American Academy of Allergy Asthma & Immunology

Contact Dermatitis and Patch Testing Education: A Work Group Report From the Allergic Skin Diseases Committee of the AAAAI

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What is already known about this topic? Patch testing (PT) identifies the cause of allergic contact dermatitis. Allergen selection, expert interpretation of the results, and patient counseling are required for successful treatment. Fellowship training increases utilization of PT and confidence in performance.

What does this article add to our knowledge? We found evidence that programs with more clinical infrastructure for PT tended toward a stronger training in PT and more scholarly activities related to PT.

How does this study impact our current management guidelines? Given the importance of PT in allergy practices, more instruction on contact dermatitis, including hands-on training for PT, should be available to Allergy-Immunology fellows.

Allergic contact dermatitis is effectively diagnosed and treated through the identification of causative allergens via patch testing (PT). Selection of allergens, along with the application and interpretation of PT results, necessitates specialized education and training. Our objective was to investigate the extent to which contact dermatitis (CD) education and PT training are components of the curriculum in Allergy and Immunology (A/I) training programs in the United States and to assess where knowledge gaps may exist. A voluntary 16-item survey was sent to program and associate program directors in A/I associated with the American Academy of Allergy, Asthma & Immunology (AAAAI) in 2021. A total of 23 out of 84 (27%) A/I training programs responded. Of the responding programs, 22% did not have a faculty member who performs PT and 25% do not have fellows perform PT. However, programs that performed more patch tests tended to use custom and expanded series, used the patient's personal products, and provided patients with a personal avoidance plan (loadings > 0.65). With respect to scholarly activity, 30% of programs had published an article on CD in the last 3 years. In conclusion, the key findings of our survey include that programs that perform PT are more likely to provide

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Abbreviations used

AAAAI- American Academy of Allergy, Asthma & Immunology
ABAI- American Board of Allergy & Immunology
ACAAI- American College of Allergy, Asthma, and Immunology
ACD- Allergic contact dermatitis
ACDS- American Contact Dermatitis Society
ACGME- Accreditation Council for Graduate Education
A/I- Allergy and Immunology
CD- Contact dermatitis
COVID-19- Coronavirus disease 2019
NACDG- North American Contact Dermatitis Group
PDs- Program directors
PT- Patch testing
T.R.U.E.- Thin-layer Rapid Use Epicutaneous Test
WAO- World Allergy Organization

expanded and customized panels, provide patients with an individualized avoidance plan, and present scholarly activity on the topic. Given the importance of CD in allergy practices, our results indicate that more instruction in this topic is needed in A/I fellowship programs. **(J Allergy Clin Immunol Pract 2025;13:1970-9)**

Key words: *Contact dermatitis; Patch testing; Fellowship/training programs*

INTRODUCTION

Contact dermatitis: a health and economic burden

Contact dermatitis (CD) represents a significant public health burden in the United States. An estimated 8.4 million outpatient visits to physicians for CD occurred annually in a National Ambulatory Medical Care Survey conducted in 1995.[1] Contact dermatitis compromises 6% to 10% of all visits to Dermatology clinics[2] with an estimated total population direct medical cost of $1.529 billion among patients with commercial, Medicaid, and Medicare insurance and uninsured patients per a 2014 investigation by the American Academy of Dermatology.[3]

Contact dermatitis can be divided into irritant contact dermatitis and allergic contact dermatitis (ACD). Irritant contact dermatitis is caused by agents that affect the skin barrier, such as extremes of pH, solvents, and defatting agents, or mechanical, thermal, or ultraviolet exposures. Allergic contact dermatitis is characterized by an immunological response to an external agent acting as an antigen or allergen, typically causing a delayed T-cell—mediated (type IV) hypersensitivity response. Of occupation- related skin diseases, irritant and allergic are the cause of 90% to 95%.[4] The currently accepted diagnostic standard for ACD diagnosis is patch testing (PT),[5] which is essential to treatment. This becomes relevant for the allergist/immunologist because, increasingly, they are the ones performing PT.

However, with more than 3,000 substances known to cause ACD, identification of potential allergens is a difficult task. Studies have demonstrated that history and physical examination alone are insufficient to identify contact allergens: only 29% to 54% of cases can be fully assessed through history taking.[6] Specific identification of the allergen through targeted PT, then, is fundamental.

