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Knowledge, attitude, and practices of medical clinicians regarding food allergy and anaphylaxis in Hyderabad, India

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ABSTRACT

Background: Food allergy (FA) is a chronic condition of emerging global concern. Surveys have been conducted in numerous countries to assess physician knowledge, attitude, and practices (KAP) pertaining to FA and anaphylaxis, and substantial deficits in their KAP were identified.

Objective: To assess the KAP of medical clinicians in Hyderabad, India, with respect to FA and anaphylaxis.

Methods: A regionally representative sample of 570 physicians including 113 general practitioners, 123 pediatricians, 110 pulmonologists, 113 dermatologists, and 111 gastroenterologists were recruited from all major institutions in Hyderabad, India. A validated questionnaire was used to assess their KAP.

Results: Overall, 90% of questions were correctly answered and differences emerged with respect to specific items, namely the following: (1) the lateral thigh being the preferred location for epinephrine administration ($P = .001$); (2) a positive skin prick test or radioallergen sorbent test is sufficient for FA diagnosis ($P = .04$); and (3) the appropriate epinephrine dose for a 27-kg child ($P = .006$). Approximately 95% of the participants in each group were confident in their ability to care for patients with FA, yet 91% desired additional periodic FA training sessions.

Conclusion: Survey findings suggest that although FA knowledge among South Indian clinicians seems high across all major specialties who care for patients with FA, there are differences in the level of knowledge among them, which in turn reflects the differences in attitude and approach toward their patients. These FA care providers still desire to further participate in continuing medical education efforts in the field of food allergy. Efforts to provide periodic training and education for all FA clinical care providers remain vital in South India.

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Introduction

Food allergy (FA) is a chronic condition, estimated to affect approximately 1.2% of the South Indian adult population¹ and an unknown proportion of the general population in India. Elsewhere in the world, FA prevalence estimates vary widely, ranging from 1% to 10%.² Unfortunately, in India, there continues to be a paucity of information regarding the prevalence and incidence of FA and anaphylaxis because of a lack of population-based studies. However, based on the limited available research, FA rates seem to be rising within India and have also been found to be markedly

Table 1
Demographic Characteristics of the Different Specialties

Variable	Overall (n = 570) n (%)	Sample population					P value
		Pul (n = 110) n (%)	GE (n = 111) n (%)	Paed (n = 123) n (%)	Derm (n = 113) n (%)	GP (n = 113) n (%)	
Sex							
• Male	311 (54.5)	69 (62.7)	55 (49.5)	68 (55.2)	56 (49.5)	63 (55.7)	.26
• Female	259 (45.5)	41 (37.3)	56 (50.5)	55 (44.7)	57 (50.5)	50 (44.3)	
Practice type							
• Private clinic	171 (30.0)	25 (22.7)	48 (43.3)	21 (17.0)	59 (52.3)	18 (16.0)	.000
• Private hospital	364 (63.8)	72 (65.4)	62 (55.8)	92 (74.7)	47 (41.6)	91 (80.5)	
• Government hospital	35 (6.2)	13 (11.8)	1 (0.9)	10 (8.3)	7 (6.1)	4 (3.5)	
Years in practice							
• <10	159 (27.8)	32 (29.2)	38 (34.2)	23 (18.6)	48 (42.6)	18 (15.9)	.000
• 10–20	281 (49.4)	50 (45.4)	53 (47.7)	71 (57.7)	38 (33.6)	69 (61.0)	
• >20	130 (22.8)	28 (25.4)	20 (18.1)	29 (23.5)	27 (23.8)	26 (23.1)	
Patients with food allergy visit per month (out of total patients visits)							
• <5%	178 (31.3)	32 (29.2)	62 (55.8)	25 (20.4)	39 (34.5)	20 (17.6)	.000
• 5–10%	261 (45.8)	30 (27.2)	43 (38.7)	54 (43.9)	50 (44.2)	84 (74.3)	
• >10%	131 (22.9)	48 (43.6)	6 (5.5)	44 (35.7)	24 (21.3)	9 (8.1)	
Age group of patients with food allergy seen							
• <5 y	164 (28.8)	15 (13.7)	28 (25.2)	58 (47.1)	52 (46.1)	11 (9.7)	.000
• 5–15 y	275 (48.3)	51 (46.4)	49 (44.2)	64 (52.1)	44 (38.9)	67 (59.5)	
• 15–50 y	109 (19.1)	30 (27.2)	31 (27.9)	1 (0.8)	13 (11.5)	34 (30.0)	
• >50 y	22 (3.8)	14 (12.7)	3 (2.7)	0 (0.0)	4 (3.5)	1 (0.08)	

Abbreviations: Derm, dermatologist; GE, gastroenterologist; GP, general physician; Paed, pediatrician; Pul, pulmonologist.

elevated among second-generation Asian immigrants to Australia.³ This rise reflects the need for precise and updated knowledge among physicians to treat patients with FA.

