

# Patterns of Clinical Management of Atopic Dermatitis in Infants and Toddlers: A Survey of Three Physician Specialties in the United States<sup>☆</sup>

José M. Saavedra, MD<sup>1,4</sup>, Mark Boguniewicz, MD<sup>2</sup>, Sarah Chamlin, MD<sup>3</sup>, Alan Lake, MD<sup>4</sup>, Susan Nedorost, MD<sup>5</sup>, Laura A. Czerkies, MS, RD<sup>1</sup>, Vardhaman Patel, MS<sup>6,7</sup>, Marc F. Botteman, MSc, MS<sup>6</sup>, and Erica G. Horodniceanu, BS<sup>6</sup>

**Objective** To describe atopic dermatitis (AD) management patterns in children  $\leq 36$  months old as reported by pediatricians, dermatologists, and allergists in the US.

**Study design** A nationally-representative survey was administered to pediatricians (n = 101), dermatologists (n = 26), and allergists (n = 26). Main outcomes included referrals to health care professionals, suggested/ordered laboratory tests, management approach (dietary, pharmacologic, or combination of both) by age, AD location, and severity.

**Results** Significant differences were observed in referrals to healthcare professionals ( $P < .001$ ). Pediatricians more frequently referred to dermatologists than allergists in mild (52.4% vs 32.0%) and moderate/severe (60.6% vs 38.1%) cases. Dermatologists referred to allergists less frequently for mild (9.1%) than moderate/severe (40.7%) AD cases. Pediatricians (59%), allergists (61.5%), and dermatologists (26.9%) reported treating at least some of their patients with AD with dietary management (infant formula change) alone (with or without emollients). Soy-based formulas were often used. For mild AD, the most commonly reported first-line pharmacologic treatments included topical emollients, topical corticosteroids, and barrier repair topical therapy/medical devices. Over 80% of physicians used a dietary and pharmacologic combination approach. Dermatologists were most likely to manage AD symptoms with a pharmacologic-only approach. AD lesion location influenced pharmacologic treatment in >80% of physicians.

**Conclusions** Significant and distinct differences in AD treatment approach exist among physicians surveyed. Most pediatricians and allergists use formula change as a management strategy in some patients, whereas dermatologists favor a pharmacologic approach. This diversity may result from inadequate evidence for a standard approach. Consistent methods for managing AD are needed. (*J Pediatr* 2013;163:1747-53).

See editorial, p 1646

Atopic dermatitis (AD), a pruritic chronic inflammatory skin disease commonly found in the pediatric population,<sup>1-3</sup> is the most common chronic disease of early infancy, affecting up to 20% of children worldwide,<sup>4</sup> with prevalence increasing particularly in children ages 6-7 years.<sup>5</sup> AD typically presents in infancy or before age 5 years in 60%-65%<sup>6,7</sup> and 85%<sup>7</sup> of cases, respectively.

AD imposes substantial burden on patients, caregivers, and society, impacting quality of life and associated costs. Its national direct medical cost ranges from US\$0.9 to US\$3.8 billion.<sup>8</sup> Quality of life concerns include itching and scratching and disturbances in sleep, school performance, and behavior.<sup>9-11</sup> Families of children with AD suffer from sleep loss, exhaustion, stress, depression, missed work, and lifestyle restrictions,<sup>9-11</sup> a burden previously reported to be greater than in diabetic families.<sup>12</sup>

Diagnosis is based on clinical features, including pruritus, typical morphology and distribution, a chronic or relapsing dermatitis, and personal or family history of atopy.<sup>1</sup> In the absence of laboratory diagnostic tests specifically for AD, allergy tests can be useful in supporting the diagnosis. AD management goals include symptom reduction and flare prevention.<sup>13,14</sup> Combination use of emollients and topical corticosteroids remains the common first-line therapeutic approach in children.<sup>11,14</sup>

Cow's milk protein is the most common AD-associated food allergen. Studies have demonstrated the potential of hydrolyzed infant formulas to reduce AD risk in infants with familial history of intact cow's milk protein allergy.<sup>15-19</sup> However,

From the <sup>1</sup>Nestlé Nutrition, Florham Park, NJ; <sup>2</sup>University of Colorado School of Medicine, Denver, CO; <sup>3</sup>Northwestern University Feinberg School of Medicine, Chicago, IL; <sup>4</sup>Johns Hopkins University, Baltimore, MD; <sup>5</sup>Case Western Reserve University, Cleveland, OH; <sup>6</sup>Pharmerit International, Bethesda, MD; and <sup>7</sup>University of Illinois, Chicago, IL.

