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Utilization of Preventive Health Care in Adults and Children With Eczema

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Abstract

Introduction—Chronic disease is a barrier to delivery of preventive health care and health maintenance. However, health behaviors of adults and children with eczema, a chronic skin disorder, have not been examined. This study examined associations of eczema with vaccination, disease screening, health maintenance, and healthcare utilization.

Methods—This study investigated 34,613 adults and 13,298 children from the 2012 National Health Interview Survey, a prospective questionnaire-based study. Data were analyzed between August 2014 and January 2015.

Results—Adult eczema was associated with higher odds of vaccination for tetanus (OR [95% CI]= 1.37 [1.22, 1.54]); influenza (1.23 [1.10, 1.37]); hepatitis A (1.21 [1.04, 1.41]) and B (1.21 [1.07, 1.35]); human papilloma virus (1.66 [1.32, 2.08]); and pneumonia (1.35 [1.19, 1.54]), but not herpes zoster virus (1.07 [0.87, 1.31]). Adult eczema was associated with increased measurement of blood glucose (1.29 [1.16, 1.44]); cholesterol (1.19 [1.06, 1.34]); blood pressure (1.84 [1.56, 2.08]); and HIV infection (1.50 [1.34, 1.70]), but not Pap smears (1.11 [0.95, 1.30]); colon cancer screening (p=0.17); or mammograms (p=0.63). Adults with eczema were more likely to interact with general doctors, mid-level providers, mental health professionals, eye doctors, podiatrists, chiropractors, therapists, obstetrician/gynecologists, and other specialists ($p \leq 0.01$). Childhood eczema was associated with higher rates of vaccination for influenza ($p<0.0002$); well child checkups (p=0.002); and interaction with most types of healthcare providers ($p \leq 0.01$). Many associations remained significant in multivariate models controlling for sociodemographics and healthcare interaction frequency.

Conclusions—Eczema in adults and children is associated with greater utilization of preventive health care and health maintenance, but not cancer screening.

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Introduction

Eczema is a chronic, relapsing, inflammatory skin disorder that can cause significant distress due to itch and a variety of comorbidities, including asthma,[1] allergic rhinitis,[1] sleep disturbances,[2] psychological and behavioral disorders,[3,4] warts and extracutaneous infections,[5] injuries,[4,6] lower bone mineral density,[7] and osteoporosis and fractures.[2,8–10] However, specific patterns of healthcare utilization in adults and children with eczema have not been fully elucidated.

Several studies examined whether various chronic diseases are associated with greater preventive healthcare utilization, including cancer screening and vaccination. However, no such studies have been completed on the behaviors of patients with eczema, which is the most common, chronic, pruritic, inflammatory skin disorder.[11] Chronic disorders have differential effects on health behaviors. For example, men with heart disease are less likely to undergo fecal occult blood testing for colon cancer.[12] Similarly, women with diabetes are less likely to undergo breast cancer screening, such as mammography.[13,14] By contrast, hypertension is associated with greater participation in cancer screening,[15] and cancer survival is associated with increased vaccination rates.[16] Determinants of altered preventive healthcare utilization in chronic disease are multifactorial and likely related to an increased number of outpatient clinic visits and focus on disease-centered care.[12] The authors hypothesized that patients with eczema have increased rates of preventive healthcare utilization and health maintenance. The present study examined the association between eczema and preventive care utilization, including vaccination, disease screening, and routine health maintenance.

Methods

National Health Interview Survey

The 2012 National Health Interview Survey (NHIS) was collected by the National Center for Health Statistics of CDC. NHIS is the principal source of information on the health of the civilian non-institutionalized population of the U.S. The questionnaires included a separate core module with questions to estimate the prevalence of various pediatric and adult health issues. The surveys were administered in person to selected households by the Bureau of the Census using approximately 400 trained interviewers with computer-assisted personal interviewing. Subsequently, one child or adult per household was randomly selected for the sample questionnaires. Interviews were conducted in English and Spanish. Using data from the U.S. Census Bureau, sample weights were created by NHIS that factored age, sex, race, ethnicity, household size, and educational attainment of the most educated household member using a multi-stage area probability sampling design. These sample weights are needed to provide nationally representative frequency and prevalence estimates for each state's population of non-institutionalized children and adults, respectively. Raw and weighted frequency and weighted prevalence estimates are presented, which reflect this complex weighting. Data were analyzed between August 2014 and January 2015. The study was approved by the IRB at Northwestern University.

Measures

One-year history of eczema was determined by an affirmative response to the question *During the past 12 months, have (you or your child) been told by a doctor or other health professional that (you or they) had eczema or any kind of skin allergy?* in adults and children, respectively.