PT: what is being tested and by whom

Performing PT does present several challenges. It can be time-consuming and labor-intensive, requiring 3 office visits over a 1-week period. Correct identification of the causative allergen(s) to include in PT can be complex, and PT requires specific training to apply and correctly interpret. The final visit providing instructions to the patient in allergen avoidance and review of personal care products can take up to 60 to 90 minutes.[7]

Owing to these challenges, PT using a limited number of allergens, such as with the commercially available U.S. Food and Drug Administration—approved Thin-layer Rapid Use Epicutaneous (T.R.U.E.) test panel of 35 allergens plus negative control,[7] is appealing but may miss relevant allergens. Data from the North American Contact Dermatitis Group (NACDG) shows that the T.R.U.E. test detects at most 66% of the clinically relevant reactions identified on the more expansive NACDG panel of allergens.[8] Estimates are that up to 38% of relevant allergens may be missed when using the T.R.U.E. test alone.[9] Importantly, most studies looking at PT trends have been from Dermatology practices. Studies assessing PT in the allergist's office are limited.[10]

Given the significant health and economic burden of ACD, as well as the limits often placed by insurers on the number of allergens that may be tested, it is imperative that practitioners of PT are adequately prepared.[11] Key to ensuring high-quality care for our patients is understanding the expertise and training in CD and PT among practicing allergists and fellows in Allergy and Immunology (A/I) training programs. A 2002 cross-sectional survey of fellows of the American Academy of Allergy, Asthma & Immunology (AAAAI) found that, of respondents, 53% reported performing PT, with 72% using the T.R.U.E. test.[12] An international survey of allergy practices by the World Allergy Organization (WAO) in 2016 found that 60% of responders used patch tests to investigate nonimmediate skin drug-induced reactions.[13] Although multiple studies have shown that more than half of surveyed allergists perform some form of PT in their office, those that have received formal training have been shown to be more confident about the clinical relevance of the testing.[14]

Although international surveys have shown that both dermatologists and allergists perform PT in different countries,[15] that percentage is rising in allergists in the United States. A retrospective cohort study examining PT in U.S. Medicare beneficiaries from 2012 to 2017 showed a 20.31% rise in those tested by allergists, compared with a 1.84% increase in those tested by dermatologists, indicating the growing importance of PT in Allergy practices.[16]

CD and PT education in Dermatology and A/I fellowship programs

Success with PT occurs when practitioners have the necessary training and experience to properly select the allergens to test, apply and interpret the results, determine their relevance, and educate the patient about their condition.[17] More information about PT education is available from Dermatology training programs; a comparison of CD education in Dermatology residencies in 2002 and in 2010 revealed an increase in its importance.[18,19] In 2002, greater than 73% of responding

TABLE I. Survey questions and results

Questions	Response	n (%)
Question 1: Does your department have a faculty member who performs/interprets PT?	Yes	18 (78.26)
	No	5 (21.74)
Question 2: If your program does not teach PT, do trainees in your program have a required external elective/rotation in a Dermatology or Allergy clinic (outside your academic department) to learn PT?	Yes	3 (13.04)
	No	3 (13.04)
	Not applicable (A/I program already teaches PT)	17 (73.91)
Question 12: Do your fellows perform PT (place, read, or interpret)?	Yes	15 (75)
	No	5 (25)
	Not answered	3
Question 15: Does your department/division train fellows in skin biopsies?	Yes	3 (15)
	No	17 (85)
	Not answered	3
How is ACD assessed in your institution? What patient information is used to select that panel of allergens tested?		
Question 3: How many persons are patch tested, on average, in a month in your department?	0−2	6 (31.58)
	3−6	9 (47.37)
	7−10	2 (10.53)
	10−15	1 (5.26)
	>15	1 (5.26)
	Not answered	4
Question 4: Is there a dedicated patch test clinic?	Yes	4 (21.05)
	No	15 (78.95)
	Not answered	4
Question 5: Is the preloaded T.R.U.E. test used for PT?	Yes	10 (52.63)
	No	9 (47.37)
	Not answered	4
Question 6: Approximately what percentage of patch tests used are T.R.U.E. test?	0%−9%	0
	10%−25%	0
	26%−50%	2 (22.22)
	51%−75%	2 (22.22)
	76%−100%	5 (55.56)
	Not answered	14
Question 7: Are the patient's personal products used in PT?	Yes	10 (55.56)
	No	8 (44.44)
	Not answered	5
Question 8: Is PT performed with allergens from an expanded series (eg, the NACDG)?	Yes	12 (66.67)
	No	6 (33.33)
	Not answered	5
Question 9: Approximately what percentage of patch tests used are from expanded series?	0%−9%	0
	10%−25%	3 (25)
	26%−50%	1 (8.33)
	51%−75%	4 (33.33)
	76%−100%	4 (33.33)
	Not answered	11
Question 10: Is custom PT performed (eg, occupation-specific, biomedical implant)?	Yes	14 (77.78)
	No	4 (22.22)
	Not answered	5
Question 11: Is a personalized avoidance treatment plan provided to your patients who have positive results on patch testing? (For example, CAMP from ACDS, Skin SAFE)	Yes	15 (83.33)
	No	3 (16.67)
	Not answered	5
Scholarly activity: Beyond training, does PT result in scholarship? Presentations at national or regional meetings? Publications?		
Question 13: Have your fellows or faculty presented a poster or abstract on CD at a national meeting in last 3 years?	Yes	4 (21.05)