Sponsored by Nestlé Nutrition. PharmIdeas Research and Consulting, Inc (Ontario, Canada) participated in the design of the survey and managed the collection of data. M.B., S.C., A.L., and S.N. are consultants to Pharmerit International. S.C. is also a consultant for Galderma. The other authors declare no conflicts of interest.

Portions of this study have been presented as a poster and an abstract at the American Academy of Asthma, Allergy, and Immunology Meeting on February 22-26, 2013, San Antonio, Texas.

0022-3476 Copyright © 2013 The Authors. Open access under CC BY license. <http://dx.doi.org/10.1016/j.jpeds.2013.06.073>

AD Atopic dermatitis  
EHF Extensively hydrolyzed formula

dietary approaches for treating pediatric AD have not been well-studied. Food challenge is the gold standard for proving food allergy as a cause of AD flares. It should be conducted in a controlled environment over several days, but this is costly and impractical. The resultant lack of clear evidence for best practice has yielded many dietary recommendations for AD.

The primary objective of this study was to describe management patterns, including referrals, laboratory test use, and treatment approach (pharmacologic, dietary, and combined) for mild and moderate/severe AD in children  $\leq 36$  months old as reported by pediatricians, dermatologists, and allergists in the US.

## Methods

A convenience sample of 3 physician specialties (general pediatricians [pediatricians], pediatric dermatologists [dermatologists], and allergist-immunologists [allergists]) practicing in the US was identified using an internet-based process, utilizing multiple databases and compendiums, including the American Medical Association's State Medical Licensure Requirements and Statistics compendium and the American Board of Medical Specialties Directory. Recruitment (via opportunistic approach) sought to identify 100 pediatricians, 25 dermatologists, and 25 allergists, with the majority located in the 25 most populous states.

The survey contained 647 questions (closed-end, multiple-choice), organized into 15 sections, exploring components of AD management of patients  $\leq 36$  months old. Skip logic and patterns were used to minimize participant burden. Questions assessed physician characteristics, referral patterns, laboratory test use, emollient use, treatment approach (based upon age, severity, and symptom location), reoccurrence, and hospitalization. Additional questions aimed to quantify AD treatment-associated costs; these data are being evaluated separately. The survey was developed and fielded by PharmIdeas Research and Consulting Inc (Ontario, Canada) with guidance from a co-investigator panel with expertise in pediatrics, dermatology, and allergy-immunology. Data collection occurred from March–November 2011. Participants were compensated monetarily for time spent completing the survey.

Questions were asked according to AD severity, AD lesion location, patient age, and treatment approach. Although exclusive breastfeeding is recommended for the first 6 months,<sup>20</sup> questions regarding dietary management were defined as formula changes and were limited to infants ( $< 12$  months old) not exclusively breastfed. Pharmacologic approach was defined as prescribing or suggesting active medications. A formal definition of "mild" and "moderate/severe" AD was not provided. Participants were asked to use clinical judgment based on personal assessment of disease severity.

Outcomes of interest reported herein include referrals to other health care professionals, laboratory tests ordered or suggested, management approach (pharmacologic, dietary, or combined treatment with both) in patients by age ( $< 12$  months or 12–36 months), by AD location (face or trunk

and extremities) in patients  $< 12$  months of age, and by disease severity (mild and moderate/severe). Response options pertaining to laboratory tests, overall AD management approach in patients  $< 12$  months of age, and AD symptom location were provided as percentage ranges. Questions that received infrequent responses such as use of atopy patch testing and skin swabs for bacterial culture and sensitivity were not included in summary data.

## Statistical Analyses

Analyses (nonparametric for nominal and ordinal data) were performed with SAS (v. 9.2, SAS Institute, Cary, North Carolina). Monte Carlo simulation of Kruskal–Wallis exact test (for ordinal data) and Fisher exact test (for nominal data) assessed differences among pediatricians, dermatologists, and allergists. An  $\alpha$  of 0.05 was the maximum acceptable probability of Type-I error for omnibus significance tests. When  $P$  values for the omnibus significance tests indicated significance, multiple-group comparisons tested for response differences between pediatricians and dermatologists, pediatricians and allergists, and dermatologists and allergists. Monte Carlo simulation of Wilcoxon rank-sum test and Fisher exact test were used for multiple group comparisons when responses were ordinal or nominal, respectively. Bonferroni correction method was used to adjust alpha (adjusted  $\alpha = 0.016$ ) for post-hoc, multiple-group comparisons.