A number of associations with adult eczema were examined, including age, sex, race, Hispanic origin, and household income. In adults (aged ≥18 years), history of vaccination was assessed for tetanus (past 10 years); influenza (past year); hepatitis A or B; human papilloma virus; herpes zoster or shingles; or pneumonia (ever). History of being screened for cervical cancer with Pap smear; colon cancer; breast cancer with mammogram (past year); and HIV (ever) were assessed. Colon cancer screening procedures included colonoscopy, fecal occult blood testing, or at-home kits to test for fecal blood. History of screening for diabetes with fasting glucose levels, high cholesterol, high blood pressure, and counseling by a physician about diet and smoking in the past year were also assessed. Finally, history of seeing different types of health care providers in the past year was assessed. In children (aged ≤17 years), history of well child checkups, vaccination for influenza, and seeing different types of healthcare providers seen in the past year was assessed.

Statistical Analysis

All data analyses and statistical processes were performed using SAS, version 9.4. Analyses of survey responses were performed using SURVEY procedures. Weighted frequencies and prevalences were determined. Bivariate and multivariable binary logistic regression models were constructed with the aforementioned measures of healthcare utilization as the dependent variables. One-year history of eczema was modeled as the binary independent variable. ORs and 95% CIs were estimated.

Multiple possible confounders were considered. Sociodemographic characteristics are associated with utilization of preventive care[17] and eczema.[18,19] Because health screening and maintenance might be related to increased frequency of healthcare visitation overall, the authors also wanted to control for the number of healthcare visits. Two different multivariate models were created to address these confounders. Model 1 controlled for age (continuous); sex (male/female); race (African American/black, Asian, Native American/American Indian, Caucasian/white, multiracial/other); Hispanic origin (yes/no); household income (<$35,000, $35,000–$74,999, $75,000–$99,999, ≥$100,000); highest level of education in the family (less than high school, high school degree or equivalent, greater than high school); and current insurance coverage (yes/no). Model 2 controlled for all of the variables included in Model 1 and additionally controlled for the number of visits per year to the physician's office and emergency department.

Post hoc correction for multiple dependent tests was performed by minimizing the false discovery rate with the approach of Benjamini and Hochberg,[20] and corrected p-values are presented. Two-sided adjusted p-values ≤0.05 were considered significant. Two-way interaction terms between covariates were tested and only included in the final models if

significant (p<0.01) and modified the effect size by >20%. AORs and 95% CIs were estimated that controlled for these covariates.

Virtually all variables had missing values in <5% of respondents (Appendix Table 1, available online). In some multivariable models, however, missing values occurred for one variable in >15% of respondents. Several approaches were used to address missing values. First, complete data analysis was performed; that is, subjects with missing data were excluded. Second, multiple imputation models (n=5 imputations) were constructed for Model 1 (Appendix Tables 2, 3, available online). However, analysis of missing values patterns for each of the healthcare behavior variables found that missing values were more likely in certain age groups, family education levels, income levels, and racial/ethnic groups, depending on the outcome being measured. Therefore, sensitivity analyses excluding these subgroups were performed.

Results

Data were collected on 34,613 adults and 13,298 children, including all ages, genders, racial/ethnic groups, and levels of household income. The prevalence and associations of adult eczema from the 2012 NHIS were previously described.[21] Briefly, the prevalence of eczema in adults was 7.2% (95% CI=6.9%, 7.6%) and in children was 12.0% (11.3%, 12.7%).

Adults with eczema had higher odds of having been vaccinated for tetanus in the past 10 years (OR [95% CI]=1.37 [1.22, 1.54]); influenza in the past 12 months (1.23 [1.10, 1.37]); hepatitis B (1.21 [1.07, 1.35]); human papilloma virus (1.66 [1.32, 2.08]); hepatitis A (1.21 [1.04, 1.41]); and pneumonia (1.35 [1.19, 1.54]) in their lifetime. The associations with higher odds of vaccination for tetanus, influenza, human papilloma virus, and pneumonia remained significant in one or more of the multivariable models (Table 1). Eczema was not associated with shingles vaccination (p=0.60). Nearly identical results were found in multiple imputation models and sensitivity analyses that excluded demographic groups with higher rates of missing values (Appendix Tables 1, 4, available online), with few exceptions. Multiple imputations of Model 1 for the associations of eczema with hepatitis A and B vaccines were significant.

A significant two-way interaction was found between eczema and age as predictors of pneumonia vaccination. Adults aged 50–69 years (4.07 [3.50, 4.73]) and ≥70 years (21.47 [18.30, 25.18]) without eczema had higher odds of pneumonia vaccination compared to those aged 18–29 years. However, adults aged 50–69 years (6.44 [5.06, 8.20]) and ≥70 years (37.78 [27.17, 52.52]) with eczema had even higher odds of pneumonia vaccination. These associations remained significant in multivariate models adjusting for sociodemographics and overall healthcare visitation (Appendix Table 5, available online).

