

# Allergy and immunology interest and exposure among US medical students and residents



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**Background:** Despite the immense burden of allergic disease, the allergy and immunology (AI) workforce in the United States continues to shrink. Fellowship applications for AI have declined sharply in contrast to those in more popular specialties. **Objectives:** Here we have sought to evaluate the current level of AI interest and exposure among early trainees in the United States, as well as their perspective on how to improve interest in the field.

**Methods:** An 18-item questionnaire was sent via e-mail list-serve to 2 groups: (1) mostly residents in the American Academy of Allergy, Asthma & Immunology (AAAAI) with interest in AI and (2) medical students in the American Medical Student Association (AMSA) whose specialty interests were not known.

**Results:** In the AAAAI group, 412 members were surveyed and 70 responses were received. In the AMSA group, 4778 members were surveyed and 47 responses were received. More individuals in the AAAAI group interacted with their AI division than in the AMSA group (73% vs 19% [ $P < .001$ ]). On average, the AAAAI group would “probably” pursue AI whereas the AMSA group who would “definitely not” do so ( $P < .001$ ). Almost all of the AMSA group (94%) had heard of AI before, but only 19% of them interacted with AI at their program. Regarding ways to increase interest in AI, the top responses for both groups were clinical exposure via electives and shadowing (a score of 4.69 on a 5-point scale) and didactic exposure via lectures and presentations (a score of 4.29).

**Conclusions:** Our study suggests that increasing AI opportunities for didactics and clinical exposure may lead medical students to develop more interest in pursuing the field. Some strategies are also discussed. (*J Allergy Clin Immunol Global* 2022;1:305-8.)

**Key words:** Fellowship, specialty interest, diversity, survey

## INTRODUCTION

Allergy and Immunology (AI) encompasses a wide breadth of diseases, including asthma, allergic rhinitis, atopic dermatitis, and food allergy, which taken together affect approximately 20% of the global population.<sup>1</sup> These chronic conditions require regular monitoring and have a significant impact on quality of life.<sup>2,3</sup> Allergic diseases are also associated with substantial direct medical costs and indirect costs, mainly by absenteeism and presentism.<sup>1</sup> Despite the immense burden of allergic disease, the AI workforce in the United States continues to shrink relative to demand.<sup>4,5</sup> According to the most recent public data from the Accreditation Council for Graduate Medical Education,<sup>6</sup> fellowship applications for AI declined sharply from 3.88% of total applications in 2007 to 1.86% in 2015 and have continued to decline to 1.51% in 2022 (Fig 1). This is in contrast to the situation in more popular specialties, in which the percentages of fellowship application have stayed relatively stable. For comparison, from 2017 to 2022 adult and pediatric gastroenterology applications remained stable at 8% and 1%, respectively.<sup>6</sup>

The reason for the decline in AI fellowship applications is difficult to assess but seems incongruent with the opportunities provided by the specialty. AI is a favorable career path, with high job satisfaction and relatively low burnout.<sup>5,7</sup> One factor that may explain the decline in AI applications may be the lack of exposure to the field. A survey study of 408 physicians in 2015 found that only 15% of residents and 33% of attendings had ever taken an AI rotation.<sup>8</sup> Even when postgraduate year 4 residents or early career attendings are considered, less than half had taken an AI rotation.<sup>8</sup> Another survey study of 375 primary care physicians conducted in 2004 found that less than half of pediatric faculty, 30% of internal medicine faculty, and only approximately 10% to 15% of residents had taken an AI rotation in the past.<sup>9</sup> Not surprisingly, both studies demonstrated increased comfort and knowledge in allergy cases for participants with AI experience. Together, these studies suggest that there is a lack of exposure to AI in early training that could have tangible consequences on management of allergic disorders.

Here we have sought to evaluate the current level of AI interest and exposure among early trainees in the United States, as well as their perspective on how to improve interest in the field. To have the broadest understanding of the factors that were contributing, we surveyed medical students and residents who had unknown specialty interests, as well as those who had already expressed interest in AI.