(continued)

TABLE I. *(Continued)*

Questions	Response	n (%)
	No	11 (57.89)
	Not sure	4 (21.05)
	Not answered	4
Question 14: Have your fellows or faculty published an article on CD in the last 3 years?	Yes	3 (15)
	No	14 (70)
	Not sure	3 (15)
	Not answered	3
Question 16: Approximately how many hours of lectures or teaching a year are dedicated to CD/PT?	0	0
	1	4 (20)
	2	11 (55)
	3	2 (10)
	>4	3 (15)
	Not answered	3

CAMP, contact allergen management programs.

Dermatology residency programs held lectures on CD, although few identified a faculty expert in CD. Only 27% of programs had rotations dedicated to CD and/or PT, and in 13% of programs (14 of 105), none of the graduates performed PT.[18] The 2010 survey of Dermatology residency programs demonstrated more faculty designated as ACD experts being members of the American Contact Dermatitis Society (ACDS), more didactic lectures in ACD, and an estimated increase in the number of residents who would use expanded tests.[19]

Given the increasing number of allergists currently performing PT, there have been few similar studies examining the state of CD and PT education in A/I training programs. A 2008 survey of allergy program directors (PDs) and community allergists[17] examined the frequency of PT performed, perceptions of obstacles to PT, and the effect of prior training on performing PT. Although the survey response rate was low, and only 34% (22 of 65) completed the entire survey, 64% of the responding PDs reported performing PT. Those with prior training performed the test more frequently, consistent with results from a 2002 study from the American College of Allergy, Asthma, and Immunology (ACAAI). That study found that allergists who were fellowship trained in PT or attended a sponsored workshop performed the test more frequently than those without training.[14]

Given the increasing prominence of PT in A/I practices, there is a need to assess the current state of CD education and PT training in A/I fellowship programs, and whether knowledge and performance gaps need to be addressed. This report aimed to answer the question of the extent to which CD education and PT training are components of the current curriculum in A/I training programs in the United States, and where improvements might, and should, be made.

METHODS

The survey was an initiative of the Allergic Skin Diseases Committee of the AAAAI, Contact Dermatitis Sub-Group, that was constructed by authors (R. S., M. R. A, R. S) on the state of PT in our A/I training programs. The survey consisted of 16 brief questions (Table I) focused on faculty expertise with PT (4 questions), how PT is performed at that institution (9 questions), and the scholarly output of PT (3 questions). If PT was not part of the A/I curriculum at that institution, there were only 6 questions to answer. The survey was distributed to PDs and associate PDs members of the AAAAI via Survey Monkey (Survey Monkey Inc., San Mateo, CA) after approval of the AAAAI Practice, Diagnostics, and Therapeutics Committee. It was sent twice to 178 individuals representing 84 A/I training programs in both the United States and Canada in 2021.

Analysis plan

To understand which aspects of CD education are being best addressed in A/I programs, we used factor analysis methodology. We postulated that the reasons some programs are better or worse at PT training is because of the departmental infrastructure. Factor analysis methodology allows for the joint estimation of the averages for each question asked as well as the common associations between responses. The magnitude of the association in factor analysis is represented by the factor loading value. Loadings typically range from −1 to 1 where negative values represent negative associations, positive values represent positive associations, and a value of 0 represents no association. Inference is based on the 95% confidence interval (95% CI), if it does not include the value of 0. If so, then the association is meaningful and considered likely different from 0. A loading value represents the average association of one question with all the other questions (eg, variables) included in the subsection. This provides a summary of the communalities across all the data points corresponding to measures of the same traits as indicated by subsections. Lastly, the correlations across questions on the same subsection can be examined to provide further information on how overall traits related to each other. In this analysis, the focus was in comparing the relative values of the loadings, comparing across the individual questions as to which were larger and smaller on this survey. In terms of assessing significance, a loading was considered meaningful based on whether or not the 95% CI excluded a value of 0 (testing the assumption of no meaningful association, numerically a value of 0).

We grouped questions together conceptually into 3 groups: (1) the overall background on PT training, (2) volume and format of patch tests that were performed, and (3) scholarly activities related to PT.