Eczema was not associated with having a Pap smear in the past 12 months in women aged 21–65 years (1.11 [0.95, 1.30]); a mammogram in the past 12 months in women aged ≥40 years (1.05 [0.88, 1.25]); or being screened for colon cancer in the past 12 months in men and women aged ≥40 years (1.14 [0.96, 1.34]). By contrast, eczema was associated with

higher odds of being tested for HIV (1.50 [1.34, 1.70]); this association remained significant in all three multivariable models (Table 2). Nearly identical results were found in multiple imputations of Model 1 and sensitivity analyses that excluded demographic groups with higher rates of missing values (Appendix Tables 2, 6, available online).

A significant two-way interaction was found between eczema and Hispanic ethnicity as predictors of colon cancer screening. Overall, Hispanic ethnicity without eczema was negatively associated with colon cancer screening (0.82 [0.72, 0.94], p=0.006) compared with non-Hispanic adults. However, Hispanic adults with eczema had higher odds of colon cancer screening (1.96 [1.25, 3.07], p=0.007). These associations remained significant in multivariate models controlling for demographics and overall healthcare visitation (Appendix Table 5, available online).

Adults with eczema had higher odds of having their fasting glucose levels (1.29 [1.16, 1.44]); cholesterol levels (1.19 [1.06, 1.34]); and blood pressure (1.84 [1.56, 2.18]) checked and also higher odds of receiving counseling about their diet (1.61 [1.44, 1.81]). Adult smokers with eczema did not have higher odds of receiving counseling about smoking cessation. These associations remained significant in one or more of the multivariate models (Table 2). Nearly identical results were found in multiple imputations of Model 1 and sensitivity analyses that excluded demographic groups with higher rates of missing values (Appendix Tables 2, 7, available online). In multiple imputations of Model 1, the association between eczema and smoking counseling was significant.

In univariate models, eczema was associated with higher odds of interaction with all types of healthcare providers in the past 12 months, including general physicians (1.64 [1.44, 1.86]); mid-level providers such as nurse practitioners, physicians assistants, and midwives (2.00 [1.77, 2.25]); mental health providers (1.99 [1.70, 2.32]); eye doctors (1.33 [1.19, 1.48]); podiatrists (1.69 [1.42, 2.00]); chiropractors (1.39 [1.18, 1.63]); therapists, including occupational, speech, physical, respiratory, and audiology (1.82 [1.54, 2.15]); and other medical specialists (1.98 [1.77, 2.21]) (Table 3). Moreover, women with eczema were more likely to interact with obstetricians and gynecologists (1.21 [1.06, 1.39]). These associations remained significant in one or both multivariable models. Nearly identical results were found in multiple imputations of Model 1 and sensitivity analyses that excluded groups with higher rates of missing values (Appendix Tables 2, 8, available online), with the exception of the crude association of eczema with obstetrician and gynecologist visitation, which was not significant in sensitivity analyses.

Significant two-way interactions were detected between eczema and less than high school education on mental health professional contact, and eczema and high school education on chiropractor contact (Appendix Table 5, available online).

Adults without eczema from a family with less than high school education had lower odds of mental health professional contact (0.82 [0.69, 0.98]), but adults with eczema from a family with less than high school education had higher odds of mental health professional contact (2.70 [1.69, 4.34]). High school education (0.64 [0.56, 0.73]) in adults without eczema was

associated with decreased odds of chiropractor contact. However, high school education (1.48 [1.03, 2.12]) with eczema was associated with increased odds of chiropractor contact.

Childhood eczema was associated with higher odds of receiving an influenza vaccination (1.35 [1.18, 1.54]) and well child checkup (1.35 [1.12, 1.61]) in the past 12 months (Table 4). Children with eczema were more likely to have a health interaction with general physicians (1.86 [1.51, 2.30]); mid-level providers (1.73 [1.46, 2.04]); mental health professionals (1.59 [1.27, 1.99]); podiatrists (1.73 [1.46, 2.04]); therapists (2.25 [1.81, 2.77]); and other medical specialists (2.13 [1.81, 2.51]) but not eye doctors (1.10 [0.95, 1.28]); chiropractors (1.09 [0.73, 1.64]); or obstetricians/gynecologists (0.59 [0.27, 1.29]). These associations remained significant in one or both multivariable models. Nearly identical results were found in multiple imputations of Model 1 and sensitivity analyses that excluded subgroups with higher rates of missing values (Appendix Tables 3, 9, and 10, available online). One exception occurred for the association of eczema with well child checkups, which was significant in multiple imputation models and sensitivity analyses when children of Chinese ethnicity and children with no insurance coverage were excluded.

Discussion

Using a U.S. population–based cohort, this study examined the patterns of preventive healthcare utilization and health maintenance in adults and children with eczema. Eczema was generally associated with higher odds of vaccination and screening for HIV, diabetes, hypertension, and hyperlipidemia in adults, but not cancer. In children, eczema was associated with higher odds of well child checkup and influenza vaccine. Children and adults with eczema had higher odds of interacting with all types of healthcare providers. Previous studies examined the effects of one or more chronic diseases on utilization of preventive health services.[22,23] Yet, eczema and other inflammatory skin diseases were not included in these analyses. This is the first study that demonstrates increased preventive healthcare utilization and health screenings in children and adults with eczema.