## Results

Of 1862 physicians identified, 153 (8.2%) participated in the survey, with 55.6% being male. Two-thirds were pediatricians, and dermatologists and allergists were equally represented. Most (92.8%) were practicing for  $> 5$  years and were located primarily in the South (37.3%), West (24.8%), and Midwest (22.9%) regions. Every state (including the District of Columbia) was represented by  $\geq 1$  participant, with the vast majority of states providing 2 participants. Eighty percent treated  $> 50$  patients with AD during the past 12 months, with 69.2% of dermatologists treating  $> 200$  patients. Over one-half of all participants reported that  $> 50\%$  of their patients were  $\leq 3$  years old. Within this age group, 78.4% of participants characterized over one-half of their patients as having mild AD and 21.5% reported over one-half as having moderate/severe AD. The proportion of moderate/severe AD cases was higher among dermatologists and allergists vs pediatricians ( $P < .001$ ).

Dermatologists reported treating more patients with AD vs pediatricians and allergists. Even though most pediatricians (81.2%) had seen patients for initial care, most dermatologists (84.6%) and allergists (69.2%) had seen patients for both initial and subsequent care. Of the dermatologist and allergist referrals, most were referred by medical professionals. Conversely, most patients referred to pediatricians were referred by a friend or family or were self-referred ( $P < .001$ ).

## Referrals to Health Care Professionals

Approximately 33% of patients with AD <36 months were referred from pediatricians to dermatologists and allergists. Significant differences were observed in referrals to other healthcare professionals across specialties for both mild and moderate/severe AD ( $P < .001$ ). Pediatricians more frequently referred to dermatologists than allergists in both mild (52.4% vs 32.0%) and moderate/severe (60.6% vs 38.1%) cases. Allergists referred 50.0% of their mild and 73.3% of moderate/severe AD cases to dermatologists. Dermatologists referred to allergists only 9.1% of the time for mild AD, but 40.7% of the time for moderate/severe AD. Dermatologists referred within their specialty up to 26% of the time (Table I).

## Use of Laboratory Tests

Overall, allergists reported greater laboratory test use vs pediatricians and dermatologists. Tests were used more frequently for patients with moderate/severe vs mild AD across all 3 specialties. Pediatricians indicated preference for laboratory tests (IgE, skin prick, elimination diet) more often for moderate/severe compared with patients with mild AD ( $\leq 36\%$  vs  $\leq 11\%$ ). No dermatologists reported ordering serum IgE, skin prick test, or elimination diet with a food challenge test for patients with mild AD. The proportion of allergists who ordered serum IgE test was higher than pediatricians and dermatologists for patients with mild AD (57.7% vs 15.8% vs 0.0%) and moderate/severe AD (88.5% vs 60.4% vs 38.5%). A higher proportion of allergists ordered skin prick test than pediatricians and dermatologists for both mild (69.2% vs 0.0% vs 0.0%) and moderate/severe (88.5% vs 6.9% vs 7.7%) AD. Elimination diet with a food challenge test was also used most often by allergists.

## Approach to Management: Dietary, Pharmacologic, and Combination

Fifty-nine percent of pediatricians, 61.5% of allergists, and 26.9% of dermatologists reported treating at least some of

their patients with AD with dietary management (ie, formula change) alone (with or without emollients). Across all specialties, >80% of physicians, including 100% of allergists, used a pharmacologic and dietary combination approach to treat some of their patients. A significant difference in the proportion of patients treated by dietary and the combination approach was observed across the specialties ( $P = .01$  and  $P = .02$ , respectively). Of patients not treated by dietary approach alone, dermatologists were more likely to manage AD symptoms by prescribing medications alone rather than in combination with formula change than pediatricians and allergists, and 19.2% of dermatologists never used a combination treatment approach (Table II). Use of emollients was universal irrespective of treatment approach, with 86.3% and 92.8% of all healthcare professionals reporting use of emollients for mild and moderate/severe AD in  $\geq 90\%$  of their patients, respectively.