Lastly, because the sample size was smaller than is preferred for factor analysis, bayesian model estimation was employed. Factor

TABLE II. Factor analysis results*

Number	Question	Mean	95% CI LL	95% CI UL	Loading	95% CI LL	95% CI UL
Section 1: background							
1	Does your department have a faculty member who performs/interprets PT?	78%	60%	92%	0.87	0.57	1.19
2	If your program does not teach PT, do trainees in your program have a required external elective/rotation in a Dermatology or Allergy clinic (outside your academic department) to learn PT?	40%	7%	81%	0.85	0.55	1.14
12	Do your fellows perform PT (place, read, or interpret)?	75%	56%	90%	0.66	0.33	0.97
15	Does your department/division train fellows in skin biopsies?	15%	4%	32%	−0.08	−0.42	0.27
Section 2: clinical infrastructure							
3	How many persons are patch tested, on average, in a month in your department?	4.89	3.08	6.71	0.45	0.15	0.80
4	Is there a dedicated patch test clinic?	21%	7%	39%	0.22	−0.16	0.67
6	Approximately what percentage of patch tests used are T.R.U.E. test?	33%	17%	61%	−0.21	−0.58	0.15
7	Are the patient's personal products used in PT?	56%	35%	75%	0.67	0.29	1.00
9	Approximately what percentage of patch tests used are from expanded series?	37%	19%	58%	0.71	0.41	1.00
10	Is custom PT performed (eg, occupation-specific, biomedical implant)?	78%	59%	92%	0.91	0.58	1.24
11	Is a personalized avoidance treatment plan provided to your patients who have positive results on PT? (For example, CAMP from ACDS, Skin SAFE)	83%	66%	95%	0.85	0.51	1.16
Section 3: scholarly activities							
13	Have your fellows or faculty presented a poster or abstract on CD at a national meeting in the last 3 years?	32%	15%	51%	0.89	0.50	1.17
14	Have your fellows or faculty published an article on CD in the last 3 years?	23%	8%	41%	0.89	0.44	1.19
16	Approximately how many hours of lectures or teaching a year are dedicated to CD/PT?	2.2	1.81	2.59	0.12	−0.47	0.50

Subsection correlations.
Section 1−Section 2: 0.13, 95% CI (0.08−0.18);Section 1−Section 3: 0.02, 95% CI (−0.06 to 0.11); Section 2−Section 3: 0.39, 95% CI (0.30−0.48).
LL, lower limit; *UL*, upper limit.
*Note: The first 2 columns provide the specific question wordings as they were asked, and the order in which they were asked in the original survey. The subsequent 3 columns labeled Mean, 95% CI LL, and 95% CI UL provide the estimated average endorsement for the individual question with 95% CI. The last 3 columns labeled Loading, 95% CI LL, and 95% CI UL represent the association between the individual question and all other questions in the same subsection with 95% CI. Positive values represent positive association with other questions in the same subsection, and negative values represent negative association with other questions in the same subsection. If the loading is close to 0 or the 95% CI cannot exclude a value of 0, then this question does not show strong enough association with other questions to consider it evidence of a meaningful relationship. Lastly, the subsection correlations follow the same inference. If the 95% CI excludes a value of 0, then it can be said the correlation between 2 subsections is meaningful; otherwise, the correlation is not strong enough to be confident that it is a reliable association.

analysis is an analysis of correlations, where even small sample sizes can provide meaningful results, but correlations may not be reliable if the sample size is not large enough. Bayesian estimation weights the final results between the observed data and a researcher-specified probability distribution, which can help mitigate the effects of small sample chance on the final estimates.

RESULTS

A total of 23 out of 84 A/I training programs responded (Table I) for a response rate of 27% (in line with response rates to other surveys from the AAAAI).[20] We found that the majority of responding programs included a faculty member who performed and interpreted PT and had fellows who placed and interpreted PT as well. However, the absolute number of patch-tested patients was relatively low, because 79% of programs patch-tested 6 or fewer patients per month. Over half the programs used T.R.U.E test panels, but also used personal products, the North American Standard Series, or custom panels specific to occupations or exposures.

In contrast, 22% of responding programs did not have a faculty member who performs PT, 25% of programs do not have fellows perform PT, and 79% of responding programs did not have a dedicated PT clinic. In addition, 29% of responding programs do not perform specialized PT (eg, occupation-specific, biomedical implant testing). In terms of scholarly activity, 42%

