Adult eczema prevalence and associations with asthma and other health and demographic factors: A US population–based study

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Background: Little is known about the epidemiology of eczema in adults. The goal of this study was to determine the prevalence of and associations with adult eczema in the United States.
Methods: We used the 2010 National Health Interview Survey from a nationally representative sample of 27,157 adults age 18 to 85 years.
Results: Overall, the 1-year prevalence of eczema was 10.2% (95% CI, 9.7% to 10.6%). The 1-year prevalence of eczema with asthma and/or hay fever was 3.2% (95% CI, 2.8% to 3.3%). Adult eczema was associated with higher prevalence of asthma ($P < .001$, Rao-Scott χ^2 test), more asthma attacks in the past year ($P < .001$), and more persistent asthma ($P = .02$). In multivariate models eczema prevalence was significantly higher in older participants; female subjects; those with Hispanic ethnicity, US birthplace, and higher level of household education; and those currently working (all $P \le .02$, logistic regression).
Conclusions: This study provides US population–based estimates of eczema prevalence and asthma associations in adults. The results suggest multiple demographic and socioeconomic influences on the US prevalence of adult eczema. (J Allergy Clin Immunol 2013;132:1132-8.)

Key words: Eczema, dermatitis, atopic dermatitis, age, race, ethnicity, Hispanic, birthplace, socioeconomic status, asthma, atopic disease, rhinoconjunctivitis, hay fever

Atopic dermatitis (AD; atopic eczema) is a chronic inflammatory skin disorder that is a significant cause of morbidity, quality-of-life impairment, and health care costs. A recent population-based study of US children found a 10.7% prevalence of eczema, with a significant variation between states and districts.[1] That study also found an association between eczema prevalence and a number of demographic factors, including race/ethnicity, higher education levels, and household incomes. Several recent population-based studies of US children identified novel risk and protective factors for eczema, including

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Abbreviations used	
AD:	Atopic dermatitis
EAH:	Eczema with asthma and/or hay fever
NHIS:	National Health Interview Survey

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the role of climate factors,[2] birthplace, and duration of US residence.[3] However, there are no recent US population–based estimates of eczema/AD for adults, and little is known about the determinants of adult eczema. A recent US population–based study of children and adolescents determined the burden of comorbid asthma and hay fever in childhood eczema.[4] However, little is known about the prevalences of these comorbidities in adult eczema.

The goal of this study was to determine the prevalence of and associations with adult eczema in the United States by using data obtained from the National Health Interview Survey (NHIS), a large population-based survey of adults in all 50 states.

METHODS
NHIS

The 2010 NHIS was collected by the National Center for Health Statistics of the Centers for Disease Control and Prevention and is the principal source of information on the health of the civilian noninstitutionalized population of the United States. The questionnaire included a separate core module with questions to estimate the prevalence of various adult health issues. The survey was administered in person to selected households by approximately 400 trained interviewers of the Bureau of the Census using computer-assisted personal interviewing. Subsequently, 1 adult per household was randomly selected for the sample adult questionnaire. Interviews were conducted in English and Spanish. Using data from the US Bureau of the Census, weights were adjusted for age, sex, race, ethnicity, household size, and educational attainment of the most educated household member to provide a data set that was more representative of each state's population of noninstitutionalized adults older than 17 years.

History of eczema and other atopic disease

One-year history of eczema was determined based on an affirmative response to the following question: "During the past 12 months, have you had dermatitis, eczema, or any other red, inflamed skin rash?" Lifetime prevalence of asthma was determined based on the response to the following question: "Have you ever been told by a doctor or other health professional that you had asthma?" Point prevalence of asthma was determined based on the response to the following question: "Do you still have asthma?" One-year history of asthma attacks was determined based on the response to the following question: "During the past 12 months, have you had an episode of asthma or an asthma attack?" One-year prevalence of hay fever was determined based on the response to the following question: "During the past 12 months, have you been told by a doctor or other health professional that you had hay fever?"

A composite binary variable for eczema with asthma and/or hay fever (EAH) was also created.