## Pharmacologic Management of AD

In patients <12 months, AD lesion location (face vs trunk and extremities) influenced which pharmacologic treatment was used in >80% of physicians (84.0% of pediatricians regardless of AD severity; 96.2% and 88.0% of dermatologists and 100% and 96.2% of allergists for mild and moderate/severe, respectively). Differences in the influence of dermatitis location on pharmacologic treatment choice was significantly different across all specialties for patients with mild AD ( $P = .02$ ).

For mild AD in patients age <12 months, independent of dermatitis location, across all specialties, the most commonly reported first-line pharmacologic treatments included topical emollients, low-potency topical corticosteroids, barrier repair topical therapy/medical devices, and medium-potency topical corticosteroids. For mild facial AD, pediatricians and allergists most often reported topical emollient use (56.1% and 48.6%, respectively) vs dermatologists, who most often prescribed low-potency topical corticosteroids (32.7%;  $P < .001$ ). Barrier repair topical therapy/

**Table I.** Referrals to other health care professionals in patients 36 months of age and younger

Referral to*	Mild AD			P value†	Moderate/severe AD			P value†
	Referral from (by specialty)				Referral from (by specialty)			
	Ped N (%) n = 101	Derm N (%) n = 24	Allerg N (%) n = 26		Ped N (%) n = 101	Derm N (%) n = 24	Allerg N (%) n = 26	
Pediatrician	2 (1.4%)	3 (9.1%)	0 (0.0%)	<.001‡,§	0 (0.0%)	1 (3.7%)	0 (0.0%)	<.001‡,§,¶
Dermatologist	77 (52.4%)	6 (18.2%)	15 (50.0%)		97 (60.6%)	7 (25.9%)	22 (73.3%)	
Allergist	47 (32.0%)	3 (9.1%)	1 (3.3%)		61 (38.1%)	11 (40.7%)	1 (3.3%)	
Gastroenterologist	1 (0.7%)	0 (0.0%)	0 (0.0%)		2 (1.3%)	1 (3.7%)	0 (0.0%)	
No referral to HCP	20 (13.6%)	11 (33.3%)	8 (26.7%)		0 (0.0%)	4 (14.8%)	3 (10.0%)	
Referral back to physician who initially referred patient	0 (0.0%)	10 (30.3%)	6 (20.0%)		0 (0.0%)	3 (11.1%)	4 (13.3%)	

Allerg, allergist; Derm, dermatologist; HCP, health care professional; Ped, pediatrician.

Corresponding survey questions: "Please select, from the list below, all of the health care professionals to whom you refer your patients with [mild and moderate or severe], AD."

\*Participants were able to select more than one referral option.

†P values represent omnibus significance tests for difference between responses from pediatricians, dermatologists and allergists.

‡Significant differences ( $P < .016$ ) detected between responses from pediatricians and dermatologists.

§Significant differences ( $P < .016$ ) detected between responses from pediatricians and allergists.

¶Significant differences ( $P < .016$ ) detected between responses from allergists and dermatologists.

**Table II.** Approach to management of AD symptoms in patients younger than 12 months of age

Treatment approach reported by physicians*	Ped N (%) n = 101 <sup>†</sup>	Derm N (%) n = 26	Allerg N (%) n = 26	P value <sup>‡</sup>
Physicians who treat some to all patients by dietary approach (formula change) alone (with or without emollient)	60 (59.4%)	7 (26.9%)	16 (61.5%)	.0116 <sup>§</sup>
Management of patients not treated by dietary approach alone				
Physicians who treat some to all patients with a combination approach	94 (94%)	21 (80.8%)	26 (100.0%)	.0215
Physicians who treat some to all patients by pharmacologic approach alone	93 (93.0%)	26 (100%)	24 (92.3%)	.5750

Corresponding survey questions: "What proportion of AD patients (newborns to 12-month-olds) do you treat exclusively by changing the formula that they were consuming (with or without emollients)? Of those patients who are NOT exclusively treated by changing their formula, what proportion is exclusively treated by an active pharmacologic approach (prescription of active medications (ie, not only emollients), and what proportion are treated by a management approach that combines the dietary and therapeutic approaches to treating AD?" (Response options: 0%, <5%, 5%–25%, 25%–50%, 50%–75%, 75%–95%, ≥95%, and 100%).

\*Treatment approach categories are not mutually exclusive and reflect physicians reporting any use of each approach in patients (ie, responses of <5%–100% vs 0% of the time, therefore reflecting "some to all"). Dietary approach was defined as changing the infant formula consumed. Pharmacologic approach was defined as prescribing medications. Combination approach was defined as the combination of the dietary (infant formula change) and pharmacologic (prescribing medication) approach.