TABLE III. Available resources for patch test instruction

Online modules	AAAAI Skin in the Game (free to AAAAI members) https://education.aaaai.org/allergic-and-immunologic-skin-diseases/node/30310#group-tabs-node-course-default4 Contact Dermatitis Institute online courses https://www.contactdermatitisinstitute.com/doctors/online-training.php ACDS Teaching Vignettes (on member's website) https://www.contactderm.org/index.php?url=education/teaching-studies
Websites	Contact Dermatitis Institute https://www.contactdermatitisinstitute.com/doctors/indexdoc.php DermNet New Zealand: https://dermnetnz.org/
In-person meetings	ACAAI and AAAAI annual meeting workshops Contact Dermatitis Institute 2-day course
Articles	Fonacier L, Uter W, Johansen JD. Recognizing and managing allergic contact dermatitis: focus on major allergens. J Allergy Clin Immunol Pract 2024;12:2227-41. Fonacier L, Noor I. Contact dermatitis and patch testing for the allergist. Ann Allergy Asthma Immunol 2018;120:592-8. Neale H, Garza-Meyers AC, Tam Idy, Yu JD. Pediatric allergic contact dermatitis. Part 2: patch testing series, procedure, and unique scenarios. J Am Acad Dermatol 2021;84:247-55. Uyesugi BA, Sheehan MP. Patch testing pearls. Clin Rev Allergy Immunol 2019;56:110-8. Poole GYB, Orlioglo N, Warshaw EM, Hylwa SA. Safety checks in patch clinic: 5 hurdles in the patch testing obstacle course. Dermatitis 2020;31:89-98.
Podcasts	AAAAI Contact Dermatitis Podcast https://www.buzzsprout.com/2049216/15539845
Webinars	ACDS (on members Website) https://www.contactderm.org/education/webinars

of responding programs have presented a project on CD at a national meeting in the last 3 years, but only 30% of responding programs have had an article published on CD in the last 3 years. Results from the factor analysis are provided in Table II.

Background on PT was examined first. As anticipated, programs with faculty members who perform PT also tended to have fellows who perform PT (all loadings > 0.60 and likely different from 0). Few programs trained fellows in skin biopsies (M = 15%; 95% CI 4%−32%), which had minimal relationship to PT activities (loading = −0.08; 95% CI −0.42 to 0.27).

We next examined the clinical infrastructure for PT. Unsurprisingly, programs that performed more patch tests tended to perform other PT procedures (loading = 0.45; 95% CI 0.15−0.80), specifically, use of custom and expanded series patch tests, using the patient's personal products in PT and having a personal avoidance plan for patients who test positive (all loadings > 0.65 and likely different from 0). Interestingly, there was only a minimal relationship to having a dedicated patch test clinic (loading = 0.22; 95% CI −0.16 to 0.67) or the use of the T.R.U.E. test for PT (loading = −0.21, 95% CI −0.58 to 0.15).

Examining scholarly activities, there was a clear distinction between programs that have more extensive scholarly output and those that do not, as demonstrated by the loading. Although most programs did not have much scholarly output on CD in the past 3 years (posters or abstracts: M = 32%; 95% CI 15%−51%; and manuscripts: M = 23%; 95% CI 8%−41%), programs that produced more posters/abstracts also tended to write more peer-reviewed publications, a strong association between the 2 activities (both, loading = 0.89 and likely different from 0). This suggests that the 20% to 30% of programs that did have scholarly output tended to publish both posters/abstracts as well as manuscripts. Interestingly, participation in scholarship had little relationship with lecture hours on PT (loading = 0.12; 95% CI −0.47 to 0.50).

Lastly, in examining the relationships between the 3 subsections, there was evidence that programs with more clinical infrastructure for PT (many patients receiving PT, use of expanded series, and custom PT) tended toward more robust training in PT (more faculty members and fellows performing PT, direct instruction on PT) (correlation = 0.13; 95% CI 0.08−0.18) and especially more scholarly activities related to PT (correlation = 0.39; 95% CI 0.30−0.48). In contrast, there was minimal relationship between PT program background (eg, faculty members who specialize in PT, fellows performing PT) and scholarly activities (correlation = 0.02; 95% CI −0.06 to 0.11).

DISCUSSION

Allergic contact dermatitis is common, and PT is recognized as the best method of identifying the causative agent and leads to better patient treatment and outcomes. More than half of practicing allergists perform PT, and that percentage among allergists is rising 10 times more rapidly than among dermatologists.[16] This background of increasing use among allergists underscores the importance of understanding the depth and extent of PT training and formal education in CD in A/I training programs.

Our study addressed three components of this training: (1) exposure to the practice and performance of PT and the additional dermatological procedure of skin biopsies, (2) the extent, complexity, and specificity of PT panels, and (3) whether training in PT leads to scholarly investigation and presentations. We found that several core attributes of PT in A/I training programs were strongly associated and meaningful. These included having a faculty member who performs and interprets PT, having a required clinical rotation for the A/I fellows to learn PT, and having a fellow perform actual PT. Attributes specific to PT itself—including the use of custom patch test panels, the use of the patient's personal care products,