Studies have been conducted in the United States, Europe, and Australia to assess and examine knowledge, attitudes, and practices (KAP) on FA and anaphylaxis. These studies have evaluated KAP among nurses,⁴ dieticians,⁵ pediatricians, family physicians,⁶ internal medicine postgraduates and practicing physicians,⁷ pediatric gastroenterologists,⁸ primary school teachers,⁹ parents of children with FA,¹⁰ food service employees,¹¹ and restaurant managers and staff.¹² Despite the relatively high prevalence rates of FA in these contexts, substantial deficits in KAP were identified, including among medical clinicians. However, to date, there have been no efforts to systematically assess KAP regarding FA and anaphylaxis among medical clinicians from different specialties in the context of the Indian population despite the potential utility of this work in identifying areas for improved medical education.

Patients typically rely on general physicians, pediatricians, pulmonologists, dermatologists, or gastroenterologists for FA diagnosis, treatment, and counseling based on their symptoms (dizziness, headache, asthma, allergic rhinitis, skin rashes, itching, urticaria, vomiting, diarrhea, etcetera). To initiate the work, Hyderabad (a state capital city in southern India) was chosen as a primary center. This study aimed to describe the KAP with respect to FA and anaphylaxis in a large, regionally representative sample of medical clinicians in a large Indian capital city of Hyderabad.

Methods

A total of 600 medical clinicians were approached for the present study and 570 completed the questionnaire with a 95% survey completion rate. Clinicians of different specialties were selected from private and government hospitals in different parts of Hyderabad to maintain uniformity and regional representativeness. The sample included the following specialties: (1) pulmonologists (n = 110); (2) gastroenterologists (n = 111); (3) pediatricians (n = 123); (4) dermatologists (n = 113); and (5) general practitioners (n = 113). The participants were from different private hospitals and clinics and government hospitals within and around a 100-km

radius from Hyderabad, India. The clinicians were given background information about the study and an appointment was made to meet them. Most surveys were administered on the same day, although in some cases participants completed the surveys up to 24 hours after being invited to participate. The title of the study, the questionnaire as a data collection tool, and the time required to fill the questionnaire were disclosed before meeting with the clinicians. The ethical approval for this study was taken from the Institutional Ethics Committee of the Indian Council of Medical Research–National Institute of Nutrition, Hyderabad, India. The study data were collected from January to June 2016.

The pencil-paper survey using a validated questionnaire¹³ was administered in English by a trained data collector. All participants were fluent in English. The questionnaire was validated in the United States but not in India. The distributed questionnaires included questions on the demographic characteristics of the medical clinicians (5 questions), their knowledge (20 questions), attitudes, and approach regarding FA and anaphylaxis (5 questions). The questions were focused on assessing knowledge of common symptoms, triggers, and risk factors in patients with FA and also diagnosis, treatment, and utilization of health care services in cases of anaphylaxis.

Descriptive statistics were calculated to summarize demographic characteristics and responses to each questionnaire item. A summary score of FA knowledge was obtained by calculating the percentage of knowledge questions that each respondent answered correctly. Descriptive analyses included a presentation of the overall score, percentage of respondents who answered each question correctly, and scores according to the respondent characteristic (sex, practice type, years of practice, FA-related patient load, and age group of patients with FA seen). Statistical analysis was performed using the statistical software package SPSS 19 (IBM, Armonk, New York). Chi-squared tests were used to evaluate associations between specific domains of knowledge (symptoms and severity, triggers, risk, diagnosis, and treatment) and compare responses between clinicians from various specialties. Multiple linear regression was used to assess the associations between respondent characteristics and the probability of correctly answering questions where highly significant bivariate associations ($P < .005$) were identified (eg correct location and dosage of epinephrine injection