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*Abbreviations used*

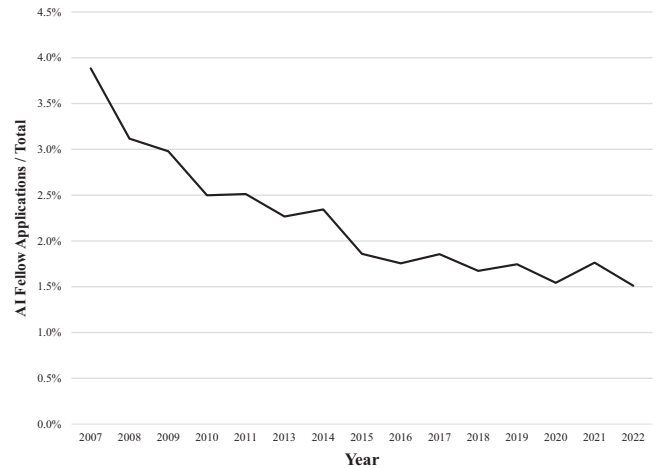
AAAAI: American Academy of Allergy, Asthma & Immunology  
 AI: Allergy and immunology  
 AMSA: American Medical Student Association

**RESULTS AND DISCUSSION**

In the American Academy of Allergy, Asthma & Immunology (AAAAI) group, 412 members were surveyed and 70 participants (17% response rate) completed the questionnaire, with 61 providing complete data. In the American Medical Student Association (AMSA) group, 4778 members were surveyed. The e-mail was opened by 3201 of the survey recipients (67%), the survey link was clicked by 93 of them (~2%), and 47 of them completed the questionnaire (response rate ~1%), with 39 providing complete data. For comparison, recent similar surveys through AMSA have an average open rate of 64.3% and survey link click rate of 5.8%, and they do not capture the survey completion rate. All available data were utilized; the survey responses can be found in [Table I](#). The respondents were from 31 different states throughout the United States, with most from New York (19%), California (7%), Tennessee (7%), Texas (7%), Arkansas (6%), Illinois (5%), and Ohio (5%). More respondents were female, and there were significantly more African Americans surveyed in the AMSA group ( $P = .006$ ). The AAAAI group consisted largely of senior residents, whereas the AMSA group consisted mostly of early-stage medical students. Almost all of the respondents (97%) had heard of AI before. For both groups, first AI interaction was predominantly in medical school (49%). Significantly more respondents in the AAAAI group had interacted with the AI division at their training program (73%) than in the AMSA group (19%) ( $P < .001$ ).

The AAAAI group had a strong interest in AI, with an average response of 4.00 (on a 5-point scale) or “probably” to pursue a career in AI, whereas the AMSA group responded “definitely not” to “probably not,” with an average score of 1.67 ( $P < .001$ ). Almost all of the AMSA group (94%) had heard of AI before, but only 19% of them had interacted with AI at their own program. Focusing on those with clinical experience, 12 of 16 of fourth year medical students (75%) and 3 of 5 residents in the AMSA group (60%) responded that they had no AI interaction at their own program. In the AAAAI group, one-third of medical students and one-fourth of residents had no interaction with AI at their own program. The AMSA group had more participants who had heard about AI in college ( $P = .02$ ), whereas the AAAAI participants heard about AI more in residency ( $P = .02$ ) and nearly more in medical school ( $P = .05$ ). More participants in the AMSA group were AI patients themselves ( $P = .04$ ), indicating prior exposure to the field.

With regard to scoring of various methods to increase interest in AI, the AMSA and AAAAI groups scored each item similarly, except that the AAAAI members scored medical student or resident sections on allergy websites slightly higher ( $P = .04$ ). Notably, both groups thought that more clinical exposure to the field in their own program via electives and shadowing was the most important method for increasing interest in AI (4.69 of 5), followed by didactic exposure to the field in their own program via lectures and presentations (4.29 of 5).



**FIG 1.** Declining AI fellowship applications (data from the Accreditation Council for Graduate Medical Education public data 2007-2022<sup>6</sup>). Note that for 2012 no application data were collected, as the recruitment cycle changed from 18 months to 12 months.

According to the most recent public data from the National Resident Matching Program,<sup>6</sup> in 2018 there were 129 AI fellowship positions available, and most recently in 2022 there were 139, for a total increase of 7.2%. Not all slots are filled each year, with 3 slots unfilled in 2022, and an average of 1 to 5 slots not filled since 2018, when a record 14 slots were not filled. From 2015 to 2020 the total number of AI programs increased from 77 to 81, with a 5-year increase of 4 programs or 5.2%.

Here we surveyed 2 different groups of trainees to assess current levels of AI exposure and interest. As expected, the AAAAI group had much higher interest in AI than the AMSA group. Surprisingly, although most respondents in the AMSA group had heard of AI, less than 20% had interacted with AI at their own program, including those who had completed clinical rotations. The majority of the AAAAI respondents also had no interaction with the AI program at their institution despite their interest in the field. These findings are in line with those of the previous survey studies, showing that most physicians and residents had not done an AI rotation during training.<sup>8,9</sup> Going 1 step further, we found that both medical students and residents strongly believed that increasing AI interaction via didactics and clinical exposure were most important to increasing AI interest. The limited number of responses to the free-text question regarding how to increase AI interest recommended increasing AI consult and elective rotation opportunities, establishing an AI program as they did not have one, increasing outreach to underrepresented minorities, and even allowing family medicine-trained residents to apply to AI fellowship. Taken together, the responses showed that increasing AI opportunities in medical school and residency training was most important to trainees and seems the most likely way to increase interest in AI fellowship.