TABLE IV. Proposed EPAs

Practice 1. Identify and manage a patient suspected of having CD				
Observation	**Execution with direct supervision**	**Execution with reactive supervision**	**Supervision at a distance**	**Supervision provided by trainee to junior colleagues**
Is able to obtain a basic history including onset of symptoms, occupational exposures, hobbies, triggers, and current treatments and their effect Performs a physical examination focused on current and suspected areas of dermatitis Identifies the clinical presentation and history of patients with ACD vs ICD Displays a basic knowledge of common contact allergens (metals, fragrances, preservatives) and irritants (wet work, solvents)	Effectively treats patients with ACD: including complete avoidance or reduced exposure (coat surface of nickel-plated objects, wash clothing with formaldehyde used for wrinkle resistance and dye binding), understand and prescribe topical corticosteroids of different potencies, add antihistamines for itch Effectively treats patients with ICD: including complete or reduced exposure; identifies the correct gloves for the exposure; prescribes emollients, topical steroids, and barrier creams.	Is able to perform prior skills, with close contact with supervising faculty available to review history and treatment recommendations	Is able to perform prior skills, with supervising faculty available "on request"	Efficiently obtains and communicates a focused history and examination, including a comprehensive exposure history and appropriate treatment recommendations Is able to review and correct the history, physical examination, and treatment recommendations of junior colleagues

EPA 1: Manage a patient suspected of having CD

This EPA includes demonstrating knowledge of the history, presentation, and exposures relevant to the development of both ACD and ICD. Skills involve the ability to take an appropriate history, perform all the elements of a relevant physical examination, identify the correct testing procedure, and provide treatment recommendations.

The specific functions that define this EPA include

1. Identifying and applying current guidelines to diagnose and manage patients with CD
   a. Obtaining relevant history including hobbies, activities, and work exposures
   b. Perform physical examination noting areas of the dermatitis (facial, eyelid, generalized, hands, or feet)
2. Utilizing procedures for evaluation of patients with CD
   a. PT
   b. Skin biopsy
   c. Use test
   d. Repeated open application test
3. Treatment of CD
   a. Avoidance measures
   b. Use of medications (ie, topical corticosteroids)
   c. Appropriate gloves for the exposure
4. Assessment of comorbid conditions including atopic dermatitis

Judicious mapping to domains of competence

- ✔ Patient care
- ✔ Medical knowledge

Practice-based learning and improvement

Interpersonal and communication skills

Professionalism

Systems-based practice

- ✔ Personal and professional development

Rationale: Allergists and immunologists frequently assess patients with skin rashes in practice. It is necessary for specialists in the field to evaluate and manage patients with allergic skin diseases including CD. Contact dermatitis is a common skin condition caused by contact with an exogenous agent that elicits an inflammatory response. Patch testing is considered the gold standard for diagnosing ACD.

EPA 2: Demonstrate competence in the use of PT for the diagnosis of ACD				
Observation	**Execution with direct supervision**	**Execution with reactive supervision**	**Supervision at a distance**	**Supervision provided by trainee to junior colleagues**
Understands the basics of PT: when and where to apply, when to remove, how to interpret Is aware of potential adverse reactions associated with PT (large positive reactions, irritant responses) Has rudimentary knowledge of potential allergens relevant to the history and location of the dermatitis	Selects the appropriate panel of allergens to test Demonstrates proficiency in performing patch tests including loading of chambers and placement of the patch tests on a patient Correctly interprets patch test results: is able to distinguish a true positive from an irritant reaction	Determines relevance of positive results to the clinical history Effectively counsels patients on avoidance measures	Is able to perform the prior skills independently in addition to the following: Understands the complexities of PT including need for delayed readings with certain allergens Can perform specialized PT (metals, occupational—baker, dental, cosmetologist)	Is able to perform the above independently and instruct others in patch testing including selection of allergens and interpretation of results.

EPA 2: Demonstrate competence in the use of PT for the diagnosis of ACD

This EPA includes demonstrating knowledge of PT procedures, such as indications, selection of correct potential allergens, knowledge of possible complications, performing the procedure, and correct interpretation and documentation of results.

The specific functions that define this EPA include

1. Preparing the patch test
   a. Choosing the appropriate panels
2. Applying the patch test
3. Interpreting of the patch test
   a. Causes of false positives
   b. Causes of false negatives
   c. Identification of irritant reactions
   d. Need for delayed readings
4. Counseling patients regarding results
   a. Communicates results with other health care members and caregivers as applicable
5. Providing patients with resources to implement avoidance measures
   a. Cross-reacting allergens
   b. Avoidance plans
   c. List of safe alternatives

Judicious mapping to domains of competence

- ✔Patient care
- ✔Medical knowledge

Practice-based learning and improvement

Interpersonal and communication skills

Professionalism

Systems-based practice

- ✔Personal and professional development.