Table 2
Comparisons of Food Allergy Knowledge by Medical Specialty

Questions or variables	Overall (n = 570) n (%)	Sample population/Specialties					
		Pul (n = 110) n (%)	GE (n = 111) n (%)	Paed (n = 123) n (%)	Derma (n = 113) n (%)	GP (n = 113) n (%)	P value
Symptoms and severity							
Child can die from milk allergy reaction (Y)	481 (84.3)	87 (79.0)	90 (81.0)	109 (88.6)	99 (87.6)	96 (84.9)	.21
Chronic nasal problems are symptoms of food allergy (N)	516 (90.5)	112 (91.0)	107 (94.6)	95 (86.3)	102 (90.2)	100 (90.0)	.33
Triggers and environmental risk							
Asthma is an important risk factor for severe anaphylaxis (Y)	521 (91.4)	101 (91.8)	101 (90.9)	113(91.8)	102 (90.2)	104 (92.0)	.99
Food component that causes allergic reaction (protein)	534 (93.6)	100 (90.9)	105 (94.5)	114 (92.6)	106 (93.8)	109 (96.4)	.51
Food allergens are passed from maternal diet into breast milk (Y)	533 (93.5)	105 (95.4)	106 (95.4)	117 (95.1)	104 (92.0)	101 (89.3)	.239
Children with IgE-mediated milk allergies can eat yogurts or cheese with milk (N)	524 (91.9)	101 (91.8)	100 (90.0)	113 (91.8)	106 (93.8)	104 (92.0)	.90
Okay for children with egg allergies to eat egg yolks (N)	543 (95.2)	103 (93.6)	104 (93.6)	119 (96.7)	110 (97.3)	107 (94.6)	.56
Moderate or severe atopic dermatitis is associated with food allergy (25%-50%)	476 (83.5)	87 (79.0)	95 (85.5)	102 (82.9)	92 (81.4)	100 (88.4)	.36
Age group most likely to have food allergies (0-5 y) 1	534 (93.6)	103 (93.6)	105 (94.5)	114 (92.6)	105 (92.9)	107 (94.6)	.96
Teenagers are at higher risk for fatal food allergy vs younger children (Y)	475 (83.3)	87 (79.0)	94 (84.6)	106 (86.1)	94 (83.1)	94 (83.1)	.68
Diagnosis, treatment, and utilization of health care							
There is a cure for food allergy (N)	538 (94.3)	104 (94.5)	106 (95.4)	116 (94.3)	107 (94.6)	105 (92.9)	.95
Daily antihistamine prevents food allergy reaction (N)	519 (91.0)	94 (85.4)	101 (90.9)	117 (95.1)	104 (92.0)	103 (91.1)	.14
I would prescribe epinephrine autoinjector for a child who had anaphylaxis (Y)	547 (95.9)	106 (96.3)	107 (96.3)	119 (96.7)	108 (95.5)	107 (94.6)	.94
The first treatment of choice is epinephrine in case of anaphylaxis(Y)	523 (91.7)	99 (90.0)	102 (91.8)	112 (91.0)	104 (92.0)	106 (93.8)	.88
The rate of preference of IM route for epinephrine injection(Y)	529 (92.8)	101 (91.8)	102 (92.8)	115 (93.4)	106 (93.8)	105 (92.9)	.97
No contraindication to prescribing self-injectable epinephrine (Y)	526 (92.2)	103 (93.6)	105 (94.5)	111 (90.2)	104 (92.0)	103 (91.1)	.73
Timely administration of epinephrine prevents fatal anaphylaxis (most of the time)	522 (91.5)	97 (88.1)	102 (91.8)	117 (95.1)	104 (92.0)	102 (90.2)	.41
Epinephrine injection location (lateral thigh)	460 (80.7)	73 (66.3)	85 (76.5)	106 (93.8)	98 (86.7)	98 (86.7)	.001 ^a
Dose of epinephrine, 27 kg child (EpiPen or Twinject, 0.3 mg of epinephrine)	494 (86.6)	91 (82.7)	93 (83.7)	106 (86.1)	94 (83.1)	110 (97.3)	.006 ^a
Positive skin prick test or RAST result is sufficient food allergy diagnosis (N)	492 (86.3)	100 (90.9)	103 (92.7)	100 (81.3)	94 (83.1)	95 (84.0)	.04 ^a
Total score	514 (90.2)	97 (88.2)	100 (90.5)	111 (91.0)	102 (90.8)	102 (90.9)	.54

Abbreviations: Derm, dermatologist; GE, gastroenterologist; GP, general physician; IgE, immunoglobulin E; N, no; Paed, pediatrician; Pul, pulmonologist; RAST, radioallergen sorbent test; Y, yes.