The relatively slow increase in AI fellowship positions has been a major concern and is considered a top priority to improve the AI workforce moving forward given population demands.<sup>4</sup> AI fellowship programs increased by only 5.2% from 2015 to 2020, with few unfilled slots. For comparison, over the same

**TABLE I.** Survey responses

Questionnaire item	AMSA survey (n= 47)	AAAAI survey (n= 70)	P value*	Total or average (N = 107)
Sex, % (no.)			.84	
Male	40% (18)	38% (26)		38% (44)
Female	56% (26)	61% (42)		59% (68)
Nonbinary	4% (2)	1% (1)		3% (3)
Race/ethnicity, % (no.)				
African American	22% (10)	4% (3)	<b>.006</b>	11% (13)
Asian	23% (11)	28% (19)	.83	26% (30)
Latino/Hispanic	4% (2)	7% (5)	.70	6% (7)
Native American	2% (1)	1% (1)	1.00	2% (2)
Pacific Islander	2% (1)	0% (0)	.40	1% (1)
White	47% (22)	60% (41)	.25	54% (63)
Age (y), % (no.)				
21-25	30% (14)	6% (4)	<b>&lt;.001</b>	16% (18)
26-30	48% (22)	72% (50)	<b>.010</b>	62% (72)
31-35	15% (7)	22% (15)	.47	19% (22)
36-40	7% (3)	0% (0)	.06	3% (3)
Year of training, % (no.)				
Medical students	85% (40)	13% (9)	<b>&lt;.001</b>	43% (49)
MS2	17% (8)	0% (0)		7% (8)
MS3	32% (15)	3% (2)		15% (17)
MS4	36% (17)	10% (7)		21% (24)
Residents	13% (6)	87% (60)	<b>&lt;.001</b>	57% (66)
PGY-1	7% (3)	12% (8)		10% (11)
PGY-2	4% (2)	27% (19)		18% (21)
PGY-3	2% (1)	42% (29)		26% (30)
PGY-4	0% (0)	6% (4)		3% (4)
Have you ever heard of AI? (yes), % (no.)	94% (44)	100% (67)	.07	97% (111)
When did you first hear about AI?, % (no.)				
Before high school	19% (8)	15% (10)	.61	17% (18)
High school	16% (7)	6% (4)	.11	10% (11)
College	28% (12)	10% (7)	<b>.02</b>	17% (19)
Medical school	37% (16)	57% (38)	.05	49% (54)
Residency	0% (0)	12% (8)	<b>.02</b>	7% (8)
Where did you hear about AI?, % (no.) <sup>†</sup>				
Online, website, social media	12% (5)	25% (17)	.09	20% (22)
Friend or family in the field	5% (2)	27% (18)	<b>.04</b>	20% (20)
Friend or family sees an allergist/immunologist	26% (11)	29% (20)	.67	28% (31)
Patient of an allergist/immunologist	33% (14)	15% (10)	<b>.04</b>	22% (24)
Interaction with program AI division	19% (8)	73% (49)	<b>&lt;.001</b>	52% (57)
Conference, special program	2% (1)	27% (18)	<b>&lt;.001</b>	17% (19)
Likelihood of pursuing an AI career, % (no.) <sup>‡</sup>	1.66	4.00	<b>&lt;.001</b>	2.57
Best way to increase interest in AI, % (no.) <sup>§</sup>				
Medical student or resident section on allergy society websites	3.49	3.93	<b>.04</b>	3.76
Better social media presence with more outreach	3.38	3.44	.84	3.42
Invitations to AI conferences/virtual meetings	3.77	4.10	.11	3.97
E-mailed information or flier from your own program	3.49	3.40	.70	3.43
More clinical exposure to the field in your own program (electives, shadowing)	4.74	4.66	.37	4.69
More didactic exposure to the field in your own program (lectures, presentations)	4.18	4.37	.34	4.29
More social exposure to the field in your own program (interest groups, mixers)	3.38	3.78	.05	3.62

Totals may vary between questions as some respondents did not answer all questions.

MS, Medical school year; PGY, postgraduate year.

\*P values were calculated between the AMSA and AAAAI groups by using a 2-tailed Fisher exact test for comparison of nominal variables and a Wilcoxon rank sums test for ordinal variables (Likert scales). Bold values represent statistical significance at P < .05.

<sup>†</sup>The question was worded “mark all that apply” so that respondents could provide more than 1 answer.

