

# Association Between Atopic Dermatitis and Vitiligo in the *All of Us* Database

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## INTRODUCTION

Atopic dermatitis (AD) is a chronic, relapsing and remitting disease characterized by erythematous lesions on flexural surfaces, which are associated with pruritus and scaling.<sup>1</sup> Vitiligo is an autoimmune disorder characterized by the loss of melanocytes, resulting in skin depigmentation and the formation of distinctive white patches.<sup>2</sup> While the association of atopic dermatitis with allergic rhinitis and asthma has been strongly established, its link to autoimmune conditions remains less well understood.<sup>3</sup> Thus, this study aims to investigate the association between atopic dermatitis and vitiligo utilizing the *All of Us* database.

## METHODS

We conducted a population-based, cross-sectional study in the *All of Us* database. The SNOMED code 56727007 was used to identify patients with vitiligo, and the SNOMED code 24079001 was used to identify patients with atopic dermatitis. Data regarding participants' age, race/ethnicity, sex, household income, education level, and tobacco use were obtained from survey results in the *All of Us* database. *P* values were calculated using Pearson  $\chi^2$  tests. Multivariate logistic regression was used to calculate adjusted odds ratios (AOR) to analyze the association between atopic dermatitis and vitiligo while controlling for age, race/ethnicity, sex, income, education level, and tobacco use. Statistical analyses were performed utilizing a 95% confidence interval (CI).

## RESULTS

Our analysis consisted of 5,295,141 individuals. 118,078 individuals were excluded due to incomplete responses regarding sex, race/ethnicity, income, education, or tobacco use. Prevalence of atopic dermatitis was higher in females than in males, at 61.89% and 38.11%, respectively (Table 1). A greater proportion of non-Hispanic Black and non-Hispanic Asian patients were present in the AD group than the group without AD (28.07% and 2.92% versus 24.85% and 1.81%, respectively). However, a greater proportion of Hispanic patients were present in the group without AD (18.15%) compared to those with AD (13.37%). Among the individuals with AD, 2.54% also had vitiligo, compared to 0.91% of patients without AD ( $P < 0.001$ ).

Multivariate logistic regression revealed that those with atopic dermatitis are 2.79 times more likely to have vitiligo than those without atopic dermatitis (Table 2). Subgroup analysis demonstrated that both males and females with AD have significantly higher odds of developing vitiligo (AOR 2.88 and 2.61, respectively,  $P < 0.001$ ). However, males with AD are 13% less likely to have vitiligo than females (AOR 0.87, CI 0.85 - 0.88). Caucasian, Black, and Hispanic patients with AD are all significantly more likely to have vitiligo (AOR 2.99, 2.65, 1.57, respectively). Black patients with AD are 20% more likely to have vitiligo than Caucasian patients (AOR 1.20, CI 1.17 - 1.23). Additionally, Hispanic patients with AD are 60% more likely to have vitiligo compared to Caucasian patients (AOR 1.60, CI 1.56 - 1.64). The subgroup AOR for Asian patients was unable to be calculated due to issues with model convergence. However, the odds of having vitiligo in Asian patients with AD was decreased compared to Caucasian patients (AOR 0.61, 95% CI 0.56 - 0.67)

**Table 1:** Characteristics of Participants with Atopic Dermatitis in the *All of Us* Database

Characteristic	Atopic Dermatitis (n = 266,510)	No Atopic Dermatitis (n = 5,028,631)	P-value
Vitiligo			
Yes	6775 / 266,510 (2.54%)	45,803 / 5,028,631 (0.91%)	$P < 0.001$
No	259,735 / 266,510 (97.46%)	4,982,828 / 5,028,631 (99.09%)	-
Mean age (y) +/- SD	66.84 +/- 12.61	64.71 ± 13.94	
Sex <sup>a</sup>			
Male	100,867/264,643 (38.11%)	2,821,560/4,960,946 (56.88%)	$P < 0.001$
Female	163,776/264,643 (61.89%)	2,139,386/4,960,946 (43.12%)	-
Household income <sup>b</sup>			
\$<35,000	48,734 / 93,923 (51.89%)	900,779/1,802,845 (49.96%)	$P < 0.001$
\$35-100,000	31,844 / 93,923 (33.90%)	577,081/ 1,802,845 (32.00%)	-
>\$100,000	13,345 / 93,923 (14.21%)	324,985/ 1,802,945 (18.03%)	-
Race/ethnicity			
Non-Hispanic White	141,591/262,272 (53.99%)	2,649,839 / 4,938,795 (53.65%)	$P < 0.001$
Non-Hispanic Black	73,624/262,272 (28.07%)	1,227,300/ 4,938,795 (24.85%)	-
Hispanic/Mexican American	35,057/262,272 (13.37%)	896,588/ 4,938,795 (18.15%)	-
Non-Hispanic Asian	7665/262,272 (2.92%)	89,628/4,938,795 (1.81%)	-
Other race/multiracial	4335/262,272 (1.65%)	75,440/ 4,938,795 (1.53%)	-
Education <sup>d</sup>			
Did not graduate high school	14,821 / 118,260 (12.53%)	290,588 / 2,264,998 (12.83%)	$P < 0.001$
High school graduate	28,945 / 118,260 (24.48%)	496,256 / 2,264,998 (21.91%)	-
Some College	37,512 / 118,260 (31.72%)	683,216 / 2,264,998 (30.16%)	-
College Graduate	36,982 / 118,260 (31.27%)	794,938 / 2,264,998 (35.10%)	-
Tobacco use <sup>e,f</sup>			
Yes	15,398 / 54,327 (28.34%)	296,655/960,691 (30.88%)	$P < 0.01$
No	38,929 / 54,327 (71.66%)	664,036/960,691 (69.12%)	-