NOTE: n (%) indicates the number (percentage) of medical clinicians or specialties providing correct answers.

^aSignificance level by χ^2 test. P value less than .05.¹⁴

and skin prick test and radioallergen sorbent test as a diagnostic tool). Relative risk ratios were calculated. A two-sided P value of less than or equal to .05 was considered statistically significant.

Results

Respondent Demographics

Most surveyed medical clinicians (63.8%) were employed in private hospitals and approximately 50% had 10 to 20 years of clinical experience. A total of 45.8% of medical clinicians reported 5% to 10% of all patient visits were with patients with FA. Of the remaining clinicians, 31.3% reported that less than 5% of patient visits were with patients with FA, whereas 22.9% reported that more than 10% of visits were with patients with FA. Children aged 5 to 15 years comprised the largest age group to patients seen for FA across specialties, except for dermatologists, who predominantly saw patients younger than 5 years old for this issue (Table 1).

Knowledge of the Medical Clinicians

The rates of correct responses for each question are summarized in Table 2 and exceeded 80% correct for all individual items. There were no substantial differences in knowledge among the physician specialty groups except for knowledge of the correct location for epinephrine injection and dosage of epinephrine. Among medical clinicians, 80.7% had knowledge of lateral thigh being the correct location for epinephrine injection in children experiencing anaphylaxis. In this aspect, pediatricians (93.8%) scored highest in comparison with others ($P < .01$). A total of 86.6% of medical clinicians had correct knowledge of the dosage of epinephrine. General physicians (97.3%) and pediatricians (86.1%) scored better with regard to the location and dosage of epinephrine than the other specialists ($P < .01$). Gastroenterologists (92.7%), however, scored significantly higher than other specialties ($P = .04$) in terms of knowing that a positive skin prick test result or radioallergen sorbent test result alone is not sufficient for a FA diagnosis. Based on the total scores, 90.4% of the medical clinicians provided appropriate answers, but general

Table 3

Multivariable Regression Relationship of Participant Characteristics and Significant Knowledge of FA

Variable	Relative risk ratio (95% CI)		
	Epinephrine injection location (lateral thigh)	Dose of epinephrine, 27 kg child (Epipen or Twinject, 0.3 mg of epinephrine)	Positive SPT or RAST result is not a sufficient tool for FA diagnosis
Sex			
Male vs female	0.99 (0.94-1.05)	0.99 (0.98-1.05)	0.98 (0.95-1.09)
Practice type			
Private clinic vs private hospital	1.02 (0.98-1.06)	0.98 (0.96-1.04)	0.98 (0.85-1.13)
Government hospital vs private hospital	0.95 (0.88-1.02)	1.04 (0.97-1.13)	1.04 (1.02-1.06) ^a
Years in practice			
<10 vs 10-20	1.03 (0.97-1.09)	0.99 (0.95-1.04)	0.98 (0.90-1.06)
>20 vs 10-20	0.92 (0.86-0.98) ^a	0.90 (0.84-0.97) ^a	0.97 (0.90-1.06)
Patients with FA load per month			
<5% vs 5-10%	0.98 (0.93-1.04)	0.98 (0.97-1.05)	0.97 (0.89-1.04)
>10% vs 5-10%	1.01 (0.97-1.05)	0.95 (0.84-1.07)	0.98 (0.90-1.07)

Abbreviations: CI, confidence interval; FA, food allergy; RAST, radioallergosorbent test; SPT, skin prick test.

^aP value of less than .05.

physicians (95.5%) scored better in terms of knowledge in the above areas. However, when the specialties were compared, these differences were not statistically significant ($P = .54$).

Relatively little variation was seen in the clinical knowledge of FA according to practice type, years in practice, and the number of patients with FA seen per month (Table 3). Participants who had more than 20 years of clinical practice were less likely to know the correct dosage ($P < .01$) or correct location for epinephrine injection ($P = .02$) for the treatment of anaphylactic shock compared with less-experienced clinicians.