Associations with eczema

A number of associations with eczema were examined, including age, sex, marital status, current working status, race, Hispanic origin and subgroup, household income, family structure and size, highest level of education in the household, health care interaction in the past year, current health insurance coverage, birthplace in the United States, region of birth, and duration of residence in the United States.

Data processing and statistical methods

All data processing and statistical analyses were performed with SAS version 9.2 software (SAS Institute, Cary, NC). Analyses of survey responses were performed with SURVEY procedures. Bivariate associations were tested by using Rao-Scott χ^2 tests. Multivariate logistic regression models were constructed that included significant variables identified in bivariate analyses. Complete data analysis was performed (ie, subjects with missing data were excluded). Linear interactions were tested and only included in final models if P values were less than .01 and modification of estimates was greater than 20%. Multicollinearity was tested by using variable inflation factors and tolerance.

Post hoc correction for multiple dependent tests (k = 81) was performed by minimizing the false discovery rate with the approach of Benjamini and Hochberg,[5] and corrected P values are presented. P values of .05 or less were considered significant.

RESULTS
Prevalence of eczema and atopic disease

Data were collected on a total of 27,157 adults including sufficient representation of all age, sex, and racial/ethnic groups. Overall, the US prevalence of eczema in adults was 10.2% (95% CI, 9.7% to 10.6%; Fig 1). In particular, 3.2% (95% CI, 2.9% to 3.4%) of the adult population had EAH, as defined by a 1-year history of eczema with either ever having a history of asthma, 1-year history of hay fever, or both, whereas 0.5% (95% CI, 0.4% to 0.6%) had eczema, asthma, and hay fever.

Overall, the lifetime prevalence of asthma was 12.7% (95% CI, 12.2% to 13.2%). Among these subjects, 65.0% (95% CI, 63.0% to 67.0%) currently had asthma, and 33.1% (95% CI, 31.2% to 35.1%) had an asthma attack in the past year (Table I). The 1-year prevalence of hay fever was 7.8% (95% CI, 7.4% to 8.2%); the lifetime prevalence was not elicited. The prevalences of ever and current history of asthma, asthma attacks, and hay fever were significantly higher in adults with eczema than those without eczema (all $P \leq .03$).

Associations with adult eczema

The prevalence of adult eczema was higher in female compared with male subjects (11.1% vs 9.1%, $P < .001$), whereas the prevalence of EAH was lower in female subjects (2.5% vs 3.8%, $P < .001$). The prevalences of adult eczema (11.2% vs 9.5%, $P = .006$) and EAH (3.8% vs 2.7%, $P = .003$) were higher in the unemployed compared with those currently working (Table II). The prevalence of eczema was significantly different among age groups ($P = .004$), with higher rates among older participants (62-85 years) compared with younger participants (18-32 years, 11.4% vs 9.0%), but EAH was not ($P = .52$, 3.1% vs 3.0%).
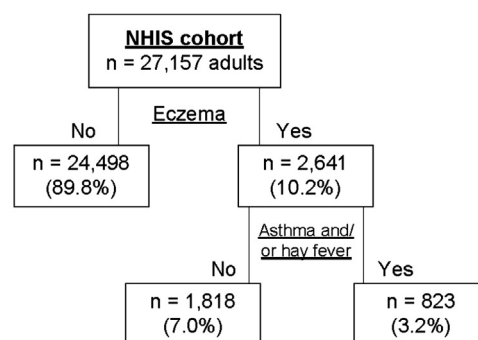

FIG 1. Study design.

Marital status was not associated with eczema ($P = .14$) or EAH prevalence ($P = .60$).

The prevalence of eczema was significantly different among racial groups ($P < .001$), with the highest rates in white and multiracial/other subjects compared with African American/black subjects (10.5% and 14.6% vs 7.7%, respectively), although no significant racial differences were found for EAH ($P = .30$). Subjects of Hispanic origin had lower prevalence of eczema (6.0% vs 10.8%, $P < .001$) and EAH (1.7% vs 3.4%, $P < .001$) than those of non-Hispanic origin, with significant differences between the various subgroups of Hispanic adults; for example, Mexican subjects had the lower and Puerto Rican subjects had the higher prevalences ($P = .02$ and $P < .001$ for eczema and EAH, respectively).

