Guideline-based medicine grading on the basis of the guidelines of care for ambulatory atopic dermatitis treatment in the United States

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Purpose: This study was designed to assess the adherence to evidence-based guidelines of care for atopic dermatitis (AD).

Methods: To characterize AD treatment in the United States, ambulatory visits from the 2006-2015 National Ambulatory Medical Care Survey were analyzed. For each medication prescribed, a grade was assigned on the basis of the American Academy of Dermatology treatment guidelines for topical and systemic medications. Considering all visit prescriptions, I calculated a composite grade, analogous to the US academic grading system (scores A-F).

Results: I noted prescribing differences across specialty groups. Systemic corticosteroids were more likely to be prescribed by family and general physicians and less likely by pediatricians. Dermatologists were more likely than other specialties to prescribe nonsedating antihistamines, which lack a guideline base supporting their use. Depending upon modeling of care assumptions, all physician specialty visits earned mean guideline-based grades of B or C in their care of AD patients.

Limitations: The clinical, social, and demographic factors influencing prescribing behavior cannot be completely assessed by using extant data.

Conclusions: This preliminary study demonstrates that physicians might benefit from reviewing guidelines of care; there might be an educational gap in the implementation of these guidelines. (J Am Acad Dermatol 2019;80:417-24.)

Key words: dermatology; health services research; skin disease.

A century ago, the practice of medicine was almost exclusively described as eminence-based, inasmuch as physicians learned to emulate those perceived to be the best.[1] In recent decades, with the growth of randomized controlled trials, meta-analyses, rational drug approval, and abundant publications,[2-9] are we now closer to practicing evidence-based medicine? To provide direction, the American Academy of Dermatology

Abbreviations used:

AAD:	American Academy of Dermatology
AD:	atopic dermatitis
CI:	confidence interval
FPGP:	family physicians and general practice physicians
HCP:	health care provider
NAMCS:	National Ambulatory Medical Care Survey

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Funding sources: None.
Conflicts of interest: Dr Fleischer was formerly employed by AbbVie Inc. He is a consultant for Qurient.
Accepted for publication September 8, 2018.
Reprints not available from the author.
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Published online October 2, 2018.
0190-9622
Published by Elsevier on behalf of the American Academy of Dermatology, Inc.
https://doi.org/10.1016/j.jaad.2018.09.026

(AAD) produces care guidelines that are based on methods designed to incorporate and interpret clinical evidence. These guidelines distill vast amounts of information into brief summaries.[10]

Clinical experts have produced such AAD guidelines in 2004 and 2014 for systemic and topical care of atopic dermatitis.[11-14] Although these care guidelines were last published in 2014, the majority of the references used to develop the guideline documents predate 2010 and many predate 2000. Physicians committed to lifelong learning will have been familiar with most of the statements in the guidelines.[15]

CAPSULE SUMMARY

- Although atopic dermatitis practice guidelines are published, how doctors adhere to these guidelines is unknown.
- Health care providers received a grade of B or C (analogous to the US academic A-F grading system) in their atopic dermatitis management, suggesting that physicians might benefit from reviewing guidelines of care.

The purpose of the present investigation is to examine the adherence to guideline-based treatment in the United States. To what extent are health care providers (HCPs) practicing guideline-based medicine as it pertains to pharmacologic treatment of atopic dermatitis (AD)? Without understanding how HCPs actually treat across the United States, policy makers and leaders cannot identify educational gaps and standard of care gaps to improve outcomes.

METHODS

Data from the 2006-2015 National Ambulatory Medical Care Survey (NAMCS), the most recently available decade, were used to characterize outpatient visits for AD as a unique diagnosis. These surveys were developed and implemented by the National Center for Health Statistics.[16] Survey results provide nationally representative estimates of nonhospital-based outpatient health care utilization. As a brief overview of how the NAMCS survey data are collected, the National Center for Health Statistics selects a sample of physicians using a list of all medical doctors and doctors of osteopathy and invites them to participate in the annual survey. For participating physicians, data were recorded for a sample of their visits for a random week of the year. To account for the variance caused by the complex survey design and for all analyses, survey weights were used to provide more precise estimates.