Previous studies have found mixed effects of chronic disease on delivery of preventive health services. Fontana et al.[12] found that diabetes, hypertension, and heart disease were all negatively associated with receiving proper cancer screening, including mammography, clinical breast exams, and sigmoidoscopy. This finding was mirrored by further studies[14,24,25] and was theorized to occur because of competing demands of the primary care physician[26] and inadequate attention given to smaller problems in the context of larger, more chronic issues that dominated the physician–patient relationship. More recently, several studies indicated there are disease-specific effects on utilization of preventive health services.[22,27,28]

Although it was not possible to determine the underlying reasons for visits to healthcare providers in study subjects, the increased rates of preventive health care and health screenings observed in patients with eczema are likely multifactorial. Eczema metaphorically “plugs” a patient into the healthcare system by allowing for the opportunity to form a positive therapeutic relationship with a provider treating their skin disease. In addition, patients with eczema likely have increased interaction with a variety of healthcare

providers and specialists owing to their many allergic and non-allergic comorbidities, including asthma, hay fever and food allergies,[1] sleep disturbances,[21] warts and extracutaneous infections,[5] obesity,[29–32] hypertension,[29,33] type II diabetes,[33] and retinal detachment[34] and atopic keratoconjunctivitis,[35] both ophthalmologic emergencies. Eczema is also associated with increased incidence of cataracts,[36] lower bone mineral density,[7] osteoporosis and fractures,[8] and other types of injury.[4,6] Increased interaction with health-care providers likely increases patients' odds of vaccination via systems-based interventions, such as reminder systems and automatic prompts in an electronic health record.[37]

Although it is logical that individuals with more healthcare visitation have higher rates of cancer screening, adult eczema was not associated with different rates of cancer screening overall. However, in Hispanic adults, eczema was associated with significantly increased odds of colon cancer screening. Hispanic Americans experience major disparities in access to cancer screening when compared with non-Hispanic whites.[38] Perhaps having a chronic condition such as eczema motivates underserved patients to increasingly engage the healthcare system, thereby offsetting the disparity gap. Future studies of the healthcare attitudes of eczema patients are needed to better understand these findings.

Of note, there were no significant differences in physician counseling about smoking in adult smokers with or without eczema. However, adults with eczema were previously found to have a higher odds of smoking and start smoking at a younger age than those without eczema.[33] Further, smoking appears to contribute toward the exacerbation of hand eczema in a dose-dependent manner.[39,40] Together, these studies indicate that smoking is a target area for intervention by dermatologists and primary care physicians alike.

Limitations

The strengths of this study include using a large-scale, U.S. population–based survey of adults and children with minimal selection bias, using population-based weighted frequencies and prevalences, and controlling for confounding demographic variables in multivariable models. In addition, the study was able to control for the effects of missing values using multiple imputation models and sensitivity analyses, and with a few minor exceptions, the results were nearly identical to complete case analysis. However, this study is not without limitations. The survey questions for cancer screening did not allow assessment of the proportion of adults currently up-to-date with recommended screening, but rather the proportion of adults who had been screened in the past year. The U.S. Preventive Services Task Force recommends cervical cancer screening once every 3 years,[41] colorectal cancer screening once every 3–10 years depending on the method used,[42] and mammography screening every 2 years.[43] It is therefore possible that the authors were unable to detect differences in cancer screening behaviors between eczema and non-eczema patients. Eczema history was self-reported by response to the question *During the past 12 months, have you had eczema or any kind of skin allergy?* and not verified by physician evaluation. Previous analyses in different populations found that there is a good correlation between self-reported eczema and eczema determined by a clinician on physical exam.[44,45] Studies of self-reported vaccination compared to medical record documentation have

generally indicated high rates of concordance.[46,47] Future studies using insurance databases and patient health records are needed to confirm the associations found in this study.

Conclusions

Eczema is associated with increased odds of vaccination, routine health maintenance, and interaction with all types of healthcare providers in both children and adults. However, adults with eczema do not have higher odds of cancer screening. Further studies are needed to elucidate the reasons for altered healthcare utilization in patients with eczema.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix. Supplementary data

Supplementary data associated with this article can be found at http://dx.doi.org/10.1016/j.amepre.2015.07.029.