Several socioeconomic factors were associated with greater adult eczema and EAH prevalences. In particular, higher level of education in the household ($P < .001$ for both), higher household income ($P = .02$ and $P = .002$, respectively), health care interaction in the past year ($P < .001$ for both), and health insurance coverage ($P < .001$ for both) were associated with increased eczema and EAH. Smaller families ($P = .001$) and families with no children ($P = .02$) had a higher prevalence of eczema but not EAH ($P = .60$).

Birthplace and adult eczema

Foreign-born American adults had significantly lower prevalences of eczema (6.2% vs 11.0%, $P < .001$) and EAH (1.5% vs 3.5%, $P < .001$) than US-born Americans (Table III). There was a significant difference among the regions of birth with respect to the prevalence of eczema and EAH ($P < .001$ for both). The prevalence of eczema in foreign-born Americans was significantly higher after 10 or more years of US residence compared with those with less than 10 years of residence (6.7% vs 4.3%, $P = .01$); however, there were no significant differences for EAH (1.6% vs 1.3%, $P = .60$).

Multivariate models

In a multivariate logistic regression model the odds of eczema were no longer significantly higher in the oldest age group (62-85 years, $P = .76$), suggesting confounding effects from other covariates. To determine which covariate or covariates were responsible, we individually tested each covariate with age as a predictor of eczema. Inclusion of health care interaction in the past year in the model rendered the association between eczema prevalence

TABLE I. Prevalence of allergic disease in US adults with and without eczema*

Variable	Overall (n = 27,157)		No eczema (n = 24,614)		Eczema (n = 2,641)		
	No.	% Prevalence (95% CI)	No.	% Prevalence (95% CI)	No.	% Prevalence (95% CI)	P value†
Lifetime asthma	3,350	12.7 (12.2-13.2)	2,779	11.7 (11.2-12.2)	570	21.1 (19.3-22.9)	<.001
Current asthma	2,218	65.0 (63.0-67.0)	1,819	63.9 (61.7-66.2)	399	70.2 (65.8-74.7)	.03
Asthma attack in past year	1,158	33.1 (31.2-35.1)	919	31.6 (29.5-33.7)	239	40.8 (36.0-45.6)	<.001
Current hay fever	2,022	7.8 (7.4-8.2)	1,619	6.9 (6.5-7.3)	401	15.7 (14.0-17.4)	<.001

*Missing data were encountered in 18 (0.07%) subjects for the eczema outcome, 20 (0.07%) for ever history of asthma, 24 (0.8%) for current asthma, 4 (0.1%) for asthma attack in past year, and 22 (0.08%) for hay fever.
†Rao-Scott χ^2 test.

and the oldest age group (62-85 years) insignificant. There were no significant issues of multicollinearity identified.

The prevalence of eczema was lower in African American/black subjects compared with white subjects (adjusted odds ratio, 0.69; 95% CI, 0.61-0.79; $P < .001$) and Hispanic compared with non-Hispanic subjects (adjusted odds ratio, 0.73; 95% CI, 0.62-0.85; $P < .001$) but higher in multiracial/other race subjects compared with white subjects (adjusted odds ratio, 1.68; 95% CI, 1.30-2.18; $P < .001$). Furthermore, the prevalence of eczema was lower in those currently working (adjusted odds ratio, 0.86; 95% CI, 0.77-0.95; $P = .008$) and those born outside the United States (adjusted odds ratio, 0.66; 95% CI, 0.56-0.77; $P < .001$) but higher in female subjects (adjusted odds ratio, 1.14; 95% CI, 1.04-1.25; $P = .01$), those with a post–high school education (adjusted odds ratio, 1.47; 95% CI, 1.24-1.75; $P < .001$), and those with a health care interaction in the past year (adjusted odds ratio, 1.99; 95% CI, 1.72-2.30; $P < .001$; Table IV).