AD visit identification

Studied in this analysis were AD visits (International Classification of Diagnoses, Ninth Edition 691.8).[17] Although NAMCS allows for up to 3 diagnoses, to eliminate biases from other non-AD treatments, this study was limited to visits at which AD was the primary and only diagnosis. Visits with missing information, including missing survey weights, and visits in which no pharmacologic treatments were prescribed were excluded.

Medication grading

Up to 10 medication mentions (prescriptions) for each visit were captured and individually classified. Medications for nondermatologic conditions, including those for asthma (eg, metered-dose inhalers), immunizations, antihypertensive agents, oral contraceptives, and similar drugs for unrelated conditions, were excluded. Because they are not pharmaceutical products, moisturizers and other personal care products as well as 510(k) nondrug devices were excluded. According to the guidelines, inclusion of moisturizer products might represent excellent care practices.[11,12] However, the NAMCS documentation for drug mentions states specifically: "the physician's entry of a pharmaceutical agent ordered or provided—by any route of administration—for prevention, diagnosis, or treatment."[16] According to the Food and Drug Administration, moisturizer products are not considered pharmaceutical agents but are either cosmetics or cosmetics and drugs.[18] By definition, devices are not drugs.[19]

Each identified medication was assigned a guideline-based medication grade on the basis of the strength of the recommendation as abstracted from the AAD guidelines for treating AD (Table I). For data collected before 2015, the earlier guidelines[11] were used, and for data collected in 2015, the more recent guidelines[12,13] were used. Analogous to the academic grading system in the United States,[20] a treatment recommendation of A was assigned 4 points, a B 3 points, and a C 2 points, and, when not recommended, an F or no points. There were some minor grading differences for the 2006-2014 visits compared with the 2015 visits. Topical antihistamines and antiviral agents were not mentioned in the earlier guidelines but were rated in later guidelines, and cyclosporine received an A grade in the earlier guidelines and a B grade in later guidelines. If a drug class was not mentioned, no contribution to the grade was given.

Because there is uncertainty as it pertains to examining extant practice data, there were several assumptions made in the analysis. For topical

Table I. Guideline grading adapted from AAD guidelines for systemic and topical treatment of atopic dermatitis

		Strength of recommendation grading system			
		2006-2014		2015	
Medication type	Medication	Liberal model*	Conservative model†	Liberal model*	Conservative model†
Topical	Corticosteroids	A	A	A	A
	Calcineurin inhibitors	A	A	A	A
	Antimicrobials and antiseptics in infected AD (mupirocin only)	B	B	B	B
	Antimicrobials other than recommended	F	F	F	F
	Antihistamines	No mention	No mention	B	B
Systemic	Cyclosporine	A	A	B	B
	Azathioprine	B	B	B	B
	Methotrexate	Outside of scope	Outside of scope	B	B
	Mycophenolate mofetil	C	C	C	C
	Interferon γ	A	A	B	B
	Corticosteroids	C	F	B	F
	Antimicrobials	A	F	A	F
	Sedating antihistamines	C	C	C	C
	Nonsedating antihistamines	F	F	F	F
	Antivirals in eczema herpeticum	No mention	No mention	C	C

AAD, American Academy of Dermatology; *AD,* atopic dermatitis.

*Model includes assumption that all systemic corticosteroids were used for acute exacerbations and systemic antimicrobials were used only for objectively confirmed infected AD.

