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Title: Outpatient utilization patterns for atopic dermatitis in the United States

Short Title: Utilization for AD in US

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Partik Singh and Jonathan Silverberg had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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Analysis and interpretation of data: Singh, Silverberg

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Capsule summary:

- This study found that outpatient healthcare visits for atopic dermatitis are increasing in the US over time. PCP visits for AD are more likely to be acute and increasing over time, while dermatologist visits for AD are more likely to be chronic and decreasing over time.
- These results suggest that dermatologists should focus on chronic disease management strategies in the outpatient setting.

Abstract

Background: The prevalence and demographics of atopic dermatitis (AD) have changed in the US. Little is known about trends and determinants of outpatient healthcare utilization.

Objective: Determine the trends and determinants of outpatient healthcare utilization for AD in US adults and children.

Methods: Data from the 1993-2015 National Ambulatory Medical Care Survey were analyzed, including 110,095 pediatric and 642,140 adult outpatient visits.

Results: AD visits occurred predominantly in primary care providers (PCPs) (768,882 mean visits annually), followed by dermatologists (466,529), and allergists (18,445). The frequency of AD visits increased from 1996-1999 to 2012-2015 overall (867,649 to 1,950,546 annually; Rao-Scott Chi square, $P=0.02$), particularly among PCPs (339,889 to 1,025,739; $P=0.02$). The frequency of AD visits to dermatologists decreased (446,669 to 371,003; $P=0.01$). AD visits to were most common among children age 0-4 years (32.0%). Adults with comorbid allergic rhinitis or food allergies had greater odds of seeing an allergist. AD visits were more likely to be acute visits among PCPs (51.5%), and chronic visits among dermatologists (41.2%).

Limitations: AD severity was unavailable.

Conclusions: Outpatient visits for AD increased in the US over time overall, but decreased for dermatologists. Dermatologists are most commonly seeing chronic AD visits and should tailor treatment appropriately.

Introduction

Atopic Dermatitis (AD) is a chronic, inflammatory skin disease, affecting approximately 13% of children^{1,2} and 7% of adults³⁻⁵ in the US. AD is associated with atopic and other comorbidities⁶⁻⁸, and has been suggested to be a systemic disorder⁹. As such, AD often requires treatment from a variety of providers to address their skin disease and comorbidities.

AD is a heterogeneous disorder, with variable severity and disease course, including a relapsing course with acute flares or a chronic persistent disease. Many AD patients with mild disease can be managed adequately in the primary care setting. Yet, patients with more severe, persistent and/or complicated AD often require specialty care with dermatologists and allergists. Yet, little is known about the trends of outpatient healthcare utilization for AD in the US and the drivers for such utilization. We sought to determine healthcare utilization patterns for AD, including provider and visit types, and the impact of atopic comorbidities and other predictors of outpatient visits.

Methods

The 1993-2015 NAMCS is a cross-sectional, national survey implemented by the National Center for Health Statistics via the Centers for Disease Control to sample outpatient physician visits in the United States. The sampled visits are used to provide nationally representative estimates of utilization of ambulatory services throughout the US. Participants in NAMCS are asked to provide data on approximately 30 patient visits during a randomly assigned 1-week reporting period. Participants include non-federally employed, office-based physicians (doctors of medicine or osteopathy) who are primarily engaged in direct patient care across an array of medical specialties. The survey uses a multistage estimation procedure using survey weights to adjust for nonresponse and reduce bias of national estimates.

The reason(s) for the visit was coded using International Classification of Disease 9th Edition diagnosis codes. AD or eczema visits were identified by ICD9 codes 691.8 (atopic dermatitis) and/or 692.9 (dermatitis not otherwise specified), respectively. Selected comorbidities, including asthma, allergic rhinitis, and food allergies were identified using the Agency for Healthcare Research and Quality's Clinical Classification Codes 49300-49302, 49310-49312, 49320-49322, 49381, 49382 49390-49392, 4770, 47710, 55830, 69250, 69310, 99560-99569, 99570, and V1500-V1505, respectively. Additional characteristics of visits included visit duration (0-15/16-30/31-45/>45 minutes), patient referral (yes/no/unknown/not applicable), number of visits in the past 12 months (0/1-2/3-5/6+/unknown/not applicable), and the major reason for the visit (acute problem/chronic problem, routine/chronic problem, flareup/pre- or post-surgery/non-illness care/unknown/ not applicable).