<sup>†</sup>N = 100 (not 101) for Ped respondents for treatment with "combination" and "pharmacologic" approach.

<sup>‡</sup>P values represent omnibus significance tests for difference between responses from pediatricians, dermatologists, and allergists.

<sup>§</sup>Significant differences ( $P < .016$ ) detected between responses from pediatricians and dermatologists.

medical devices were most often suggested by dermatologists (21.2% for mild facial AD). Medium-potency topical corticosteroids were most often used by dermatologists (32.1% in moderate/severe AD on trunk and extremities). No physicians suggested high-potency steroids in mild AD, and few suggested their use in moderate/severe AD, independent of location (0%–8.9%). In mild AD located on both the face and trunk or extremities, allergists more often reported prescribing oral antihistamines (14.3% and 20.0%, respectively) vs other specialties. Low-potency topical corticosteroids were reported more often by all specialists for patients with mild AD with symptoms on the trunk or extremities than patients with facial symptoms (pediatricians: 28.6% vs 17.8%; dermatologists: 34.1% vs 32.7%; allergists: 26.0% vs 20.0%). A similar pattern was observed for medium-potency topical corticosteroids among all specialties for mild and moderate/severe AD.

In patients with moderate/severe AD <12 months of age, the most commonly reported first-line pharmacologic treatments included medium-potency topical corticosteroids, low-potency topical corticosteroids, and oral antihistamines. The proportion of physicians prescribing medium-potency topical corticosteroids as first-line therapy for moderate/severe was higher than for mild AD; topical emollients were less frequently reported by all specialties. Although low-potency topical corticosteroids were prescribed most often by pediatricians (24.9%) and allergists (22.6%) for patients with moderate/severe AD with facial symptoms, topical calcineurin inhibitors (ie, tacrolimus or pimecrolimus) were prescribed most often by dermatologists (23.1%). For moderate/severe AD located on the trunk or extremities, pediatricians, dermatologists, and allergists reported prescribing medium-potency topical corticosteroids (30.3%, 32.1%, and 29.5%, respectively), more than other medications.

The majority of participants (78% of pediatricians, 58% of dermatologists, and 61.5% of allergists) stated that their approach to pharmacologic management of AD was identical for patients 12 to 36 months old vs patients <12 months old ( $P = .06$ ).

### Dietary Management of AD in Patients <12 Months of Age

Overall, a dietary change alone (with or without emollients) as a therapeutic approach was recommended more often by pediatricians and allergists than dermatologists, and soy-based formulas were often used. When infants were receiving routine intact milk-based protein formula, 44.0% of pediatricians, 45.8% of allergists, and 73.7% of dermatologists recommended change to soy-based formula, and 46.2%, 41.7%, and 15.8% recommended extensively hydrolyzed formula (EHF), respectively ( $P = .06$ ). For infants receiving partially hydrolyzed milk-based formula, 61.5% of pediatricians, 50.0% of allergists, and 36.8% of dermatologists recommended EHF ( $P = .01$ ). For infants already consuming EHF, amino acid-based formulas were recommended by 62.6%, 66.7%, and 26.3% of pediatricians, allergists, and dermatologists, respectively ( $P < .001$ ).

The average time a new formula was consumed before being considered a failure (ie, no improvement of AD signs or symptoms) did not differ significantly between the 3 specialties ( $P = .11$ ). Dermatologists (36.8%) and allergists (37.5%) primarily considered 4–5 weeks compared with pediatricians (39.6%) who considered 2 weeks as average time new formula was consumed before considered a failure (Table III).

## Discussion

This study provides insight into AD management in the US. Given the natural history of AD, most patients are infants and young children, and pediatricians provide the majority of initial care. In this study, all physicians referred to other healthcare professionals more often for patients with moderate/severe vs mild AD. The findings correspond to usual referral recommendations for pediatric AD management.<sup>13,21</sup> Most often, referral to a dermatologist is suggested in patients with moderate/severe AD, particularly when they are nonresponsive to therapy and have uncontrolled symptoms. In addition, referral to an allergist is suggested when