†Model includes assumption that all systemic corticosteroids were not used for acute exacerbations and systemic antimicrobials were not used only for objectively confirmed clinically infected AD.

antimicrobials, only intranasal mupirocin is recommended in the presence of clinical infection.[12] Because the route of administration is not identified, and the mentions of mupirocin were few, the author assumed that the mupirocin use was for intranasal use. All other topical antimicrobial products were considered to be inadvisable and received a treatment recommendation of F. Prescribing nonsedating systemic antihistamines, including cetirizine, fexofenadine, levocetirizine, and loratadine, which are explicitly not recommended in the guidelines,[13] resulted in a grade of an F. All sedating systemic antihistamine prescriptions were graded a C.

Care modeling

To account for the ambiguity that cannot be elucidated from interpretation of an extant clinical data set such as the NAMCS, 2 care models were created. These models represent the extremes of interpretation of the information presented. In the first or less conservative (liberal) model, if a systemic antibiotic, systemic corticosteroid, or both was prescribed, I assumed AD with a clinically verified infection was being treated or systemic corticosteroids were being used short term for a severe exacerbation. Under these assumptions, both systemic antibiotics and systemic corticosteroids would be considered clinically appropriate and graded with a guideline level of A. In the second or more conservative model, if a systemic antibiotic, systemic corticosteroid, or both was prescribed, the implicit assumption was made that infected AD was not clinically verified and this treatment was not an episode of short term use for a severe exacerbation. In this situation, clinical use of both of these types of agents would be considered inappropriate and graded with a guideline grade level of F. Although some have stated that the use of antibiotics in noninfected AD is controversial,[21] the guidelines are clear that this prescribing behavior is inappropriate.[12] In addition, although many patients receive systemic corticosteroids for AD management, this treatment modality is not without major toxicity.[22]

To quantitate a HCP's overall adherence to AAD guidelines for each visit, a mean quantitative score (or grade) for all prescriptions was generated that ranged 0-4, corresponding to grades F through A. Although the generated guideline-based grade score was a continuous variable, individual letter grades corresponded to the following ranges: F (0-0.66), D (0.67-1.66), C (1.67-2.66), B (2.67-3.66), and A (3.67-4.0).[20]

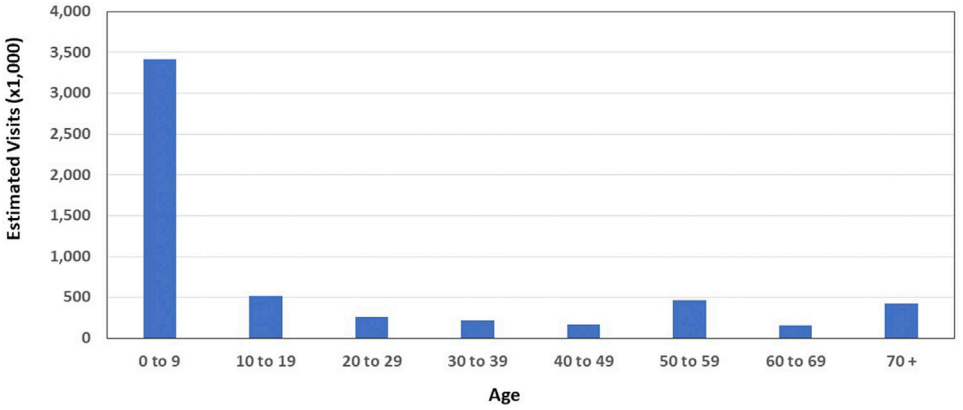

Fig 1. Estimated age distribution of the entire studied atopic dermatitis population with 1 and only 1 diagnosis. Population age distribution is skewed.

Other analytic details

Although the NAMCS allows for 15 different specialty classifications, family physicians and general practice physicians (FPGPs), dermatologists, pediatricians, and all other specialties were included in this study. Analyses were performed by using SAS University Edition (SAS Institute, Cary, NC) and weighted SURVEY procedures utilizing patient weights to provide nationally representative estimates. All hypothesis testing was performed with SURVEYFREQ and SURVEYREG. Significance was defined as being achieved when P was $<.05$.