Table 1

Associations Between Eczema and Vaccination in Adults From the 2012 NHIS (*n*=34,613)

	No eczema (*n*=32,100)	Eczema (*n*=2,488)						
					Model 1		Model 2	
Vaccination type	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
Tetanus vaccine (past 10 years)								
No	38.0 (37.3, 38.7)	30.8 (28.4, 33.2)	1.00	—	1.00	—	1.00	—
Yes	62.0 (61.3, 62.7)	69.2 (66.7, 71.6)	**1.37 (1.22, 1.54)**	**<0.0002**	**1.33 (1.17, 1.50)**	**<0.0002**	**1.23 (1.09, 1.39)**	**0.002**
Influenza vaccine (past year)								
No	63.2 (62.5, 63.9)	58.2 (55.7, 60.8)	1.00	—	1.00	—	1.00	—
Yes	36.8 (36.1, 37.5)	41.8 (39.2, 44.3)	**1.23 (1.10, 1.37)**	**0.0004**	**1.22 (1.08, 1.38)**	**0.004**	1.10 (0.97, 1.24)	0.19
Hepatitis B vaccine (ever)								
No	66.7 (66.0, 67.4	62.5 (60.0, 65.1)	1.00	—	1.00	—	1.00	—
Yes	33.3 (32.6, 34.0)	37.5 (34.9, 40.1)	**1.21 (1.07, 1.35)**	**0.004**	1.12 (0.99, 1.27)	0.11	1.06 (0.94, 1.21)	0.39
HPV vaccine (ever)								
No	95.1 (94.7, 95.4)	92.1 (90.6, 93.7)	1.00	—	1.00	—	1.00	—
Yes	4.90 (4.51, 5.30	7.88 (6.34, 9.41)	**1.66 (1.32, 2.08**	**<0.0002**	**1.43 (1.10, 1.85)**	**0.01**	**1.38 (1.06, 1.79)**	**0.03**
Hepatitis A vaccine (ever)								
No	85.5 (85.0, 86.0)	83.0 (80.9, 85.0)	1.00	—	1.00	—	1.00	—
Yes	14.5 (14.0, 15.0)	17.0 (15.0, 19.0)	**1.21 (1.04–1.41)**	**0.02**	1.17 (0.99, 1.37)	0.09	1.11 (0.94, 1.31)	0.24
Shingles vaccine (ever)								
No	85.8 (85.1, 86.6)	85.0 (82.5, 87.5)	1.00	—	1.00	—	1.00	—
Yes	14.2 (13.4, 14.9)	15.0 (12.5, 17.5)	1.07 (0.87, 1.31)	0.60	1.00 (0.80, 1.24)	0.98	1.00 (0.80, 1.26)	0.98

	No eczema (*n*=32,100)	Eczema (*n*=2,488)						
					Model 1		Model 2	
Vaccination type	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
Pneumonia vaccine (ever)								
No	79.6 (79.0, 80.2)	74.3 (72.0, 76.5)	1.00	—	1.00	—	1.00	—
Yes	20.4 (19.8, 21.0)	25.7 (23.5, 28.0)	**1.35 (1.19, 1.53)**	**<0.0002**	**1.38 (1.20, 1.59)**	**<0.0002**	**1.20 (1.04, 1.37)**	**0.02**

Note: Boldface indicates statistical significance ($p<0.05$).

Binary survey logistic regression models were constructed with history of vaccination for tetanus in the past 10 years, influenza in the past year, HAV, HBV, HPV, shingles, and pneumonia (ever) as the binary dependent variables and history of eczema as the binary independent variable. ORs and 95% CIs were determined. Three separate multivariate regression models were constructed. Model 1 included eczema status, age, gender, race/ethnicity, Hispanic origin, family income, insurance status, and level of education of the most educated family member. Model 2 included eczema status, age, gender, race/ethnicity, Hispanic origin, family income, insurance status, level of education of the most educated family member, number of office visits per year, and number of emergency department visits per year. AORs and 95% CIs were determined.

% Prev, % prevalence; HAV, hepatitis virus; HBV, hepatitis B virus; HPV, human papilloma virus; NHIS, National Health Interview Survey.

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Table 2

Associations Between Eczema, Disease Screening Behavior and Routine Health Maintenance and Counseling in Adults From the 2012 NHIS (*n*=34,613)