A. 4,366 participants excluded  
 B. 82,176 participants excluded  
 C. 15,942 participants excluded  
 D. 13,359 participants excluded  
 E. 2,235 participants excluded  
 F. Tobacco use was assessed by the question "Do you smoke cigarettes every day, some days, or not at all?"

**Table 2:** Multivariate Logistic Regression of the Association between Atopic Dermatitis and Vitiligo

Variable	Subgroup AOR (95% CI) <sup>a</sup>	P-value	Subgroup OR (95% CI) <sup>b</sup>	P-value	Between Subgroups AOR (95% CI) <sup>c</sup>	P-value
All Participants	2.79 (2.71 - 2.86)	$P < 0.001$	2.84 (2.77 - 2.91)	$P < 0.001$	-	-
Sex						
Female	2.61 (2.53 - 2.70)	$P < 0.001$	2.73 (2.64 - 2.82)	$P < 0.001$	1.00 (Reference)	-
Male	2.88 (2.76 - 3.00)	$P < 0.001$	2.95 (2.83 - 3.08)	$P < 0.001$	0.84 (0.83 - 0.86)	$P < 0.001$
Race/ethnicity						
Non-Hispanic White	2.99 (2.88 - 3.10)	$P < 0.001$	3.01 (2.91 - 3.12)	$P < 0.001$	1.00 (Reference)	-
Non-Hispanic Black	2.65 (2.51 - 2.79)	$P < 0.001$	2.67 (2.54 - 2.82)	$P < 0.001$	1.20 (1.17 - 1.23)	$P < 0.001$
Non-Hispanic Asian	-	-	0.09 (0.03 - 0.24)	$P < 0.001$	0.61 (0.56 - 0.67)	$P < 0.001$
Hispanic/Mexican American	1.57 (1.45 - 1.69)	$P < 0.001$	1.71 (1.58 - 1.85)	$P < 0.001$	1.60 (1.56-1.64)	$P < 0.001$

A. Subgroup analysis of adjusted odds ratios  
 B. Subgroup analysis of unadjusted odds ratios  
 C. Overall odds ratios comparing subgroups to one another  
 D. Unable to calculate subgroup AOR due to issues with model convergence

## CONCLUSION

Our findings demonstrate that those with atopic dermatitis have an increased risk of developing vitiligo, providing further support for research that links autoimmune diseases with atopic dermatitis. This association is particularly pronounced in certain demographic groups, including Black, Hispanic, and female patients, emphasizing the need for vigilant monitoring for vitiligo in these populations. A deeper understanding of the pathophysiological mechanisms underlying atopic dermatitis is necessary to clarify its association with autoimmune diseases and how they may influence each other's development and outcomes.

## REFERENCES

1.Frazier W, Bhardwaj N. Atopic Dermatitis: Diagnosis and Treatment. *Am Fam Physician*. 2020;101(10):590-598.  
 2.Hu Z, Wang T. Beyond skin white spots: Vitiligo and associated comorbidities. *Front Med (Lausanne)*. 2023;10:1072837. Published 2023 Feb 23. doi:10.3389/fmed.2023.1072837  
 3.Mohan GC, Silverberg JI. Association of Vitiligo and Alopecia Areata With Atopic Dermatitis: A Systematic Review and Meta-analysis. *JAMA Dermatol*. 2015;151(5):522-528. doi:10.1001/jamadermatol.2014.3324