RESULTS

Over the study interval, there were a total of 449 evaluable AD visits, representing an estimated 10.4 million visits. To eliminate visits at which treatment of comorbid conditions (secondary and tertiary diagnoses) might confuse the interpretation, the data were extracted only for visits at which AD was the only diagnosis, for which there were 228 visits, representing an estimated 5.62 million visits.

Patient population

The estimated mean age (95% confidence interval [CI]) of this AD population was 18.5 (13.2-23.9) years, whereas the estimated median age was 4.4 (95% CI 0.7-8.1) years, indicating this population was skewed, with a large proportion of young children (Fig 1). Because of this distribution, a dichotomous age variable was created for patients 0-5 years of age (52% of patients) and those ≥6 years of age (48% of patients). In total, 51% of visits were by female patients; 30% of visits were to dermatologists, 32% to pediatricians, 15% to FPGPs, and 29% to all other specialties.

Medications

There were an estimated 10.1 million medication mentions analyzed in this population. A total of 168 unique medication mentions resulted, of which 71 were deemed unrelated to AD treatment or were emollients, emollient devices, or personal care products. The mean number of prescribed medications at a visit was 1.5 (95% CI 1.3-1.7) and the median was 1.0 (95% CI 0.7-1.3). There were differences between physician groups in terms of the number of prescriptions used to manage patients (P = .001). The mean number of prescriptions were 1.8 (95% CI 1.6-2.1) for dermatologists, 1.9 (95% CI 1.1-2.8) for FPGPs, 1.2 (95% CI 1.1-1.5) for pediatrics, and 1.3 (95% CI 1.1-1.5) for other physicians.

Table II presents the categories of medications prescribed at these visits. There were differences that appear to suggest that treatment patterns differ between specialties. For instance, systemic corticosteroids were prescribed at no observed AD visits by pediatricians and 46% of visits to FPGP clinicians. By contrast, dermatologists prescribed systemic corticosteroids at 18% of AD visits. A similar behavior was seen regarding the likelihood of low-potency topical corticosteroid agents, with pediatricians prescribing them at 47% of visits and FPGPs at 7% of visits. Differences in prescription of nonsedating antihistamines between specialty groups was also observed, with dermatologists more likely to prescribe these agents than other HCPs. There were no observations of noncorticosteroidal systemic immunosuppressant use in this patient population.

Grading of prescribing behavior

Guideline-based grading of prescribing behavior for each visit was cumulated across all physicians and across specialty groups. The mean grade for all visits to all physicians was 3.5 (95% CI 3.3-3.7) for the liberal model and 2.8 (95% CI 2.3-3.2) for the conservative model, corresponding to letter grades B and C, respectively. In Table III are presented

Table II. Proportion of patients receiving prescriptions for agents, by specialty group*

Type of medication	Proportion of all visits, %	Specialty group, %				Test statistic
		Dermatology	FPGPs	Pediatrics	Others	
Systemic corticosteroids	13	18	46	0	4	.001
Systemic antihistamines						
Any	18	30	19	11	19	NS
Sedating	8	16	6	1	8	NS
Nonsedating	13	20	6	10	11	.02
Topical corticosteroids						
Any	80	79	50	95	80	.001
Low potency	31	25	7	47	34	.03
Mid-to-high potency	53	58	45	55	49	NS
Topical calcineurin inhibitor	9	12	6	15	0.3	NS
Topical antibiotics	4	7	3	4	0	NS

FPGP, Family physicians and general practice physicians; *NS*, not significant.
*Too few observations for systemic antiviral agents were observed to present, and there were no observations for topical antihistamines or oral immunosuppressants other than systemic corticosteroids.

results for patient subpopulations by age, sex, year (2005-2009 vs 2010-2015), and physician group. For both liberal and conservative models, individual regression showed that specialty group, year, and sex did not predict the visit score, but age (0-5 years vs ≥6 years) did predict the visit score (P = .002). Younger children were more likely to receive guideline-based care than older children and adults. Multivariate regression for the score in which specialty group, sex, age, and year were all included found no significant differences. The guideline-based grade distribution of A through F for all physician visits together and individual physician group visits is presented in Fig 2.