	No eczema (n=32,100)	Eczema (n=2,488)						
					Model 1		Model 2	
Disease screening behavior	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
Pap smear (past year)								
No	41.2 (40.1, 42.2)	38.7 (35.1, 42.3)	1.00	—	1.00	—	1.00	—
Yes	58.8 (57.8, 59.9)	61.3 (57.7, 64.9)	1.11 (0.95, 1.30)	0.25	1.13 (0.96, 1.34)	0.18	1.00 (0.85, 1.19)	0.98
Colon cancer screening (past year)								
No	81.4 (80.7, 82.1)	79.4 (76.8, 82.0)	1.00	—	1.00	—	1.00	—
Yes	18.6 (17.9, 19.3)	20.6 (18.0, 23.2)	1.14 (0.96, 1.34)	0.17	1.20 (1.00, 1.43)	0.07	1.09 (0.91, 1.29)	0.42
Mammogram (past year)								
No	43.3 (42.1, 44.5)	42.1 (38.1, 46.1)	1.00	—	1.00	—	1.00	—
Yes	56.7 (55.5,57.9)	57.9 (53.9, 57.9)	1.05 (0.88, 1.25)	0.63	1.10 (0.91, 1.33)	0.37	1.07 (0.89, 1.30)	0.54
HIV test (ever)								
No	65.7 (65.0, 66.4)	56.1 (53.5, 58.7)	1.00	—	1.00	—	1.00	—
Yes	34.3 (33.6, 35.0)	43.9 (41.3, 46.4)	**1.50 (1.34, 1.67)**	**<0.0002**	**1.51 (1.34, 1.70)**	**<0.0002**	**1.37 (1.22, 1.55)**	**<0.0002**
Health maintenance in the past year								
Fasting glucose check								
No	55.6 (54.9, 56.3)	49.2 (46.6, 51.8)	1.00	—	1.00	—	1.00	—
Yes	44.4 (43.7, 45.1)	50.8 (48.2, 53.4)	**1.29 (1.16, 1.44)**	**<0.0002**	**1.26 (1.13, 1.42)**	**<0.0002**	1.10 (0.97, 1.24)	0.17
Cholesterol check								
No	37.7 (37.0, 38.5)	33.7 (31.2, 36.2)	1.00	—	1.00	—	1.00	—

	No eczema (n=32,100)	Eczema (n=2,488)						
					Model 1		Model 2	
Disease screening behavior	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
Yes	62.3 (61.5, 63.0)	66.3 (63.8, 68.8)	**1.19 (1.06, 1.34)**	**0.006**	**1.16 (1.02, 1.32)**	**0.05**	0.98 (0.85, 1.13)	0.83
Blood pressure check								
No	18.4 (17.9, 19.0)	10.9 (9.34, 12.5)	1.00	—	1.00	—	1.00	—
Yes	81.6 (81.0, 82.1)	89.1 (87.5, 90.7)	**1.84 (1.56, 2.18)**	**<0.0002**	**1.67 (1.40, 2.00)**	**<0.0002**	**1.33 (1.09, 1.61)**	**0.007**
Dietary counseling by physician								
No	74.7 (74.1, 75.3)	64.7 (62.1, 67.2)	1.00	—	1.00	—	1.00	—
Yes	25.3 (24.7, 25.9)	35.3 (32.8, 37.9)	**1.61 (1.44, 1.81)**	**<0.0002**	**1.60 (1.42, 1.81)**	**<0.0002**	**1.37 (1.21, 1.55)**	**<0.0002**
Smoking counseling by physician in adult smokers								
No	49.6 (47.9, 51.3)	43.8 (38.3, 49.3)	1.00	—	1.00	—	1.00	—
Yes	50.4 (48.7, 52.1)	56.2 (50.7, 61.7)	1.26 (1.00, 1.60)	0.08	1.18 (0.92, 1.51)	0.23	1.04 (0.80, 1.35)	0.81

Note: Boldface indicates statistical significance ($p<0.05$). Binary survey logistic regression models were constructed with history of vaccination for tetanus in the past 10 years, influenza in the past year, HAV, HBV, HPV, shingles and pneumonia (ever) and health maintenance and counseling in the past year, including fasting glucose check, cholesterol check, blood pressure check, dietary counseling and smoking counseling (in adult smokers) by a physician as the binary dependent variables and history of eczema as the binary independent variable. ORs and 95% CIs were determined. Three separate multivariate regression models were constructed. Model 1 included eczema status, age, gender, race/ethnicity, Hispanic origin, family income, insurance status, and level of education of the most educated family member. Model 2 included eczema status, age, gender, race/ethnicity, Hispanic origin, family income, insurance status, level of education of the most educated family member, number of office visits per year, and number of emergency department visits per year. AORs and 95% CIs were determined.

% Prev, % prevalence; HAV, hepatitis virus; HBV, hepatitis B virus; HPV, human papilloma virus; NHIS, National Health Interview Survey.

Table 3

Associations Between Eczema and Interaction With Different Types of Healthcare Providers in Adults From the 2012 NHIS (*n*=34,613)

