

Acknowledgments

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Atopic dermatitis in US adults

Epidemiology, association with marital status, and atopy



Atopic dermatitis (AD) prevalence and risk factors in the US population are not fully elucidated. A study from the 2010 National Health Interview Survey (NHIS) found that 10.2% of US adults reported having “dermatitis, eczema, or any other red, inflamed skin rash”¹ in the past 12 months, likely overestimating AD prevalence by including other rashes. Furthermore, 3.2% reported having rash with asthma or hay fever,¹ likely underestimating AD prevalence by excluding intrinsic AD or those with a remote history of atopic disease. The true 1-year prevalence of AD in US adults likely lies in the middle of that 3.2% to 10.3% range. We sought to provide improved estimates and examine associations of AD prevalence in US adults. Atopic dermatitis is associated with increased psychosocial stressors that negatively impact relationships. We hypothesized that adult AD is associated with higher rates of separation and divorce.

We used the 2012 NHIS, an in-person household survey administered in English and Spanish (n = 34,588 adults). One adult per household was randomly selected for the adult questionnaire. One-year prevalence of AD was determined based on an affirmative response to: “During the past 12 months, have you had eczema or any kind of skin allergy?” Self- and caregiver-report of eczema and skin allergy has been validated and found to have good correlation with clinical examination results.² Using data from the US Bureau of the Census, sampling weights were adjusted for age, sex, race, ethnicity, household size, and educational attainment of the most educated household member. This study was approved by the institutional review board at Northwestern University.

All statistical analyses were performed with SAS version 9.4 (SAS Institute, Cary, North Carolina). Multivariable logistic regression models were constructed with AD as the binary dependent variable (yes/

no) and sociodemographics (Model 1), as well as marital status (Model 2) and each of the atopic diseases (Model 3) as the independent variables. Complete data analysis was performed. *P* values ≤ .05 were considered significant.

The US prevalence of AD in adults was 7.2% (95% confidence interval, 6.9%–7.6%). In multivariable logistic regression models, adult AD was associated with female sex, multiracial/other race, health care interaction in the past year, and current health insurance coverage, but inversely associated with highest-quartile age, currently working, African American/black and Native American race, Hispanic ethnicity, US birthplace, and household income above the FPL (Model 1, Table 1). Atopic dermatitis prevalence was higher among those born in the United States vs all other regions (*P* < .0001).

In multivariable models controlling for all variables in Model 1, AD was associated with being divorced, separated, and never married compared with those married with their spouse in the home (Model 2, Table 1).

In multivariable models controlling for all variables in Model 2, lifetime prevalence of asthma (25.5% [23.1%–27.8%] vs 11.7% [11.2%–12.1%]), point prevalence of asthma (18.7% [16.6%–20.8%] vs 7.2% [6.8%–7.6%]), and 1-year prevalence of asthma attack (11.6% [9.8%–13.4%] vs 3.5% [3.3%–3.8%]) and hay fever or respiratory allergy (34.9.0% [32.5%–37.4%] vs 14.2% [13.7%–14.7%]) were all higher in adults with vs without AD (Model 3, Table 1). The observed prevalences are very similar to previously reported prevalences of these disorders in US children (25.1% [23.1%–27.2%], 19.8% [17.8%–21.7%] and 34.4% [32.1%–36.7%], respectively³).

This study found a 7.2% prevalence of adult AD in the United States, which is approximately in the middle of the range of estimates (3.2%–10.2%) from the 2010 NHIS. The question used to identify AD in this study is more refined than in 2010 NHIS by not including “dermatitis or any other red, inflamed skin rash.” Nevertheless, misclassification of AD may occur when it is defined

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Table 1

Multivariable Logistic Regression Models of Sociodemographic Factors Associated with AD Prevalence in US adults