Rationale: Allergists/immunologists must recognize the indications for specialty-specific procedures including PT and have the knowledge and skills to competently perform the procedures and interpret the results.

performing expanded PT series, and providing patients with a personalized avoidance plan—were all strongly associated. Scholarly activities in the form of poster/abstract presentations or publications demonstrated strong associations (ie, meaningful associations), although in general, the frequency of these activities was low. This suggests that most institutions were not engaging in scholarly activities related to CD and PT, but those programs that were engaged in the scholarly activities tended to produce poster/abstract presentations and publications. In contrast, training in skin biopsies, the number of persons patch tested per month, having a dedicated patch test clinic, using the T.R.U.E. test, or increased hours of formal lectures did not have strong associations with PT training. There was little formal training in CD with 75% of responding programs reporting 2 hours or less of formal lectures or teaching in these subjects.

There are limitations to our study. The rate of response, although typical for AAAAI surveys, was low. Only 23 of 84 A/I training programs (27%) responded. It is possible that only programs that do focus on CD and PT training were the ones to respond, and that many more programs do not include PT training, suggesting the rate of A/I programs with PT training may in fact be much lower than that reported here. Our survey was administered during the height of the coronavirus disease 2019 (COVID-19) pandemic, and it is possible that the level of PT activity and education was lower than normal activity during nonpandemic times. However, the wording of the questions referred to normal activities during training and were not specific to the pandemic. Our results may not be representative of the majority of A/I training programs.

We can draw several conclusions from our survey results. Although all A/I trainees are required by the American Board of Allergy & Immunology (ABAI) to have performed a minimum number of patch tests to be board-eligible at the end of their training, there is a discordance between these recommendations and practice. Formal education in PT, including the selection of allergens, interpretation of results, and development of a treatment plan, is limited in many A/I training programs. Practicing allergists, conversely, are being asked to accurately diagnose and manage CD and need to be equipped with the necessary knowledge and skills. There is a need for adequate training, including hands-on practical instruction, in how to identify the allergens that should be tested, placing and accurately interpreting the results, and providing patient-specific materials for what is safe and what should be avoided. Therefore, investing in comprehensive education and training programs for A/I fellows is crucial in meeting the growing demands of this field and ensuring the highest standard of patient care. The Accreditation Council for Graduate Education (ACGME) requirements for Dermatology programs include that residents obtain "competence through direct clinical experiences in the application and interpretation of patch test procedures, and in counseling patients on the results" [IV.B.1.b]. Fellows in A/I programs are required to "demonstrate proficiency in performing and evaluating results for contact or delayed hypersensitivity testing" [IV.B.1.b).(1).(b).(ii)] and have direct patient care with pediatric and adult patients with contact dermatitis [IV.C.5.b).(4)]. In addition, the ABAI requires the procedural skill of PT for individual board accreditation. However, there is a lack of a standardized curriculum that can be utilized by A/I fellowship training programs. Table III is a nonexhaustive list of different available resources for PT training from multiple sources, including hands-on training opportunities at both the AAAAI and the ACAAI annual national meetings and a 2-day PT course offered annually by the Contact Dermatitis Institute to obtain knowledge and experience and to aid programs in establishing their PT curriculum.

Although A/I fellows are evaluated on procedural skills, including PT, via milestone Patient Care 3-Diagnostic Tests and Procedures for AI Patients (https://www.acgme.org/globalassets/PDFs/Milestones/AllergyandImmunologyMilestones.pdf) as well as via a procedural assessment from the ABAI including contact/delayed hypersensitivity (https://www.abai.org/ProcSkills.asp), there is not a specific tool designed to evaluate the fellow's knowledge of CD and PT skills. Thus, we propose a set of detailed competencies based on Entrustable Program Activities in Table IV, modeled from other medical training programs, to apply to A/I programs to assess fellow competence and proficiency in PT. Briefly, Entrustable Program Activities are the specific knowledge, activities, and skills that physicians in a particular specialty are expected to have mastered prior to graduation.[21] Practice 1 (Table IV) evaluates the fellow's ability to "identify and manage a patient suspected of having contact dermatitis" utilizing history, physical examination, knowledge of testing and treatment options available, starting from the observer stage (stage 1) to the final stage at which fellows can supervise junior trainees (stage 5). At the same time, practice 2 seeks to determine the "competence in the use of patch testing for the diagnosis of allergic contact dermatitis" through evaluation of PT preparation, application of patch tests, interpretation of patch test results, and counseling patients on their results, from the observer stage to supervision of junior learners stage.