	No eczema (*n*=32,100)	Eczema (*n*=2,488)						
					Model 1		Model 2	
Healthcare provider	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
General doctor								
No	33.6 (32.9, 34.3)	23.6 (21.4, 25.8)	1.00	—	1.00	—	1.00	—
Yes	66.4 (65.7, 67.1)	76.4 (74.2, 78.6)	**1.64 (1.44, 1.86)**	**<0.0002**	**1.61 (1.40, 1.84)**	**<0.0002**	**1.33 (1.15, 1.54)**	**0.0002**
Mid-level providers (including NP/PA/Midwife)								
No	81.7 (81.1, 82.2)	69.1 (66.6, 71.5)	1.00	—	1.00	—	1.00	—
Yes	18.3 (17.8, 18.9)	30.9 (28.5, 33.4)	**2.00 (1.77, 2.25)**	**<0.0002**	**1.79 (1.58, 2.03)**	**<0.0002**	**1.51 (1.32, 1.72)**	**<0.0002**
Mental health professional								
No	92.6 (92.3, 93.0)	86.4 (84.6, 88.1)	1.00	—	1.00	—	1.00	—
Yes	7.36 (6.99, 7.74)	13.6 (11.9, 15.4)	**1.99 (1.70, 2.32)**	**<0.0002**	**1.81 (1.54, 2.14)**	**<0.0002**	**1.43 (1.20, 1.70)**	**<0.0002**
Eye doctor								
No	62.5 (61.8, 63.2)	55.6 (53.0, 58.2)	1.00	—	1.00	—	1.00	—
Yes	37.5 (36.8, 38.2)	44.4 (41.8, 47.0)	**1.33 (1.19, 1.48)**	**<0.0002**	**1.25 (1.11, 1.41)**	**0.0004**	**1.15 (1.02, 1.31)**	**0.03**
Podiatrist								
No	92.9 (92.6, 93.3)	88.6 (86.9, 90.3)	1.00	—	1.00	—	1.00	—
Yes	7.07 (6.72, 7.43)	11.4 (9.76, 13.1)	**1.69 (1.42, 2.00)**	**<0.0002**	**1.67 (1.39, 2.01)**	**<0.0002**	**1.35 (1.12, 1.64)**	**0.004**
Chiropractor								
No	91.0 (90.6, 91.4)	87.9 (86.3, 89.5)	1.00	—	1.00	—	1.00	—
Yes	9.03 (8.62, 9.44)	12.1 (10.5, 13.7)	**1.39 (1.18, 1.63)**	**<0.0002**	**1.28 (1.08, 1.51)**	**0.007**	1.09 (0.91, 1.30)	0.39

	No eczema (*n*=32,100)	Eczema (*n*=2,488)						
					Model 1		Model 2	
Healthcare provider	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
Therapist (including OT, PT, RT, speech therapist, audiologist)								
No	91.7 (91.3, 92.1)	85.9 (84.0, 87.8)	1.00	—	1.00	—	1.00	—
Yes	8.28 (7.29, 8.67)	14.1 (12.2, 16.0)	**1.82 (1.54, 2.15)**	**<0.0002**	**1.75 (1.47, 2.09)**	**<0.0002**	**1.32 (1.10, 1.59)**	**0.006**
Obstetrician-gynecologist								
No	60.3 (59.3, 61.2)	55.6 (52.4, 58.8)	1.00	—	1.00	—	1.00	—
Yes	39.7 (38.8, 40.7)	44.4 (41.2, 47.6)	**1.21 (1.06, 1.39)**	**0.01**	1.15 (0.99, 1.324	0.10	1.03 (0.88, 1.20)	0.79
Medical specialist								
No	74.9 (74.3, 75.5)	60.2 (57.6, 62.7)	1.00	—	1.00	—	1.00	—
Yes	25.1 (24.5, 25.7)	39.8 (37.3, 42.4)	**1.98 (1.77, 2.21)**	**<0.0002**	**1.99 (1.76, 2.24)**	**<0.0002**	**1.58 (1.38, 1.82)**	**<0.0002**

Note: Boldface indicates statistical significance ($p<0.05$).

Binary survey logistic regression models were constructed with history of interacting with different types of healthcare providers in the past year as the binary dependent variables and history of eczema as the binary independent variable. ORs and 95% CIs were determined. Three separate multivariate regression models were constructed. Model 1 included eczema status, age, gender, race/ethnicity, Hispanic origin, family income, insurance status, and level of education of the most educated family member. Model 2 included eczema status, age, gender, race/ethnicity, Hispanic origin, family income, insurance status, level of education of the most educated family member, number of office visits per year, and number of emergency department visits per year. AORs and 95% CIs were determined.

% Prev, % prevalence; NHIS, National Health Interview Survey; NP, nurse practitioner; OT, occupational therapist; PA, physician assistant; PT, physical therapist; respiratory therapist.

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Table 4

Associations Between Eczema and Health Behavior and Interaction With Different Types of Healthcare Providers in Children From the 2012 NHIS (*n*=13,298)