In a multivariate logistic regression model the odds of EAH were significantly lower in the oldest age group (62-85 years, $P = .03$). Furthermore, the prevalence of EAH was lower in those currently working ($P < .001$), those with a higher household income ($P = .01$, see individual results in Table IV), and those with a birthplace outside the United States ($P < .001$) and higher in female subjects ($P = .001$), multiracial/other compared with white subjects ($P = .002$), those with a post–high school education ($P = .03$), and those with a health care interaction in the past year ($P < .001$). Of note, the effect sizes for some of these associations are small.

There were no significant 2-way interaction terms found in multivariate models of eczema or AD.

Distribution of adult eczema lesions

Approximately 25% of adults with eczema reported lesions on the hands, and 35% to 40% reported lesions on the arms, face, head, and neck (Table V). Female subjects were more likely to have lesions on the arms ($P = .02$, data not shown). There were no significant associations between demographic factors and the distribution of lesions in patients with AD ($P \geq .11$).

DISCUSSION

By using a population-based approach, the present study found a 10.2% 1-year prevalence of eczema and 3.2% prevalence of AD in US adults. There are no recent US population–based studies of adult eczema *per se* to compare or contrast with the present study. Hanifin and Reed[6] performed a questionnaire-based study of eczema prevalence in a sample of 116,202 subjects in 42,249 US households. They found that 10.7% and 6%

had empirically defined eczema and AD, respectively. However, that study's cohort included both children and adults, and estimates were provided only for the combined cohort, which might overestimate the prevalence of eczema or AD in adults *per se*. Several international studies demonstrated varying prevalences of adult AD. A single-center questionnaire study of 10,762 Japanese adults found an approximately 3% prevalence of AD, as defined by the UK Working Party.[7] A single-center clinical study of 2,123 adults found a 6.9% point prevalence of AD.[8] An Australian study of 1,457 adults using questionnaires and clinical assessment by dermatologists found a 6.9% point prevalence of AD, as defined by the UK Working Party's diagnostic criteria.[9] A questionnaire study of 3,368 Russian adults found a 5.9% lifetime prevalence of AD, as defined by a relapsing pruritic rash in characteristic flexural distribution.[10] A clinical study of 9,786 Lothian patients found 2.0% and 0.2% 1-year period prevalences of AD, as defined by the UK Working Party's diagnostic criteria, in subjects ages 16 to 40 and greater than 40 years, respectively.[11] The different prevalences observed in these studies likely stem from a combination of methodological and regional differences.

It is important to understand the spectrum of eczema captured by the definitions used in this study. The NHIS question for eczema asked about "dermatitis, eczema, or any other red, inflamed skin rash." This rather broad question might result in overestimation of prevalence for AD *per se* through inclusion of other entities, such as irritant contact and allergic contact dermatitis and other inflammatory disorders. However, adults with AD have a more heterogeneous presentation, including episodes of nonflexural or nummular eczema.[12,13] Thus this question has the advantage of being more sensitive at the expense of less specificity. On the other hand, the composite definition of EAH based on a history of eczema and other atopic disease might underestimate the prevalence of AD because many patients present with AD and no other allergic disorders (ie, more specific and less sensitive). Both of these are accepted approaches that have been used in previous epidemiologic studies.[14] However, each definition captures a different subset of the eczema/AD disease spectrum, and therefore both definitions were included in this study. The NHIS question for eczema is rather broad and might result in overestimation of the prevalence for eczema or AD by inclusion of other dermatitides. However, we believe it sufficiently identifies adults with eczema because the 10% prevalence of eczema is similar to the US prevalence of empirically defined eczema found by Hanifin and Reed.[6] Furthermore, the 3% prevalence of EAH is similar to the prevalence of AD previously found in Japanese adults.[7]

The 1-year eczema/EAH prevalences observed in this study encompass both childhood eczema that persisted into adulthood

TABLE II. Bivariate associations of personal demographic factors with prevalences of eczema and EAH in adults*