DISCUSSION

This report represents an initial exploration of the guideline-based patterns of AD treatment in the United States. When an individual HCP and an individual patient experience an episode of care, all of the factors that HCPs factor into treatment decisions cannot be known using extant data. For instance, one cannot assess the severity of the condition. The severity might be much greater or lesser for patients visiting one or multiple specialties, and these differences could influence prescribing behavior. These factors aside, we are afforded a high-level examination of treatment practices and management of patients.

Compared with other physician groups managing AD, FPGPs appeared more likely to prescribe systemic corticosteroids and less likely to prescribe topical corticosteroids. Dermatologists were more likely that any other HCP group to prescribe the nonrecommended nonsedating antihistamines. Whereas sedating antihistamines might play a role in sleep hygiene, there is little evidence to support nonsedating antihistamines except for AD comorbidities.[23] Compared with other HCPs, pediatricians are more likely to prescribe only topical corticosteroids and no other treatments. Clinicians across disciplines might have different training and experience, which might be reflected in prescribing behavior. In other disease management areas, different specialties have been reported to display quite different management behavior.[24-27] Nearly 2 decades ago, we demonstrated specialty-specific differences in surgical outcomes for basal cell carcinoma.[28] Understanding these differences as well as understanding the treatment guidelines can help promote better patient outcomes.

Note that provider grades appeared to be better for younger patients. This finding might be due to differences in severity with age or the disease being more refractory in adults than children.[29,30] This difference could introduce a case-mix differential, which could bias the evaluation of physician visits against HCPs who see adults and children or adults alone.

We were not able to find significant differences between specialties in their management grade. Nevertheless, the sobering finding that all physician specialty group visits received a grade of B or C, depending upon the analytic model, shows that much can be done to improve the practice of guideline-based treatment. It is likely that the reason that no significant differences in grading were found was due to the marginal sample size. The NAMCS is conducted on an ongoing basis. As more data cumulates, undoubtedly, these data will be able to demonstrate interspecialty differences.

Taken from a broader context, one may ask how do other HCPs fare with adherence to guidelines. Although there are many published guidelines,

Table III. Univariate analysis of guideline-based grades on a 0-4.0 scale

	Liberal model			Conservative model		
Variable	**Mean (95% CI)**	**Test statistic**	**Letter grade**	**Mean (95% CI)**	**Test statistic**	**Letter grade**
Patient age, y		.002			.002	
0-5	3.7 (3.6-3.9)		A	3.1 (2.6-3.6)		B
≥6	3.2 (3.0-3.5)		B	2.4 (1.8-3.0)		C
Year of treatment		NS			NS	
2006-2010	3.6 (3.4-3.8)		B	3.0 (2.5-3.4)		B
2011-2015	3.4 (3.2-3.7)		B	2.6 (2.0-3.2)		C
Sex		NS			NS	
Female	3.5 (3.3-3.7)		B	2.9 (2.2-3.5)		B
Male	3.5 (3.2-3.7)		B	2.6 (2.1-3.1)		C
Specialty group		NS			NS	
Dermatology	3.2 (2.9-3.5)		B	2.6 (2.2-3.0)		C
FPGPs	3.5 (3.1-3.8)		B	2.0 (0.4-3.6)		C
Pediatrics	3.7 (3.5-4.0)		A	3.0 (2.3-3.6)		B
All others	3.5 (3.2-3.9)		B	3.1 (2.3-3.6)		B

CI, Confidence interval; *FPGP*, family physicians and general practice physicians; *NS*, not significant.

