new ICD-11 is already in use in some countries and is thought to have improved the specificity of coding (14). In turn, there was a decrease in the use of L23.9 (ACD, unspecified cause). In the adult population, it has been demonstrated that this code has mostly been falsely used prior to patch testing (15). In recent years, more information on the importance of precise coding has been shared among Finnish dermatologists, and this may have affected this finding.

The main strength of this study is its nationwide data set, which includes over 1,700 individuals with over 20 years’ follow-up. All recorded L23 sub-diagnoses were hospital based and set in dermatology clinics, which most likely delivered relatively accurate diagnoses. The Finnish CRHC is a unique research resource, as it includes data for all living people in Finland, regardless of socioeconomic status. Previous studies have shown the CRHC to be highly reliable (16); nevertheless, there has been no validation made for allergic diseases. Patch tests for children are performed solely in public hospitals in Finland (not in private clinics), thus all diagnoses can be found from the CRHC. Although patch tests are the gold standard in diagnosing ACD, we cannot verify that all diagnoses are based on patch tests. A limitation of the study design is that the CRHC data do not contain detailed findings of patch testing, and we were therefore forced to rely on L23 codes in the absence of exact information on the allergens driving each case.

In practice, this study highlights that ACD is common in children, and should be kept in mind as a differential diagnosis for dermatitis, especially if it does not respond to conventional treatments. Furthermore, early diagnosis of ACD is important to prevent a chronic pattern and long-term impact. As new potential allergens appear continuously, dermatologists and paediatricians need to be aware of present-day trends.

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Data availability statement: Our data are from the Finnish Care Register for Health Care (CRHC; former name: the Finnish Hospital Discharge Register), which is maintained by the Finnish Institute of Health and Welfare. According to Finnish laws and regulations, the data contained in social welfare and healthcare registries and associated documents are confidential. As a responsible authority, FinData can, on a case-by-case basis, grant permission to use the data for the purposes of scientific research. More information on research authorization applications can be found at www.findata.fi/en

The authors have no conflicts of interest to declare.

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