Variable, no. (%)	Eczema			EAH		
	No (n = 24,498)	Yes (n = 2,641)	P value†	No (n = 26,316)	Yes (n = 823)	P value†
Age (y), quartile (minimum-maximum)			.004			.52
1 (18-32)	6,245 (91.0)	578 (9.0)		6,640 (97.0)	183 (3.0)	
2 (33-46)	6,061 (89.6)	655 (10.4)		5,580 (96.9)	172 (3.1)	
3 (47-61)	6,180 (89.9)	719 (10.1)		6,792 (96.5)	251 (3.5)	
4 (62-85)	6,012 (88.6)	689 (11.4)		7,304 (96.9)	217 (3.1)	
Sex			<.001			<.001
Female	13,567 (88.9)	1,597 (11.1)		11,694 (97.5)	281 (2.5)	
Male	10,931 (90.9)	1,044 (9.1)		14,622 (96.2)	542 (3.8)	
Marital status			.14			.60
Lives with wife or partner	11,873 (89.6)	1,289 (10.4)		12,772 (96.8)	390 (3.2)	
Married but not living together	406 (94.0)	27 (6.0)		426 (98.3)	7 (1.7)	
Formerly married	6,353 (89.7)	698 (10.3)		6,831 (96.9)	220 (3.1)	
Never married	5,820 (90.3)	626 (9.7)		6,241 (96.9)	205 (3.1)	
Currently working			<.001			<.001
No	10,285 (88.8)	1,198 (11.2)		11,087 (96.2)	409 (3.8)	
Yes	14,201 (90.5)	1,442 (9.5)		15,229 (97.3)	414 (2.7)	
Race			<.001			.30
African American	4,231 (92.3)	351 (7.7)		4,442 (97.0)	140 (3.0)	
White	18,043 (89.5)	2,042 (10.5)		19,484 (96.8)	601 (3.2)	
Asian	1,613 (90.9)	154 (9.1)		1,718 (97.1)	49 (2.9)	
American Indian	197 (92.2)	22 (7.8)		213 (97.6)	6 (2.4)	
Other/multiracial	414 (85.4)	72 (14.6)		459 (94.8)	27 (5.2)	
Hispanic origin			<.001			<.001
No	19,650 (89.2)	2,331 (10.8)		21,250 (96.6)	731 (3.4)	
Yes	4,848 (94.0)	310 (6.0)		5,066 (98.3)	92 (1.7)	
Puerto Rican	485 (91.4)	46 (8.6)	.02	503 (94.8)	28 (5.2)	<.001
Mexican	1,925 (95.9)	81 (4.1)		1,992 (99.2)	14 (0.8)	
Mexican American	975 (93.0)	75 (7.0)		1,029 (98.4)	22 (1.6)	
Cuban or Cuban American	258 (94.3)	15 (5.7)		266 (96.9)	7 (3.1)	
Dominican	184 (93.2)	13 (6.8)		192 (98.5)	5 (1.5)	
Central or South American	820 (93.1)	61 (6.9)		870 (98.4)	11 (1.6)	
Multiple or other	201 (93.4)	19 (6.6)		214 (98.1)	6 (1.9)	
Household income (× FPL)			.02			.002
0-0.99	4,175 (90.8)	417 (9.2)		4,430 (96.5)	162 (3.5)	
1.00-1.99	4,374 (90.3)	448 (9.7)		4,700 (97.2)	122 (1.8)	
2.00-2.99	3,340 (89.8)	364 (10.2)		3,594 (97.0)	110 (3.0)	
3.00-3.99	2,512 (89.6)	286 (10.4)		2,728 (97.6)	70 (2.4)	
≥4.00	6,235 (88.5)	787 (11.5)		6,759 (96.0)	263 (4.0)	
Family type			.03			.60
One adult, no children	7,891 (89.7)	899 (10.3)		8,512 (96.9)	278 (3.1)	
Multiple adults, no children	8,327 (89.3)	958 (10.7)		8,987 (96.6)	298 (3.4)	
One adult and children	1,667 (90.3)	163 (9.7)		1,775 (97.0)	55 (3.0)	
Multiple adults and children	6,613 (90.7)	621 (9.3)		7,042 (97.0)	192 (3.0)	
Family size: quartile (minimum-maximum)			.002			.60
First (1-1)	7,891 (89.7)	899 (10.3)		8,512 (96.9)	278 (3.1)	
Second (2-2)	7,298 (88.7)	867 (11.3)		7,899 (96.6)	266 (3.4)	
Third (3-3)	3,702 (90.5)	353 (9.5)		3,938 (96.7)	117 (3.3)	
Fourth (4-17)	5,607 (90.8)	522 (9.2)		5,967 (97.1)	162 (2.9)	
Highest level of education in household			<.001			<.001
Not a high school graduate	2,981 (93.5)	209 (6.5)		3,115 (97.9)	75 (2.1)	
High school graduate/GED	5,654 (91.6)	505 (8.4)		6,031 (97.8)	128 (2.2)	
Greater than high school	15,807 (88.9)	1,925 (11.1)		17,113 (96.4)	619 (3.6)	
Health care interaction in past year			<.001			<.001
No	5,085 (94.6)	277 (5.4)		5,313 (98.9)	49 (1.1)	
Yes	18,940 (88.6)	2,327 (11.4)		20,507 (96.3)	760 (3.7)	
Current health insurance coverage			<.001			<.001
No	4,721 (92.3)	372 (7.7)		4,996 (97.9)	97 (2.1)	
Yes	19,704 (89.3)	2,264 (10.7)		21,246 (96.6)	722 (3.4)	