All statistical analyses were performed in Stata (version 14.2 StataCorp LLC, College Station, Texas) and accounted for survey weights and the complex study design. Summary

statistics were estimated, including frequencies, weighted proportions and 95% confidence intervals (CI). Data were pooled into either two or four-year bins to minimize variance. Rao Scott Chi Square tests were used to examine associations of categorical data. Multivariable logistic regression models were constructed to determine the predictors of AD visits to PCPs, dermatologists or allergists (dependent variables). The covariables include sex (male/female), race/ethnicity (Caucasian/African-American/Hispanic/Asian-Pacific Islander/American Indian-Eskimo/Other), payer (public/private/self-pay/other), comorbidity (asthma, allergic rhinitis, food allergies), metropolitan statistical area (yes/no), region (Northeast/Midwest/South/West), season (fall/winter/spring/summer), and number of medications (0/1/2/3/4+). Adjusted odds ratios (aOR) and 95% CI were estimated.

Results

Population characteristics

Data were collected on a total of 128,300 pediatric and 623,935 adult visits (weighted frequency [SE]: 3,840,000,000 [371,000,000] and 16,300,000,000 [1,410,000,000], respectively). Overall, the weighted frequency [SE] of annual visits for AD and eczema were 984,310 [114,165] and 3,282,324 [154,566] in children and 542,367 [54,644] and 6,267,758 [110,758] in adults, respectively. This corresponds to weighted proportions [95% CI] of 0.59% [0.51%-0.68%] and 1.9% [1.8%-2.1%] in children and 0.10% [0.08%-0.11%] and 0.93% [0.88%-0.98%] in adults, respectively. A large subset of patients in AD (40.6% [32.3%-49.6%]) and non-AD (46.6% [39.5%-53.9%]) visits had seen a provider ≥ 6 times in the past calendar year.

Provider types

The most common provider type for AD visits in children was Pediatrics (55.5% [48.7%-62.2%]), followed by Dermatology (18.4% [14.0%-23.7%]) and other specialties (17.6% [11.5%-26.1%]). In adults, the most common provider type for AD visits was Dermatology (37.0%-51.7%), followed by other specialties (16.6% [10.9%-24.3%]) and General/family practice (16.5% [12.1%-22.1%]). In contrast, the most common provider type for non-AD visits was Pediatrics (61.7% [59.7%-63.7%]) in children (Rao-Scott Chi square, $P < 0.0001$) and General/family practice (23.9% [22.5%-25.4%]) in adults ($P < 0.0001$).

The frequency [SE] of AD visits increased between 1996-1999 (867,649 [63,601]) and 2012-2015 (1,950,546 [226,260]), overall ($P = 0.02$), and at PCPs, in particular (339,889 [122,788] and 1,025,739 [72,310], $P = 0.0004$) (Figure 1). The frequency of visits to a

dermatologist did not, however, significantly change from 1996-1999 (446,669 [122,080]) to 2012-2015 (371,003 [124,881]) time ($P=0.15$). The frequency of eczema visits did not significantly change between 1996-1999 (8,710,691 [226,009]) and 2012-2015 (9,338,978 [406,555]), overall ($P=0.48$), for dermatologists (2,789,697 [182,676] and 2,608,880 [231,336], $P=0.06$), or PCPs (5,306,412 [193,562] and 5,313,307 [140,373], $P=0.23$).

AD visit characteristics

AD visits were shorter than non-AD visits (mean [SE]: 18.4 [0.45] vs. 19.3 [0.14] minutes, $P=0.03$), though more AD vs. non-AD visits lasted >15 minutes among dermatologists (34.8% [29.5-40.5%] vs. 29.5% [27.7-31.3%], $P=0.004$) (Supplemental Table 1; <https://data.mendeley.com/datasets/6fc3vty7vt/1>). PCPs did not, however, demonstrate a significant difference ($P=0.51$). There were no significant differences of visit duration by demographics or insurance type (Supplemental Table 2 <https://data.mendeley.com/datasets/6fc3vty7vt/1>).

Dermatology visits were more likely than PCP visits to be referrals from another healthcare provider in AD (29.3% [25.3%-33.8%] vs. 3.2% [1.3%-7.8%], $P<0.0001$) and non-AD visits (21.5% [19.9%-23.2%] vs. 3.9% [3.5%-4.3%], $P<0.0001$).