**Table III.** Dietary management of AD in patients younger than 12 months of age

Infant formula changes	Ped N (%) n = 91	Derm N (%) n = 19	Allerg N (%) n = 24	P value <sup>†</sup>
Patients on routine intact cow's milk protein formula change to:				.0604
Soy-based formula	40 (44.0%)	14 (73.7%)	11 (45.8%)	
Partially hydrolyzed formula	6 (6.6%)	1 (5.3%)	0 (0.0%)	
EHF	42 (46.2%)	3 (15.8%)	10 (41.7%)	
Amino acid-based formula	3 (3.3%)	1 (5.3%)	3 (12.5%)	
Patients on partially hydrolyzed formula change to:				.0106
Soy-based formula	31 (34.1%)	11 (57.9%)	7 (29.2%)	
Routine intact cow's milk protein formula	1 (1.1%)	1 (5.3%)	0 (0.0%)	
EHF	56 (61.5%)	7 (36.8%)	12 (50.0%)	
Amino acid-based formula	3 (3.3%)	0 (0.0%)	5 (20.8%)	
Patients on EHF change to:				<.001 <sup>‡</sup>
Soy-based formula	10 (11.0%)	11 (57.9%)	5 (20.8%)	
Routine intact cow's milk protein formula	1 (1.1%)	1 (5.3%)	0 (0.0%)	
EHF	23 (25.3%)	2 (10.5%)	3 (12.5%)	
Amino acid-based formula	57 (62.6%)	5 (26.3%)	16 (66.7%)	
Average number of wk new formula is consumed before considered a failure*				.1141
1 wk	2 (2.2%)	0 (0.0%)	0 (0.0%)	
2 wk	36 (39.6%)	6 (31.6%)	5 (20.8%)	
3 wk	18 (19.8%)	3 (15.8%)	7 (29.2%)	
4-5 wk	31 (34.1%)	7 (36.8%)	9 (37.5%)	
6 wk or more	4 (4.4%)	3 (15.8%)	3 (12.5%)	

Corresponding survey questions: "If an affected infant had been consuming [initial type of formula being consumed, eg, routine intact protein formula], please select from the list below the formula that you recommend as a replacement; how long, on average (in wk), is a new formula continued before it is considered a failure?"

\*Failure defined as no improvement of AD signs or symptoms.

<sup>†</sup>P values represent omnibus significance tests for difference between responses from pediatricians, dermatologists, and allergists.

<sup>‡</sup>Significant differences ( $P < .016$ ) detected between responses from pediatricians and dermatologists.

specific triggers including food allergy are strongly suspected. This study shows that patients are frequently referred by pediatricians to other specialists. At least one-half of the pediatricians and allergists referred patients to dermatologists, and dermatologists referred 41% of moderate/severe cases to allergists.

Although laboratory testing is not used to diagnose AD, it may be used to detect allergic-sensitization given the potential connection between AD and allergy in children with moderate/severe AD.<sup>22</sup> Herein, allergists reported higher test utilization vs pediatricians and dermatologists, regardless of AD severity.

In line with increased awareness of allergic responses as an AD trigger, formula changes alone or in combination with pharmacologic therapy is common practice in infants not exclusively breastfed. Our data suggest that dermatologists approach dietary changes differently than pediatricians and allergists. More than one-half of pediatricians and allergists, but only a one-quarter of dermatologists, used formula change alone (with or without emollients) as a primary management strategy in some of their patients. In patients initially consuming routine intact protein formula, pediatricians and allergists recommended changing to EHF or soy-based formula in about 45% of their cases. Most dermatologists recommended change to soy-based formula regardless of initial formula consumed. Of note, changes to soy protein formulas are common and suggested by physicians despite insufficient evidence that soy protein formulas are an adequate management approach to allergic disease.<sup>23,24</sup> Differences were also seen regarding the amount of time the physicians considered waiting before

judging use of a new formula was a failure. Although dermatologists and allergists would consider 4-5 weeks as an appropriate amount of time, pediatricians would wait only 2 weeks. This may be due to the closer contact parents maintain with their pediatrician.

Research investigating the role of specific infant formulas for AD/atopic disease-prevention demonstrates the preventive effect on AD of partially hydrolyzed whey protein and extensively hydrolyzed casein formulas.<sup>15-19</sup> However, studies of AD treatment with infant formula changes are lacking. Nevertheless, our findings indicate that concerns about allergic disease influence AD management. Nutritional intervention and dietary changes as an approach to controlling AD needs further study.<sup>25</sup>

The most commonly reported first-line pharmacologic treatments included topical emollients, low- and medium-potency topical corticosteroids, and barrier repair topical therapy/medical devices, for mild AD. Low- and medium-potency topical corticosteroids and oral antihistamines were most frequently reported for moderate/severe AD. Our findings are consistent with current guidelines, which state that topical corticosteroids and emollients are the standard of care in AD treatment.<sup>26</sup> Even though medication potency should be patient-specific, low-potency corticosteroid use for AD treatment is preferred by most physicians, and this strength category is most often prescribed for pediatric patients.