<sup>‡</sup>Measured on a 5-point Likert scale as follows: 1 = definitely not, 2 = probably not, 3 = possibly, 4 = probably, 5 = definitely; AMSA, n = 39; AAAAI, n = 61.

<sup>§</sup>Measured on a 5-point Likert scale as follows: 1 = not at all important, 2 = low importance, 3 = neutral, 4 = important, 5 = very important; AMSA, n = 39; AAAAI, n = 61.

time frame, adult and pediatric gastroenterology increased by 23.2% and 8.3%, respectively.<sup>6</sup> Our study adds another important perspective in that increasing AI opportunities for didactics and clinical exposure is likely to lead to medical students having more interest in pursuing the field.

Finally, it is important to address the importance of increasing diversity in the AI field. There were significantly fewer African Americans in the AAAAI group of AI-interested residents than among the AMSA medical students. Additionally, a few AMSA respondents expressed the importance of increasing diversity in AI, with 1 participant even suggesting “increasing physical examinations on diverse skin tones.” Increasing AI workforce diversity is likely to lead to better care of the diverse populations requiring AI care.<sup>10</sup>

Limitations to our study include its volunteer survey-based nature and the low number of respondents. Another important limitation is the wide difference in training levels between groups. Strengths of our study include broad nonbiased sampling of several different states, covering a wide range of different institutions, and the novelty of comparing 2 distinct levels of AI interest at both the medical school and residency levels. Overall, our findings suggest that AI interest could be improved by increasing AI didactics and clinical exposure at earlier levels of training.

Our results show the importance of increasing AI exposure throughout medical training, including by increasing AI didactics and electives. A starting point would be advocating for current AI physicians to give guest lectures or create roundtable discussions at their medical school alma mater, especially those without a formal AI program. A broader approach could include AI societies coordinating events with medical student societies. For example, inviting medical students through AMSA to attend an exciting case-based talk hosted by the AAAAI could spark interest in the specialty and provide an avenue to provide further resources. For programs with established AI didactics, 1 medical student suggested focusing more on common diseases rather than on markers and tests to garner more interest in the field. Increasing understanding of the diseases encountered daily in AI will improve clinical care for our patients and showcase the importance of AI as a field and a career.

For detailed methods, please see the Methods section in this article’s [Online Repository at www.jaci-global.org](http://www.jaci-global.org).

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**Clinical implications: AI fellowship applications are declining, and AI exposure is low at earlier levels of training. In this survey study, US medical students and residents reported that increasing AI electives and didactics was the most important way to increase interest in AI.**

## REFERENCES

1. Dierick BJH, van der Molen T, Flokstra-de Blok BMJ, et al. Burden and socioeconomics of asthma, allergic rhinitis, atopic dermatitis and food allergy. *Expert Rev Pharmacoecon Outcomes Res* 2020;20:437-53.
2. Denton E, Bousquet J. Quality of life in combined asthma and rhinitis: the impact of sniff, sneeze, and wheeze. *J Allergy Clin Immunol Pract* 2022;10:853-4.
3. Koinis-Mitchell D, Craig T, Esteban CA, Klein RB. Sleep and allergic disease: a summary of the literature and future directions for research. *J Allergy Clin Immunol* 2012;130:1275-81.
4. Malick A, Meadows JA. Allergy and immunology physician workforce: where do we stand today? *Ann Allergy Asthma Immunol* 2021;127:522-3.
5. Marshall GD. American Academy of Allergy AtIWC. The status of US allergy/immunology physicians in the 21st century: a report from the American Academy of Allergy, Asthma & Immunology Workforce Committee. *J Allergy Clin Immunol* 2007;119:802-7.
6. Data from: Electronic Residency Service (ERAS) Data, Accreditation Council for Graduate Medical Education (ACGME) 2008-2022. Available at: <https://www.aamc.org/data-reports/interactive-data/eras-statistics-data>. Accessed April 1, 2022.
7. Bingemann T, Sharma H, Nanda A, et al. AAAAI work group report: physician wellness in allergy and immunology. *J Allergy Clin Immunol Pract* 2020;8:1224-9.
8. Stukus DR, Green T, Montandon SV, Wada KJ. Deficits in allergy knowledge among physicians at academic medical centers. *Ann Allergy Asthma Immunol* 2015;115:51-5.e1.
9. Baptist AP, Baldwin JL. Physician attitudes, opinions, and referral patterns: comparisons of those who have and have not taken an allergy/immunology rotation. *Ann Allergy Asthma Immunol* 2004;93:227-31.
10. Carter MC, Saini SS, Davis CM. Diversity, disparities, and the allergy immunology pipeline. *J Allergy Clin Immunol Pract* 2022;10:923-8.