Attitude and Practices of Medical Clinicians

Among medical professionals, 30% preferred sending patients with suspected FA for allergy testing. General physicians (80.5%), pediatricians (74.7%), pulmonologists (64.6%), and gastroenterologists (55.9%) considered identifying the cause of food allergy as the most important step to overcome the problem of FA. Most (94.5%) medical clinicians were confident in their ability to care for patients with FA, and 91.4% of participants stated that they would like periodic training sessions for continued education on allergic disease (Table 4).

Table 4

Attitude and Practices of Participants (%) and Comparisons Based on Their Specialty

Questions or variables	Sample population or specialties						P value
	Overall (n = 570) n (%)	Pul (n = 110) n (%)	Gastro (n = 111) n (%)	Paed (n = 123) n (%)	Derma (n = 113) n (%)	GP (n = 113) n (%)	
How often do you refer your patients with suspected FA for allergy testing?							
• Mostly	171 (30)	41 (37.3)	33 (29.8)	32 (26.1)	39 (34.5)	26 (23.1)	.12
• Rarely	399 (70)	69 (62.7)	78 (70.2)	91 (73.9)	74 (65.5)	87 (76.9)	
I am confident in my ability to care for patients with FA (Y)	539 (94.5)	104 (94.5)	106 (95.4)	117 (95.1)	107 (94.6)	108 (95.5)	.99
Which of the following do you think is the most important to help people with food allergies?							
• Promote public awareness campaigns about FA	34 (5.9)	12 (10.9)	1 (0.9)	10 (8.1)	7 (6.1)	4 (3.5)	.001 ^a
• Identify the cause of FA	363 (63.6)	71 (64.6)	62 (55.9)	92 (74.7)	47 (41.7)	91 (80.5)	
• Develop a cure for FA	173 (30.5)	27 (24.5)	48 (43.2)	21 (17.2)	59 (52.2)	18 (15.9)	
Would you like periodic training sessions for allergic diseases? (Y)	521 (91.4)	99 (90)	103 (92.7)	111 (90.2)	102 (90.3)	106 (93.8)	.78

Abbreviations: Derm, dermatologist; FA, food allergy; GE, gastroenterologist; GP, general physician; Paed, pediatrician; Pul, pulmonologist; Y, yes.

^aSignificance level measured by χ^2 test with a P value of less than .05.

Discussion

This study suggests that knowledge on FA among medical clinicians in Hyderabad was high across all the major specialties who routinely care for patients with FA (ie, general practitioners, pediatricians, pulmonologists, dermatologists, and gastroenterologists). This is encouraging because no previous studies have examined FA-related knowledge or attitudes among subspecialties in Indian communities. These findings were in contrast with a study¹⁴ done in Turkey using the same validated questionnaire on 297 general physicians, in which 47.2 % gave correct answers as compared with more than 90% in this study. A similar United States study⁶ on 339 pediatricians and 68 family physicians revealed that 72% of the pediatricians and 65% of the family physicians gave correct answers to the administered FA knowledge questions. The dissimilarity of the scores may be because of the systematic differences in the educational background of the surveyed physicians and the differences in knowledge transfer from more senior clinicians.

In this study, most surveyed medical clinicians reported correct knowledge regarding epinephrine being the treatment of choice in the case of anaphylaxis, the correct location for its administration, and its proper dosage. Among these clinicians, pediatricians were more aware of the fact that lateral thigh is the correct location for epinephrine injection in children, whereas general physicians were more knowledgeable in calculating the dose of the epinephrine based on the weight of the patient. Senior physicians answered anaphylaxis-related questions incorrectly more often, suggesting the need for continuous education and other related training to overcome their knowledge gaps.

Currently, in India, training and specialization in allergy are not common, although gaining more attention. Undergraduate and postgraduate medical students in India are not exposed to teaching and training in allergic diseases. Allergy is not a recognized specialty. Consequently, the quality of allergy care can differ when patients with FA are managed by allergists vs nonallergists. For example, 1 notable Indian nonrandomized interventional study reported that allergy-related symptoms were significantly ($P < .001$) reduced in patients when treated by allergists in comparison with nonallergists.¹⁵ The confirmatory tests used in FA care can be expensive and, as such, patients from a poor economic background often cannot bear the expenses charged by private organizations/hospitals. Our study results suggest that most Indian medical clinicians—at least in the Hyderabad region—do not generally refer patients for allergy testing. At the time of the study, no allergists were practicing in the Hyderabad area.