FPL, Family poverty level.

*Missing data were encountered in 18 (0.07%) subjects for the eczema outcome; 20 (0.07%) for asthma and 22 (0.08%) for hay fever; 0 (0.00%) for age, sex, race, ethnicity, family type, and family size; 927 (3.4%) for household income; 13 (0.05%) for current working status; 58 (0.2%) for highest level of household education; 48 (0.2%) for marital status; 528 (1.9%) for health interaction in past year; and 16 (0.1%) for health insurance coverage.

†Rao-Scott χ^2 test.

TABLE III. Inverse association of foreign birthplace with eczema and EAH prevalence in adults*

Variable, no. (%)	Eczema			EAH		
	No (n = 24,498)	Yes (n = 2,641)	P value†	No (n = 26,316)	Yes (n = 823)	P value†
Birthplace outside United States			<.001			<.001
No	19,007 (89.0)	2,287 (11.0)		20,565 (96.5)	729 (3.5)	
Yes	5,491 (93.8)	354 (6.2)		5,751 (98.5)	94 (1.5)	
Region of birth			<.001			<.001
United States of America	19,007 (89.0)	2,287 (11.0)		20,565 (96.5)	729 (3.5)	
Mexico, Central America, Caribbean	2,972 (95.1)	153 (4.9)		3,083 (98.8)	42 (1.2)	
South America	364 (93.2)	26 (6.8)		385 (98.6)	5 (1.4)	
Europe	419 (91.3)	44 (8.7)		456 (98.9)	7 (1.1)	
Russia and former USSR	86 (92.3)	8 (7.7)		91 (97.3)	3 (2.7)	
Africa	233 (97.0)	7 (3.0)		239 (99.7)	1 (0.3)	
Middle East	98 (95.3)	5 (4.7)		101 (98.6)	2 (1.4)	
Indian Subcontinent	280 (91.5)	22 (8.5)		296 (97.2)	6 (2.8)	
Asia	423 (96.0)	21 (4.0)		439 (99.1)	5 (0.9)	
Southeast Asia	495 (2.0)	46 (8.0)		526 (97.7)	15 (2.3)	
Duration of US residence (y)			.01			.60
<10	1,286 (95.7)	60 (4.3)		1,328 (98.7)	18 (1.3)	
≥10	4,136 (93.3)	289 (6.7)		4,350 (98.4)	75 (1.6)	

*Missing data were encountered in 0 (0.0%) subjects for US birthplace, 19 (0.07%) for region of birth, and 64 (1.1%) for duration of US residence.
†Rao-Scott χ^2 test.

and adult-onset disease. Recent US population–based studies of childhood eczema/AD from the National Survey of Children's Health found prevalences of 10.7%[1] and 12.2%.[3] Most adults with eczema/AD have a history of childhood disease. However, a recent study of 725 German adolescents and adults found that 18.5% reported onset of AD after 20 years of age.[12] The above-mentioned study of Hanifin and Reed[7] found that 64% and 53% of subjects reported adult onset (>18 years of age) of their eczema and AD, respectively. Both of those studies were based on self-report of disease onset by questionnaire and therefore are subject to potential recall bias. Additional studies are needed to more precisely determine the age of eczema onset and the predictors of adult-onset disease.