	No eczema (*n*=11,658)	Eczema (*n*=1,603)						
					Model 1		Model 2	
Health behavior	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
Flu shot (past year)								
No	56.5 (55.4, 57.7)	49.1 (46.0, 52.3)	1.00	—	1.00	—	1.00	—
Yes	43.5 (42.3, 44.6)	50.9 (47.7, 54.0)	**1.35 (1.18, 1.54)**	**<0.0002**	**1.25 (1.09, 1.45)**	**0.004**	1.15 (0.99, 1.33)	0.10
Well child checkup (past year)								
No	20.4 (19.4, 21.3)	16.0 (13.7, 18.3)	1.00	—	1.00	—	1.00	—
Yes	79.6 (78.7, 80.6)	84.0 (81.7, 86.3)	**1.35 (1.12, 1.61)**	**0.002**	1.18 (0.97, 1.43)	0.12	1.06 (0.86, 1.28)	0.65
Healthcare provider								
General doctor								
No	18.3 (17.4, 19.2)	10.7 (8.81, 12.7)	1.00	—	1.00	—	1.00	—
Yes	81.7 (80.8, 82.6)	89.3 (87.3, 91.2)	**1.86 (1.51, 2.30)**	**<0.0002**	**1.78 (1.43, 2.22)**	**<0.0002**	**1.53 (1.22, 1.91)**	**0.0004**
NP/PA/midwife								
No	84.3 (83.4, 85.2)	75.7 (72.9, 78.5)	1.00	—	1.00	—	1.00	—
Yes	15.7 (14.8, 16.6)	24.3 (21.5, 27.1)	**1.73 (1.46, 2.04)**	**<0.0002**	**1.72 (1.45, 2.04)**	**<0.0002**	**1.41 (1.18, 1.68)**	**0.0002**
Mental health professional								
No	92.3 (91.6, 93.0)	88.3 (86.2, 90.4)	1.00	—	1.00	—	1.00	—
Yes	7.71 (7.04, 8.37)	11.7 (9.64, 13.8)	**1.59 (1.27, 1.99)**	**<0.0002**	**1.65 (1.30, 2.09)**	**<0.0002**	1.15 (0.88, 1.50)	0.36
Eye doctor								

	No eczema (*n*=11,658)	Eczema (*n*=1,603)						
					Model 1		Model 2	
Health behavior	**% Prev (95% CI)**	**% Prev (95% CI)**	**Crude OR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
No	75.8 (74.8, 76.8)	74.0 (71.3, 76.7)	1.00	—	1.00	—	1.00	—
Yes	24.2 (23.2, 25.2)	26.0 (23.3, 28.7)	1.10 (0.95, 1.28)	0.26	**1.25 (1.06, 1.47)**	**0.01**	1.10 (0.93, 1.30)	0.29
Podiatrist								
No	98.1 (97.8, 98.5)	97.0 (96.0, 98.0)	1.00	—	1.00	—	1.00	—
Yes	1.87 (1.54, 2.19)	2.96 (1.99, 3.93)	**1.60 (1.09, 2.35)**	**0.01**	**1.74 (1.17, 2.57)**	**0.006**	1.30 (0.86, 1.98)	0.26
Chiropractor								
No	96.9 (96.4, 97.3)	96.6 (95.3, 97.8)	1.00	—	1.00	—	1.00	—
Yes	3.14 (2.68, 3.60)	3.42 (2.18, 4.67)	1.09 (0.73, 1.64)	0.72	1.35 (0.88, 2.07)	0.21	1.06 (0.67, 1.366	0.85
Therapist								
No	93.5 (92.9, 94.1)	86.5 (84.3, 88.7)	1.00	—	1.00	—	1.00	—
Yes	6.52 (5.93, 7.11)	13.5 (11.3, 15.7)	**2.25 (1.81, 2.77)**	**<0.0002**	**2.16 (1.73, 2.70)**	**<0.0002**	**1.61 (1.26, 2.04)**	**0.0002**
Obstetrician-gynecologist								
No	83.2 (80.3, 86.1)	89.4 (82.3, 96.6)	1.00	—	1.00	—	1.00	—
Yes	16.8 (13.9, 19.7)	10.6 (3.38, 17.7)	0.59 (0.27, 1.29)	0.22	0.53 (0.23, 1.21)	0.17	**0.29 (0.11, 0.76)**	**0.02**
Medical specialist								
No	86.9 (86.1, 87.7)	75.7 (73.0, 78.4)	1.00	—	1.00	—	1.00	—
Yes	13.1 (12.3, 13.9)	24.3 (21.6, 27.0)	**2.13 (1.81, 2.51)**	**<0.0002**	**2.20 (1.86, 2.61)**	**<0.0002**	**1.62 (1.34, 1.95)**	**<0.0002**

Note: Boldface indicates statistical significance ($p<0.05$).

Binary survey logistic regression models were constructed with history of vaccination for influenza, well child checkups and interacting with different types of healthcare providers in the past year as the binary dependent variables and history of eczema as the binary independent variable. ORs and 95% CIs were determined. Three separate multivariate regression models were constructed. Model 1 included eczema status, age, gender, race/ethnicity, Hispanic origin, family income, insurance status, and level of education of the most educated family member. Model 2 included eczema status, age, gender, race/

ethnicity, family income, insurance status, level of education of the most educated family member, number of office visits per year, and number of emergency department visits per year. AORs and 95% CIs were determined.

% Prev, % prevalence; NHIS, National Health Interview Survey; NP, nurse practitioner; PA, physician assistant.