In our study, across all specialties, low-potency topical steroids in mild AD and medium-potency steroids in moderate/severe AD were used in 18%-34% and 16%-32% of patients, respectively. Dermatologists utilized

higher-potency anti-inflammatory agents more frequently than pediatricians or allergists. There is little evidence to validate the effectiveness of oral antihistamines in relieving AD symptoms, although, antihistamines may alleviate sleep disturbance attributable to AD symptoms and may benefit patients with associated allergic conditions.<sup>26,27</sup> In this study, oral antihistamines were recommended in  $\leq 20\%$  of mild AD cases, especially by allergists, and in  $\leq 23\%$  of moderate/severe cases, especially by pediatricians and allergists.

This study has several limitations. Convenience sampling may have introduced bias, resulting in a less representative sample, although, to minimize bias, physicians were randomly recruited nationally. Additionally, participants may not reflect the proportions of physician specialties treating these patients. Our sample included two-thirds pediatricians and one-third specialists (dermatologist and allergists). Given the method and sources of recruitment of this convenience sample, it would be anticipated that the majority of the respondents would be private practitioners. Gathering more detailed information on the respondents could have provided further insight into current AD management practices. AD severity was not defined for participants. This severity designation was intended to determine treatment and referral practices based on physicians' clinical experience and practice. Questions concerning dietary management of AD in the current survey focused on infant formula; this was more feasible given that infant formula is the sole source of nutrition for a good part of the first year of life, in infants who are not exclusively breastfed. Future studies may benefit from detailing dietary modifications in later childhood. Finally, data were not validated through medical record review; physicians chose options concerning proportions of patients based on recall.

Although this study provides information on current AD management strategies for infants and young children, effectiveness of such strategies was not addressed. Follow-up studies evaluating the effectiveness of the most commonly recommended treatments are warranted. Best practices for evaluation and management could then be compiled to support development of guidelines for AD standard of care.

Our findings provide insights into AD management in infants and toddlers stratified by physician specialty in the US. The diversity in management approaches in both referral patterns and topical steroid use may be due to inadequate evidence for a standard approach. Development of a standard approach is challenging because of the inherent multi-factorial nature of this disease. Dietary management (formula change in infants) is often used by pediatricians and allergists, but less so by dermatologists. Soy formula is commonly used as an approach indicating that education efforts are needed regarding when and which infant formula changes are appropriate for affected infants. Developing consensus guidelines for managing patients with AD should be based on research on both dietary and pharmacologic

interventions with input from physicians of different specialties caring for these patients. Further research is warranted to understand the effectiveness of all AD management strategies. ■

Submitted for publication Feb 25, 2013; last revision received May 17, 2013; accepted Jun 26, 2013.

Reprint requests: José M. Saavedra, MD, Nestlé Nutrition, 12 Vreeland Rd, Florham Park, NJ 07932. E-mail: jose.saavedra@us.nestle.com