Based on our results from this survey, we propose that a formal curriculum in CD, including diagnosis and treatment, be developed for A/I training programs. Identifying faculty at these locations with particular interest in this topic and providing additional support through the AAAAI or other institutions will aid in incorporating formal training into the syllabus. Taken together and based on the increasing importance and demand for PT in allergy practices, we recommend that A/I fellows obtain proficiency with PT during training: this emphasizes the importance of the availability of at least one faculty member who is qualified to teach PT. In those institutions at which PT is performed by Dermatology or no expert in CD exists in the A/I division, we recommend a rotation by the A/I fellows in Dermatology with a focus on PT. Programmatic improvements to CD and PT education in A/I training programs should include assessment of patient and practice outcomes, depending on the source of training.

REFERENCES

1. Hogan DJ. Allergic contact dermatitis. Medscape Reference. Accessed January 19, 2024. https://emedicine.medscape.com/article/1049216-overview#a5
2. Sherertz EF. Controversies in contact dermatitis. Am J Contact Dermat 1994;5:130-5.
3. Lim HW, Collins SAB, Resneck JS Jr, Bolognia JL, Hodge JA, Rohrer TA, et al. The burden of skin disease in the United States. J Am Acad Dermatol 2017;76:958-72.
4. Skin Exposures and Effects. Accessed January 19, 2024. https://www.cdc.gov/niosh/topics/skin/
5. Fonacier L, Noor I. Contact dermatitis and patch testing for the allergist. Ann Allergy Asthma Immunol 2018;120:592-8.
6. Fleming CJ, Burden AD, Forsyth A. Accuracy of questions related to allergic contact dermatitis. Am J Contact Dermat 2000;11:218-21.
7. Zhu TH, Suresh R, Warshaw E, Scheinman P, Mowad C, Botto N, et al. The medical necessity of comprehensive patch testing. Dermatitis 2018;29:107-11.

8. DeKoven JG, Warshaw EM, Belsito DV, Sasseville D, Maibach HI, Taylor JS, et al. North American Contact Dermatitis Group Patch Test Results 2013−2014. Dermatitis 2017;28:33-46.
9. DeKoven JG, Warshaw EM, Zug KA, Maibach HI, Belsito DV, Sasseville D, et al. North American Contact Dermatitis Group Patch Test Results: 2015−2016. Dermatitis 2018;29:297-309.
10. Camacho-Halili M, Axelrod S, Michelis MA, Lighvani S, Khan F, Leon S, et al. A multi-center, retrospective review of patch testing for contact dermatitis in allergy practices. Ann Allergy Asthma Immunol 2011;107:487-92.
11. Rodriguez-Homs LG, Taylor J, Liu B, Green CL, Brod B, Jacob SE, et al. Patch test practice patterns of members of the American Contact Dermatitis Society. Dermatitis 2020;31:272-5.
12. Farrell AL, Warshaw EM, Zhao Y, Nelson D. Prevalence and methodology of patch testing by allergists in the United States: results of a cross-sectional survey. Am J Contact Dermat 2002;13:157-63.
13. Thong BYH, Castells M, Pichler W, Romano A, Bonadonna P, Diana D, et al. A World Allergy Organization international survey on diagnostic procedures and therapies in drug allergy/hypersensitivity. World Allergy Organization J 2011;4:257-70.
14. Fonacier L, Charlesworth EM, Mak WY, Bahna SL. American College of Allergy, Asthma & Immunology Patch Testing and Allergic Dermatologic Disease Survey: use of patch testing and effect of education on confidence, attitude, and usage. Am J Contact Dermat 2002;13:164-9.
15. Tanno LK, Darlenski R, Sánchez-Garcia S, Bonini M, Vereda A, Kolkhir P, et al. International survey on skin patch test procedures, attitudes and interpretation. World Allergy Organ J 2016;9:8.
16. Cheraghlou S, Watsky KL, Cohen JM. Utilization, cost, and provider trends in patch testing among Medicare beneficiaries in the United States from 2012 to 2017. J Am Acad Dermatol 2021;85:1218-26.
17. Ghaffari G, Craig T. The perceived obstacles in performing patch test to detect allergic contact dermatitis: a comparison between community allergists and directors of allergy training programs. Ann Allergy Asthma Immunol 2008;100:323-6.
18. High WA, Cruz PD Jr. Contact dermatitis education in dermatology residency programs: can (will) the American Contact Dermatitis Society be a force for improvement? Am J Contact Dermat 2003;14:195-9.
19. Nelson J, Mowad C, Sun H. Allergic contact dermatitis and patch-testing education in US dermatology residencies in 2010. Dermatitis 2012;23:56-60.
20. Sharma H, Nanda A, Bingemann TA, Khan DA, Sussman J, Kalman D, et al. Fellows in training wellness in allergy and immunology: AAAAI Workgroup Report. J Allergy Clin Immunol Pract 2022;10:2868-74.
21. Ten Cate O. Nuts and bolts of entrustable professional activities. J Grad Med Educ 2013;5:157-8.