		Atopic dermatitis				
Model-1	Sociodemographics ^a	No (n = 32,100)	Yes (n = 2,488)	aOR	95% CI	P value
	Age (y), tertile (minimum-maximum)					
	1 (18-39)	11,584 (93.2)	873 (6.8)	1.00	—	—
	2 (40-59)	10,965 (92.4)	879 (7.6)	1.11	0.99-1.25	.07
	3 (60-85)	9,551 (92.6)	736 (7.4)	0.99	0.86-1.34	.88
	Sex					
	Male	14,417 (94.1)	887 (5.8)	1.00	—	—
	Female	17,683 (91.4)	1,601 (8.6)	1.38	1.26-1.51	<.0001
	Currently working					
	No	14,049 (91.7)	1231 (8.3)	1.00	—	—
	Yes	18,051 (93.5)	1257 (6.5)	0.75	0.68-0.82	<.0001
	Race					
	White	24,100 (92.7)	1,890 (7.3)	1.00	—	—
	African American	5,010 (93.9)	321 (6.1)	0.73	0.64-0.83	<.0001
	Asian	2,031 (93.3)	152 (6.7)	1.11	0.91-1.34	.32
	American Indian	320 (91.7)	29 (8.3)	1.20	0.81-1.77	.36
	Other/multiracial	639 (88.1)	96 (11.9)	1.77	1.42-2.21	<.0001
	Hispanic origin					
	No	26,561 (92.5)	2,160 (7.5)	1.00	—	—
	Yes	5,539 (94.4)	328 (5.6)	0.87	0.76-1.00	0.05
	Puerto Rican	535 (89.6)	49 (10.4)			
	Mexican	2,114 (94.4)	112 (5.6)			
	Mexican American	1,280 (95.3)	78 (4.7)			
	Cuban or Cuban American	283 (97.5)	8 (2.5)			
	Dominican	176 (93.3)	13 (6.7)			
	Central or South American	903 (96.3)	42 (3.7)			
	Multiple or other	248 (90.8)	26 (9.2)			
	Household income (× FPL)					
	<1	5,574 (92.3)	461 (7.7)	1.00	—	—
	>1	22,970 (92.7)	1,796 (7.3)	0.94	0.83-1.06	.31
	Highest level of education in household					
	High school graduate or less	10,694 (94.3)	660 (5.7)	1.00	—	—
Greater than high school	21,341 (92.2)	1,825 (7.8)	1.35	1.21-1.50	<.0001	
Health care interaction in past year						
No	6,460 (96.2)	266 (3.8)	1.00	—	—	
Yes	25,640 (92.0)	2,222 (8.0)	1.91	1.66-2.20	<.0001	
Current health insurance coverage						
No	5,788 (93.6)	377 (6.4)	1.00	—	—	
Yes	26,203 (92.6)	2,108 (7.4)	0.95	0.84-1.08	.45	
Birthplace in the United States						
No	25,874 (92.3)	2,141 (7.7)	1.00	—	—	
Yes	6,226 (95.0)	347 (5.0)	1.32	1.14-1.53	.0002	
Model-2	Marital status ^b					
	Married—spouse in household	13,443 (93.3)	941 (6.7)	1.00	—	—
	Married—spouse not in household	527 (94.3)	34 (5.7)	1.22	0.85-1.76	.28
	Widowed	3071 (92.9)	219 (7.1)	0.96	0.83-1.06	.66
	Divorced	4421 (91.6)	391 (8.4)	1.22	1.07-1.40	.0036
	Separated	958 (91.7)	88 (8.3)	1.41	1.11-1.81	.0056
	Never married	7645 (92.4)	645 (7.6)	1.29	1.14-1.46	<.0001
	Living with partner	1962 (91.8)	165 (8.2)	1.27	1.06-1.54	.012
	Unknown marital status	73 (93.0)	5 (7.0)	1.17	0.29-4.70	.82
Model-3	Comorbid atopic disease ^c					
	Lifetime asthma	3,781 (85.5)	629 (14.5)	2.28	2.06-2.51	<.0001
	Current asthma	2,423 (83.2)	464 (16.8)	2.48	2.22-2.78	<.0001
	Asthma attack in the past year	1,159 (79.7)	288 (20.3)	3.00	2.60-3.45	<.0001
	Hay fever and/or respiratory allergy in the past year	4,537 (83.9)	871 (16.1)	2.96	2.71-3.24	<.0001

aOR, adjusted odds ratio; CI, confidence interval; FPL, Family poverty level; OR, odds ratio.

NOTE. Five subjects (0.001%) for the eczema outcome, 0 for age, sex, race, ethnicity, family type, family size, current working status, health insurance coverage, 3,787 for household income (11.3%), 68 for highest level of household education (0.2%), 78 for marital status (0.2%).

^aModel 1: Multivariate logistic regression models were constructed with AD (yes/no) modeled as the dependent variable (see Methods) and demographic and socioeconomic variables as independent variables.^bModel 2: Multivariate logistic regression models were constructed with AD (yes/no) modeled as the dependent variable (see Methods) and demographic and socioeconomic variables and marital status as independent variables.^cModel 3: Multivariate logistic regression models were constructed with AD (yes/no) modeled as the dependent variable (see Methods) and demographic and socioeconomic variables, marital status and each of the comorbid atopic diseases as independent variables.

by a single self-reported question. Remarkably, a recent cross-sectional US population-based study found the prevalence of adult AD to be 7.3%, using an adapted United Kingdom Working Party (UKWP) Criteria.^{4,5} These nearly identical estimates, despite using different cohorts and definitions of AD, support the validity of the results and true prevalence of AD in the US population being

approximately 7%. An international, cross-sectional, web-based survey found the US prevalence of adult AD to be 4.9%.⁶ Atopic dermatitis was defined by UKWP-like criteria plus self-report of ever having an AD diagnosis by a physician. This definition has not been validated and is likely excessively rigorous given numerous previous studies showing the validity of UKWP criteria alone

for identifying AD. Requiring a diagnosis of AD is problematic given the lack of use of the terminology AD by clinicians and patients during clinical encounters, health disparities, and poor access to specialty care in the United States. Had that study employed UKWP-like criteria alone, the prevalence would have likely been approximately 7%, which we posit is the true US prevalence of AD.