Most AD visits were acute visits (41.3% [36.2%-46.6%]), followed by visits for follow-up of chronic problems (23.0% [18.2%-28.7%]) and chronic problems with an acute flare (14.4% [11.5%-17.9%]). AD vs. non-AD visits were more likely to be acute visits among PCPs (51.5% [44.8%-58.2%] vs. 43.7% [42.9%-44.4%], $P<0.0001$), but not dermatologists (32.4% [26.1%-39.3%] vs. 35.0% [33.3%-36.7%], $P<0.0001$). Conversely, AD vs. non-AD visits were more likely to be chronic visits among dermatologists (41.2% [3.7%-49.2%] vs. 36.7% [34.4%-

38.9%]), but less likely to be chronic visits among PCPs (7.3% [4.8%-10.9%] vs. 23.6% [22.8%-24.4%]).

Demographic differences of utilization for AD

Non-AD visits were evenly distributed by age. AD visits were most common among children age 0-4 years (32.0%) and 5-9 (10.6%), decreased in adolescents age 10-19 years (11.6%), remained fairly steady between ages 20-89 years (1.0%-4.7%), and increased at age >90 years (20.7%) ($P<0.0001$) (Figure 2).

There were sex differences of AD visits by age ($P<0.0001$), with male predominance in persons age 0-19 years, though female predominance among those age >20 years. Additionally, there were racial/ethnic differences ($P=0.01$) across age groups with white patients in >80% of encounters age 70-89.

Determinants of AD visits

Among healthcare visits with vs. without any AD diagnosis, there were lower proportions [CI] of females (51.2% [47.4%-54.9%] vs. 58.9% [58.6%-59.2%]; $P<0.0001$), but higher proportions of African Americans/blacks (18.9% [15.9%-22.3%]) vs. 9.7% [8.9%-10.6%]), Asians/Pacific Islanders (10.9% [8.1%-14.6%] vs. 3.6% [3.0%-4.4%]) ($P<0.0001$), and private insurance (34.1% [28.0%-40.8%] vs. 29.3% [25.5%-33.4%], $P=0.02$). There was no difference in proportion [CI] of AD visits ($P=0.13$), though there were more eczema visits (90.5% [86.5%-93.4%] vs. 88.4% [84.7%-91.3%]; $P=0.04$) in metropolitan areas. There was no difference by season ($P=0.63$ and 0.16). AD vs. non-AD visits were associated with higher prevalence [CI] of asthma (7.0% [5.1%-9.4%] vs. 2.0% [1.9%-2.1%]), allergic rhinitis (7.3% [5.1%-10.4%] vs.

1.7% [1.6%-1.9%]) and food allergies (3.5% [2.3%-5.3%] vs. 0.08% [0.06%-0.09%]) ($P < 0.0001$ for all). Similar results were found for healthcare visits with vs. without a diagnosis of eczema.

In adults, dermatologist visits were associated with self-pay (10.38 [1.77-60.74]). Diagnoses of allergic rhinitis (multivariable logistic regression models; aOR [95% CI]: 63.53 [4.94-816.80]) and food allergies (98.14 [3.29-2926.76]) were significantly increased in allergist visits. Whereas, diagnoses of asthma (0.00 [0.00-0.02]) and allergic rhinitis (0.04 [0.00-0.69]) were lower in dermatologist visits. In children, dermatologist visits were associated with private insurance (6.12 [2.73-13.72]), and self-pay (18.02 [3.73-87.72]).

Discussion

This study found a high frequency of outpatient healthcare utilization in US children and adults with AD or eczema. The frequency of AD visits increased over time, which likely reflects increasing prevalence of childhood AD in that time period¹⁰. Pediatricians saw most children with AD, whereas dermatologists saw most adults with AD. The frequency of PCP visits for AD or eczema increased over time but were offset by fewer dermatology visits for AD. Allergy visits for AD were more likely to have a diagnosis of comorbid atopic disease, whereas dermatology visits were less likely to have such diagnoses. This likely reflects a referral bias, such that patients with atopic multi-morbidity are more likely to be seen by allergists. Further, dermatologists may not address atopic comorbidities during AD visits as it is outside their practice scope.