The present study found that adults with eczema had a significantly higher lifetime prevalence of asthma compared with those without eczema (21.1% vs 11.7%), with more persistent disease and asthma attacks, as well as more hay fever. This is consistent with prior studies that found increased rates of asthma and hay fever in children with eczema/AD.[4,15-19] We studied 79,667 children from the National Survey of Children's Health and found similar prevalences of asthma in children with and without eczema (25.1% vs 12.3%). The mechanisms underlying the association between eczema, asthma, and hay fever are not known. AD might be "proallergic" secondary to epidermal disruption, permitting epicutaneous allergen sensitization and ultimately leading to systemic inflammation and atopic disease.[20] The increased asthma persistence and attacks observed in this study suggest that eczema might play an ongoing role in the perpetuation of asthma in adults. Future studies are warranted to elucidate these points.

The prevalences of eczema and EAH were significantly lower in foreign-born American adults compared with US-born Americans. This was true for birthplace in any region outside the United States. Moreover, the prevalence of eczema, but not EAH, increased after 10 or more years of residence in the United States. These findings are consistent with a previous study from Silverberg et al[3] that found dramatically lower prevalences of atopic

disease, including eczema, in foreign-born American children compared with their US-born counterparts. In that study the prevalence of allergic disease also increased after 10 or more years of residence in the United States. In multivariate models controlling for birthplace outside the United States, the inverse association between Hispanic ethnicity and EAH prevalence was no longer significant. This suggests that the association between eczema prevalence and birthplace is related in part to foreign birthplace. Interestingly, Puerto Rican subjects had the highest prevalence of eczema and EAH among Hispanic subjects and even had higher rates of EAH than non-Hispanic subjects. These associations raise important questions about whether certain demographic groups are at higher risk for either persistent childhood-onset disease, adult-onset disease, or both. Moreover, Silverberg et al[2] demonstrated that climate factors influence the US prevalence of childhood eczema. In particular, eczema prevalence was significantly lower in states with higher temperature, outdoor humidity, and UV light exposure and with less indoor heating. It is possible that such climate factors influence the prevalence of adult eczema as well. Future studies are warranted to verify these points.

The strengths of this study include being a large-scale, US population–based survey of adults with minimal selection bias and controlling for confounding demographic variables in multivariate models. However, the study also has some limitations. Eczema was assessed by means of self-report on questionnaire. Self-report and parental report of AD and other types of dermatitis have previously been validated for a wide array of study designs.[21-23] Self-report of eczema is likely more sensitive than self-report of flexural eczema or AD *per se* but also can encompass clinical entities other than AD, such as contact and nummular dermatitis. On the other hand, questions limited to flexural eczema might be more specific but also risk excluding large subsets of patients with AD. In particular, the distribution of AD lesions (eg, flexural vs nonflexural) was found to vary by age of onset and persistence of lesions into older age groups.[12] Thus we prefer the use of a broader question with greater

TABLE IV. Multivariate logistic regression models of eczema and EAH prevalence in adults