## References

- Hanifin J, Rajka G. Diagnostic features of atopic dermatitis. *Acta Derm Venereol (Stockh)* 1980;92(Suppl.):44-7.
- Horii KA, Simon SD, Liu DY, Sharma V. Atopic dermatitis in children in the United States, 1997-2004: visit trends, patient and provider characteristics, and prescribing patterns. *Pediatrics* 2007;120:e527-34.
- Spergel JM, Paller AS. Atopic dermatitis and the atopic march. *J Allergy Clin Immunol* 2003;112:S118-27.
- Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. The International Study of Asthma and Allergies in Childhood Steering Committee. *Lancet* 1998; 351:1225-32.
- Williams H, Stewart A, von ME, Cookson W, Anderson HR. Is eczema really on the increase worldwide? *J Allergy Clin Immunol* 2008;121: 947-54.
- Kay J, Gawkrödger DJ, Mortimer MJ, Jaron AG. The prevalence of childhood atopic eczema in a general population. *J Am Acad Dermatol* 1994; 30:35-9.
- National Institutes of Health NIOAaMaSD. Handout on Health: Atopic Dermatitis. Bethesda, Maryland: National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) Information Clearinghouse; National Institutes of Health ; 2011.
- Ellis CN, Drake LA, Prendergast MM, Abramovits W, Boguniewicz M, Daniel CR, et al. Cost of atopic dermatitis and eczema in the United States. *J Am Acad Dermatol* 2002;46:361-70.
- Carroll CL, Balkrishnan R, Feldman SR, Fleischer AB Jr, Manuel JC. The burden of atopic dermatitis: impact on the patient, family, and society. *Pediatr Dermatol* 2005;22:192-9.
- Chamlin SL, Frieden IJ, Williams ML, Chren MM. Effects of atopic dermatitis on young American children and their families. *Pediatrics* 2004;114:607-11.
- Rehal B, Armstrong AW. Health outcomes in atopic dermatitis. *Dermatol Clin* 2012;30:73-86. viii.
- Su JC, Kemp AS, Varigos GA, Nolan TM. Atopic eczema: its impact on the family and financial cost. *Arch Dis Child* 1997;76:159-62.
- Krakowski AC, Eichenfield LF, Dohil MA. Management of atopic dermatitis in the pediatric population. *Pediatrics* 2008;122:812-24.
- Kristal L, Klein PA. Atopic dermatitis in infants and children. An update. *Pediatr Clin North Am* 2000;47:877-95.
- Alexander DD, Schmitt DF, Tran NL, Barra J, Cushing CA. Partially hydrolyzed 100% whey protein infant formula and atopic dermatitis risk reduction: a systematic review of the literature. *Nutr Rev* 2010; 68:232-45.
- Alexander DD, Cabana MD. Partially hydrolyzed 100% whey protein infant formula and reduced risk of atopic dermatitis: a meta-analysis. *J Pediatr Gastroenterol Nutr* 2010;50:422-30.
- Hays T, Wood RA. A systematic review of the role of hydrolyzed infant formulas in allergy prevention. *Arch Pediatr Adolesc Med* 2005;159:810-6.
- Szajewska H, Horvath A. Meta-analysis of the evidence for a partially hydrolyzed 100% whey formula for the prevention of allergic diseases. *Curr Med Res Opin* 2010;26:423-37.
- von BA, Filipiak-Pittroff B, Kramer U, Link E, Bollrath C, Brockow I, et al. Preventive effect of hydrolyzed infant formulas persists until age 6 years: long-term results from the German Infant Nutrition Intervention Study (GINI). *J Allergy Clin Immunol* 2008;121:1442-7.

20. Greer FR, Sicherer SH, Burks AW. Effects of early nutritional interventions on the development of atopic disease in infants and children: the role of maternal dietary restriction, breastfeeding, timing of introduction of complementary foods, and hydrolyzed formulas. *Pediatrics* 2008;121:183-91.
21. Dempster J, Jani B, Daly T. Managing eczema in children—a treatment update. *J Fam Pract* 2011;60:660-8.
22. Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, et al. Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. *J Allergy Clin Immunol* 2010;126:S1-58.
23. American Academy of Pediatrics, Committee on Nutrition. Soy protein-based formulas: recommendations for use in infant feeding. *Pediatrics* 1998;101:148-53.
24. Fiocchi A, Brozek J, Schunemann H, Bahna SL, von Berg A, Beyer K, et al. World Allergy Organization (WAO) Diagnosis and Rationale for Action against Cow's Milk Allergy (DRACMA) Guidelines. *Pediatr Allergy Immunol* 2010;21(Suppl 21):1-125.
25. Finch J, Munhutu MN, Whitaker-Worth DL. Atopic dermatitis and nutrition. *Clin Dermatol* 2010;28:605-14.
26. Hanifin JM, Cooper KD, Ho VC, Kang S, Krafchik BR, Margolis DJ, et al. Guidelines of care for atopic dermatitis, developed in accordance with the American Academy of Dermatology (AAD)/American Academy of Dermatology Association "Administrative Regulations for Evidence-Based Clinical Practice Guidelines". *J Am Acad Dermatol* 2004;50:391-404.
27. Akdis CA, Akdis M, Bieber T, Bindslev-Jensen C, Boguniewicz M, Eigenmann P, et al. Diagnosis and treatment of atopic dermatitis in children and adults: European Academy of Allergology and Clinical Immunology/American Academy of Allergy, Asthma, and Immunology/PRACTALL Consensus Report. *J Allergy Clin Immunol* 2006;118:152-69.