Despite its increasing global prevalence, many medical training programs in India do not offer formal training in FA. A 2016 study¹⁶ on 60 pediatric residents and 8 academic pediatricians in India reported that 56% of the participants have not received formal education on how to recognize and treat food allergies, whereas 59% claimed not being trained on how to administer injectable epinephrine. In this context, on review, it was seen that medical residents who opted for a “rotation” in an allergy clinic were more aware of common allergic disorders and were more likely to refer patients to the appropriate specialists. More focused training on the setting up of certified diagnostic laboratories and on anaphylaxis and its treatment could help overcome the knowledge gaps among clinicians in India.

With the recent increase in FA and the threat posed by food-induced anaphylaxis, physicians need to be educated regarding the diagnosis and treatment of this condition. A survey of 168 Australian pediatricians¹⁷ reported that pediatricians associated with tertiary allergy services scored higher in questions related to anaphylaxis treatment and were more aware of the tools to be used to diagnose FA. In our study, physicians belonging to government hospitals were more aware of the diagnostic tools to be used, and also, there was an increase in the knowledge of the physicians regarding epinephrine dose and location along with the increase in their clinical experience. Another study done by Al-Herz et al¹⁸ using a self-administered questionnaire reported that among Kuwaiti pediatricians, clinical experience was positively associated with FA knowledge. However, it is notable that among half of the respondents who reported that they felt comfortable evaluating and treating patients with FA, fewer than 1 in 5 passed the questionnaire (ie, correctly answered more than two-thirds of the questions).

Most of the aforementioned studies were either surveyed physicians at a single US medical institution or other smaller countries (eg, Turkey, Kuwait). This study is unique and important because, to the best of our knowledge, it is the first to systematically characterize FA KAP within India, home to 20% of the world's population, and the site of medical education for a substantial number of global physicians. Therefore, the knowledge of Indian physicians is not only important for Indians but also the United States and other countries where these physicians (and their trainees) end up practicing.^{19,20}

This study is not without limitations; the most important of which is that the topic of the survey was disclosed to the physicians before data collection (because they may have had the opportunity to rapidly reeducate themselves regarding FA before the survey). However, we felt that the risk of such potential bias is low because respondents were only included in the study if they gave an appointment for the same day or, at the maximum, within 24 hours for data collection. Thus, it is assumed that the physicians did not have sufficient time (between the scheduling and completion of the survey) to reeducate themselves given their patient load and other commitments. Another potential limitation is that this survey was conducted only in 1 city in India (Hyderabad), which is located in the Southern part of the country and is inhabited by roughly 7 million people. This may limit the generalizability of the resulting findings. The National Family Health Survey reported that, compared with other states in India, private clinics in Hyderabad (the capital and largest city of the Indian state of Telangana and de jure capital of Andhra Pradesh) are preferred by many residents compared with government facilities because of the following reasons: (1) distance from the facility, (2) poor quality of care, and (3) long waiting times. Our study results revealed that most physicians were committed to caring for patients with FA in private practice. Relative to Indian government clinics, private clinics and hospitals are generally more financially stable, better equipped, and have more ready access to other required resources for FA diagnosis (skin prick test, Serum immunoglobulin E testing, and others)

and treatment of FA (epinephrine autoinjectors). Moreover, the questionnaire used was validated for US physicians and pediatricians and it was used in the same language (ie, English for Indian physicians). The survey has not specifically been validated among Indian medical specialists. Hence, there is a need to address the exact level of knowledge of physicians at the national level by targeting a larger population of Indian medical clinicians from different specialties.

In India, the knowledge on FA was high among physicians in Hyderabad, with strengths and weaknesses in each domain. General physicians and pediatricians had more precise knowledge, particularly in the case of anaphylaxis, which in turn reflects the differences in attitude and approach toward their patients. With the increase in FA and anaphylaxis prevalence, it is important for all clinicians of various specialties to be educated in the diagnosis and treatment of FA to decrease the morbidity and mortality in the population among all age groups.

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