Variable	Eczema			EAH		
	Adjusted OR	**95% CI**	***P* value***	**Adjusted OR**	**95% CI**	***P* value***
Age (y), quartile (minimum-maximum)						
1 (18-32)	1.00	—	—	1.00	—	—
2 (33-46)	1.25	1.10-1.42	.002	1.33	1.06-1.67	.02
3 (47-61)	1.19	1.04-1.35	.02	1.37	1.10-1.71	.01
4 (62-85)	0.98	0.84-1.13	.76	0.73	0.56-0.95	.03
Sex						
Male	1.00	—	—	1.00	—	—
Female	1.14	1.04-1.25	.01	1.34	1.14-1.57	.001
Currently working						
No	1.00	—	—	1.00	—	—
Yes	0.86	0.77-0.95	.008	0.67	0.56-0.80	<.001
Race						
White	1.00	—	—	1.00	—	—
African American	0.69	0.61-0.79	<.001	0.95	0.77-1.17	.63
Asian	1.09	0.88-1.35	.52	1.33	0.92-1.93	.18
American Indian	1.14	0.71-1.84	.62	0.70	0.26-1.92	.57
Other/multiracial	1.68	1.30-2.18	<.001	1.95	1.29-2.93	.002
Hispanic origin						
No	1.00	—	—	1.00	—	—
Yes	0.73	0.62-0.85	<.001	0.81	0.61-1.07	.18
Household income (× FPL)						
0-0.99	1.00	—	—	1.00	—	—
1.00-1.99	0.97	0.84-1.12	.66	0.73	0.57-0.93	.02
2.00-2.99	0.92	0.78-1.08	.38	0.76	0.58-0.99	.06
3.00-3.99	0.87	0.73-1.03	.15	0.59	0.43-0.80	.002
≥4.00	0.87	0.75-1.02	.11	0.77	0.60-0.99	.06
Family size: quartile (minimum-maximum)						
First (1-1)	1.00	—	—	1.00	—	—
Second (2-2)	0.97	0.87-1.08	.59	0.98	0.81-1.19	.86
Third (3-3)	0.86	0.75-0.99	.06	0.86	0.67-1.10	.28
Fourth (4-17)	0.84	0.73-0.96	.02	0.84	0.66-1.06	.18
Highest level of education in household						
Not a high school graduate	1.00	—	—	1.00	—	—
High school graduate/GED	1.08	0.90-1.30	.50	0.84	0.61-1.17	.38
Greater than high school	1.47	1.24-1.75	<.001	1.41	1.05-1.88	.03
Health care interaction in past year						
No	1.00	—	—	1.00	—	—
Yes	1.99	1.72-2.30	<.001	3.72	2.68-5.18	<.001
Current health insurance coverage						
No	1.00	—	—	1.00	—	—
Yes	0.96	0.84-1.09	.59	0.80	0.63-1.02	.11
Birthplace outside United States						
No	1.00	—	—	1.00	—	—
Yes	0.66	0.56-0.77	<.001	0.52	0.39-0.70	<.001

FPL, Family poverty level; *OR*, odds ratio.

*Multivariate logistic regression models were constructed with the 3 definitions of eczema (yes/no) modeled as the dependent variables (see the Methods section) and demographic and socioeconomic variables as independent variables.

TABLE V. Distribution of skin lesions in adult eczema*

Location, no. (%)	Eczema (n = 2,641)	EAH (n = 823)
Hands	663 (25.1)	239 (29.4)
Arms	990 (37.0)	356 (41.4)
Head, face, or neck	944 (35.5)	329 (38.8)
Other	1,314 (39.4)	421 (51.2)

*Missing data were encountered in 18 (0.07%) subjects for the eczema outcome, 20 (0.07%) for asthma and 22 (0.08%) for hay fever, and 0 (0.00%) for the hands, arms, head, face, or neck. Note: these categories are not mutually exclusive.

sensitivity for the study of adult eczema. We also created a composite variable of EAH to improve the specificity of the AD definition. Future studies are needed to validate the accuracy of self-report of eczema/AD in adults and determine the ideal survey instrument for the epidemiologic study of AD in this group.

In conclusion, the US prevalences of eczema and EAH in adults were 10.2% and 3.2%, respectively. Eczema in adults is associated with increased asthma and hay fever prevalence, with greater asthma persistence and attacks in the past year. Significant predictors of adult eczema in the United States included age, race, ethnicity, birthplace outside the United States, sex, current working status, highest level of education in the household, health insurance coverage, and health care interactions in the past year.

Key messages

- **This study found that the US prevalences of eczema and EAH were 10.2% and 3.2%, respectively.**

- **Adult eczema was associated with more persistent asthma and more asthma attacks.**

- **Factors associated with higher eczema prevalence included older age, female sex, Hispanic ethnicity, US birthplace, higher level of household education, and current employment.**

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