We found that AD visits to PCPs were more likely to be acute visits, whereas dermatology visits were more likely to be chronic visits and referrals. Patients with a long-standing relationship with a PCP may choose to first see their PCP at AD onset. In addition, even long-standing AD patients may not be able to see a dermatologist fast enough to address an acute flare, and therefore turn toward their PCP for acute care. This has important ramifications for resource allocation and setting treatment goals. That is, dermatology practices should consider scheduling options to improve access for AD patients experiencing flares, e.g. walk-in hours or sick visit scheduling slots. There is also a need for more pediatric dermatologists^{11, 12}.

Regardless, there are simply not enough dermatologists to see every AD visit, and many will continue to initially be seen by PCPs and referred to dermatologists in select scenarios. However, it is critical that providers distinguish between an acute flare vs. chronic disease when setting treatment goals. Patients with intermittent flares may be treated with short-courses of topical

and/or systemic treatments depending on their disease severity. Those with chronic disease warrant chronic treatment approaches, including maintenance topical therapy, phototherapy and/or better tolerated oral systemic or biologic therapy. Dermatologists should not manage chronic AD patients using only short-term treatment approaches, though these may be sufficient in the primary care setting.

The age distribution of AD visits reflects that peak AD prevalence occurring in early childhood (~15%), with decreasing prevalence in adolescents and stable prevalence throughout the adult years (~7%)^{3-5, 10}. In addition, utilization patterns for AD may vary by age. Young children see their pediatrician more frequently for health maintenance visits, at which AD may also be addressed. Further, many adults with AD, even severe disease, do not regularly utilize outpatient healthcare¹³. Parents of children with AD may be more inclined to seek care for their child's AD compared to adults with AD.

The associations of AD visits with demographics are likely related to a combination of effects on AD prevalence and severity, as well as access to outpatient care. Previous studies found higher prevalence^{14, 15} and severity^{2, 16} of childhood AD in African Americans/blacks. Childhood AD prevalence was also found to be higher in metropolitan areas^{15, 17}, which may be attributable to early sensitization¹⁸ or pollution¹⁹. A study of the 2001-2013 Medical Expenditure Panel Surveys found that African Americans/black children with eczema were less likely to report an ambulatory eczema visit compared to whites, suggesting potential racial/ethnic disparities of access to care²⁰. However, among those with ≥ 1 ambulatory visit for eczema, African Americans/blacks reported more visits overall and more dermatology visits compared to Caucasians/whites, suggesting more severe disease. Further, being uninsured was found to be associated with more severe adult AD¹³. Taken together, there appears to be a complex

relationship between AD prevalence, severity, access to care, and ultimately healthcare utilization for AD.

The major strength of this study is the use of NAMCS that remains the only source of nationally representative data on physician office visits. There are several potential limitations of this study. NAMCS data provide a snapshot of what services physicians provide at a single visit. Thus, we were not able to assess the annual number of outpatient visits per patient. AD and comorbid conditions are not measured unless they are related to the reason for the visit and hence captured in ICD codes. Data on AD severity, age of AD onset, past history of AD or comorbidities were not assessed. Future studies are needed to address the impact of these factors on healthcare utilization.

In conclusion, outpatient visits for AD increased in the US over time, and the provider landscape appears to be changing. It is important that healthcare providers understand the landscape of resource utilization and treatment needs in AD. Many AD visits were acute in nature and occurred with PCPs in children and adults. These data have important ramifications for resource allocation and treatment considerations in the dermatology setting. Future interventions are needed to improve access to dermatological care for chronic AD.

Figure Legends

Figure 1. Time trends of AD visits. Frequency of AD visits are plotted over two-year intervals for all clinicians, dermatologists, and primary care physicians.

P-values from Rao Scott Chi square tests between AD visits and are displayed.

Figure 2. Distribution of age and other visit characteristics. Proportion of patient ages, as well patient sex, season of visit, and patient race/ethnicity stratified by patient age.

P-values from Rao Scott Chi square tests between patient/visit characteristics by patient age.

Figure 3. Distribution of patient sex, race/ethnicity and age over time among AD and non-AD visits. Proportion of patient sex, race/ethnicity and age stratified by year of visit.

P-values from Rao Scott Chi square tests between patient/visit characteristics by year of visit.

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