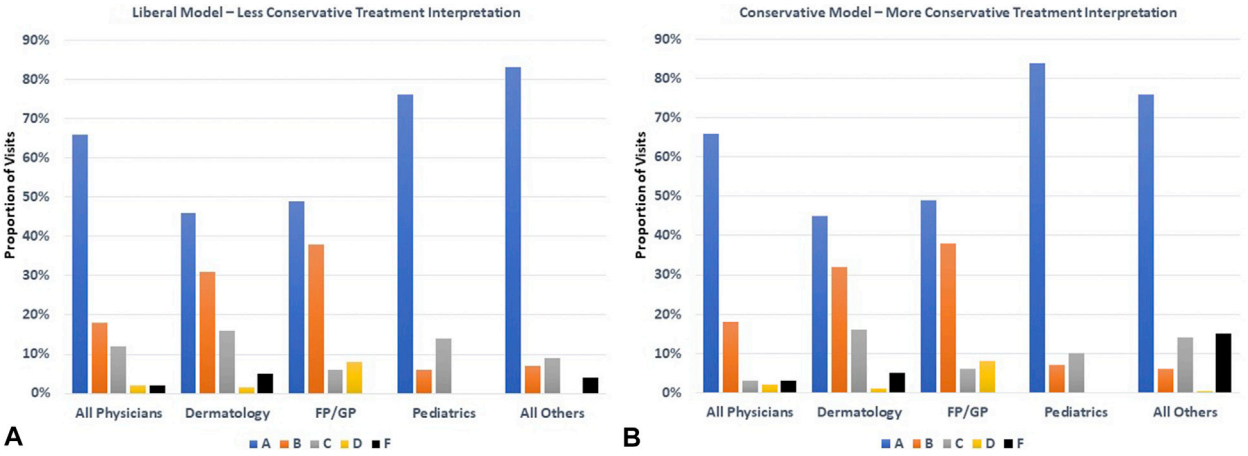

Fig 2. Distribution of guideline-based treatment grades for all physicians and by specialty group using a less conservative interpretation (**A**) and a more conservative interpretation (**B**) of observed treatments for atopic dermatitis. Grades for treatments were given on the basis of the American Academy of Dermatology atopic dermatitis guideline grade recommendations. Ideally, all visits to all physicians should receive a grade of A, but there was observed heterogeneity in the guideline-based grade distribution.

assessments of implementation performance are uncommon. One study of guidelines on prevention of mother-to-child transmission of HIV showed initial high rates of effectiveness, with subsequent loss of effectiveness.[31] Another study on the implementation of back and neck pain guidelines showed little effect upon HCP behavior.[32] The literature does contain some optimistic findings, such as evidence that physicians can improve their ability to order laboratory tests for thyroid disease more appropriately.[33] To the best of this author's knowledge, no study to date except the present one has graded HCPs on performance consistent with guideline behavior.

The advantages of this study are that it is cross-sectional and has a broad sampling scope from across the United States. Limiting the sample to 1 and only 1 diagnosis eliminated all prescriptions for systemic immunosuppressants other than systemic corticosteroids. The disadvantages are multiple. First, although these visits were collected by the National Center for Health Statistics in a rigorous fashion, there are a limited number of observations. The observed differences in the guideline-based grade between specialties could not be confirmed by hypothesis testing. Most importantly, there is no way to assess severity differences between patients and between specialty groups. Perhaps many more patients visiting

FPGPs were severe compared with other physicians and warranted systemic corticosteroid intervention. The 2 models created in this investigation could not be constructed to include all of the variability in signs and symptoms combined with all patient social, demographic, and comorbid conditions. The true clinical condition is likely somewhere between the liberal and conservative models.

As previously noted, moisturizer treatments represent critically important interventions for AD patients.[11,12] Due to data acquisition strategies, moisturizer recommendations were not uniformly noted. This is an important limitation to the present study.

This investigation represents an attempt to objectively grade HCPs in their guideline-based practice of AD management. Physicians of all specialties might benefit from reviewing existing guidelines of care. There might be an educational gap as well as a standard of care gap in the implementation of these guidelines.

The author thanks SAS Institute for providing University Edition for scholarly research.

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