We confirmed previously observed associations of adult AD with female sex, higher education status, and household income, and inverse associations with black race, Hispanic ethnicity, birthplace outside the United States, and currently working.¹

Adult AD was also associated with higher rates of divorce and separation. Atopic dermatitis is worsened by emotional factors, which may trigger or flare AD in adults. Indeed, early life stressful events, including parental divorce, were found to be associated with higher risk of childhood AD.⁷ Similarly, US children from families with single or unmarried mothers and nonbiological fathers had increased odds of AD and poor health outcomes, even after controlling for parental history of AD.⁸ Moreover, AD is associated with impaired quality of life, including vitality, social functioning, relationships, and mental health, and higher rates of sleep disturbances, fatigue, anxiety, and depression.^{9,10} The negative life impacts of AD and comorbidities on social function and relationships may increase risk of separation and divorce. Parents with AD and concomitant psychosocial stressors may indirectly confer increased AD risk to their children through psychosocial stressors, in addition to established hereditary AD risk factors. Improved treatment of adult AD might reduce psychosocial stressors, quality of life impact, subsequent family impact, such as separation and depression, and possibly even rates of AD in their offspring. Future studies are needed to confirm these associations and determine whether AD treatment mitigates these effects.

In conclusion, AD occurs in 7% of US adults and is associated with higher odds of divorce or separation and previously demonstrated sociodemographic factors.

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Allergy to ginger with cysteine proteinase GP-I as the relevant allergen



Ginger (*Zingiber officinale*) belongs to the family Zingiberaceae, along with cardamom and turmeric. The edible portion is the horizontal rhizome, and it is valued for aroma and spicy flavor. The US Food and Drug Administration considers ginger to be a food additive that is “generally recognized as safe.” Rare cases of immunoglobulin (IgE)-mediated allergy to ginger have been reported,^{1–3} but specific allergens have not been described.

We report 4 cases of IgE-mediated allergy to ginger. Patients were 52, 50, 45, and 40 years of age (patients 1, 2, 3, and 4, respectively), patients 1 and 2 presented with a history of vomiting, diarrhea, and dyspnea; patient 1 also presented with abdominal bloating and hypotension, whereas patient 3 presented with palpitations, profuse sweating, diarrhea, and loss of consciousness within minutes of consuming raw ginger. Patient 4 reported facial angioedema and conjunctival injection after handling ginger powder but tolerated ingestion of ginger. All patients tolerated ingestion of cardamom and turmeric. Patients 1, 2, and 4 had no atopic background, and patient 3 reported

seasonal rhinoconjunctivitis caused by grass pollen. Skin prick tests (SPT) to commercial extracts of common aeroallergens (ALK Allergologisk Laboratorium A/S, Horsholm, Denmark), including pollens, dust mites, molds, danders, and pan-allergens such as palm pollen profilin (Pho d 2) and peach lipid transfer protein (Pru p3) were performed with negative results (wheal < 3 mm) to all of the 24 allergens tested for patients 1, 2, and 4. Patient 3 showed positive SPT to pollen (*Phleum pratense*, *Olea europaea*, *Platanus acerifolia*, *Cupressus arizonica*). Prick-by-prick skin test with raw ginger was positive in all patients (wheal diameter for: patient 1: 7 mm; patient 2: 8 mm; patient 3: 12 mm; patient 4: 6 mm). Three healthy control subjects had negative skin test with raw ginger, serum specific IgE (sIgE) to ginger (ThermoFisher Scientific Phadia AB, Uppsala, Sweden) was 2.2, 4, 5, and 2.5 kUA/L, respectively. A raw ginger extract (GE) was prepared by homogenization in phosphate-buffered saline (20% wt/vol), dialysis, and lyophilization (Roxall Laboratory, Bilbao, Spain). Protein content of GE was 21% (wt/wt) according to Bradford.⁴ Skin prick test with GE was positive in all patients (wheal diameter for patient 1: 6 mm; patient 2: 7 mm; patient 3: 10 mm; patient 4: 6 mm). The GE was analyzed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) as described by Laemmli,⁵ showing protein bands ranging from 90 kDa to 8 kDa (results not shown). The SDS-PAGE IgE immunoblotting assays with the individual patients' sera were performed and revealed

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