Allergy Asthma Immunol Res. 2025 Mar;17(2):271-284
https://doi.org/10.4168/aair.2025.17.2.271
pISSN 2092-7355·eISSN 2092-7363

Allergy, Asthma & Immunology Research AAIR

Brief Communication

Changes of Clinical Practice Patterns of Allergen Immunotherapy in Korea

Hwa Young Lee [1], Sung-Yoon Kang [2], Kyunghoon Kim [3], Ju Hee Kim [4], Gwanghui Ryu [5], Jin-Young Min [6], Kyung Hee Park [7], So-Young Park [8], Myongsoon Sung [9], Youngsoo Lee [10], Eun-Ae Yang [11], Hye Mi Jee [12], Eun Kyo Ha [13], Yoo Seob Shin [10], Yong Won Lee [14], Eun Hee Chung [15], Sun Hee Choi [16], Young-Il Koh [17], Seon Tae Kim [18], Dong-Ho Nahm [10], Jung Won Park [7], Jung Yeon Shim [19], Doo Hee Han [20], Man Yong Han [12], Sang Min Lee [21], Jeong-Hee Choi [22*] The Korean Academy of Asthma Allergy and Clinical Immunology (KAAACI) working group on Allergen Immunotherapy and Allergen

[1]Department of Internal Medicine, Seoul St Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
[2]Division of Pulmonology and Allergy, Department of Internal Medicine, Gil Medical Center, Gachon University College of Medicine, Incheon, Korea
[3]Department of Pediatrics, Seoul National University, College of Medicine, Seoul National University Bundang Hospital, Seongnam, Korea
[4]Department of Pediatrics, Kyung Hee University School of Medicine, Seoul, Korea
[5]Department of Otorhinolaryngology-Head and Neck Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea
[6]Department of Otorhinolaryngology-Head and Neck Surgery, Kyung Hee University Hospital, Kyung Hee University College of Medicine, Seoul, Korea
[7]Department of Internal Medicine, Yonsei University College of Medicine, Seoul, Korea
[8]Department of Internal Medicine, Chung-Ang University College of Medicine, Gwangmyeong, Korea
[9]Department of Pediatrics, Soon Chun Hyang University Gumi Hospital, Gumi, Korea
[10]Department of Allergy and Clinical Immunology, Ajou University School of Medicine, Suwon, Korea
[11]Department of Pediatrics, Daejeon St Mary's Hospital, College of Medicine, The Catholic University of Korea, Daejeon, Korea
[12]Department of Pediatrics, CHA Bundang Medical Center, CHA University School of Medicine, Seongnam, Korea
[13]Department of Pediatrics, Kangnam Sacred Heart Hospital, Hallym University College of Medicine, Seoul, Korea
[14]Division of Allergy & Clinical Immunology, Department of Internal Medicine, Center for Health Policy Research, Catholic Kwandong University College of Medicine, International St. Mary's Hospital, Incheon, Korea
[15]Department of Pediatrics, Chungnam National University School of Medicine, Daejeon, Korea
[16]Department of Pediatrics, Kyung Hee University Hospital at Gangdong, Seoul, Korea
[17]Department of Allergy and Clinical Immunology, Chonnam National University Hospital, Chonnam National University Medical School, Gwangju, Korea
[18]Department of Otolaryngology-Head and Neck Surgery, Gil Medical Center, Gachon University College of Medicine, Incheon, Korea
[19]Department of Pediatrics, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, Korea
[20]Department of Otorhinolaryngology-Head and Neck Surgery, Seoul National University College of Medicine, Seoul, Korea
[21]Department of Internal Medicine, Dankook University College of Medicine, Cheonan, Korea
[22]Department of Pulmonology and Allergy, Hallym University Dongtan Sacred Heart Hospital, Hwaseong, Korea

Received: Jul 22, 2024
Revised: Oct 4, 2024
Accepted: Oct 17, 2024
Published online: Jan 24, 2025

Correspondence to
Jeong-Hee Choi, MD, PhD
Department of Pulmonology and Allergy, Hallym University Dongtan Sacred Heart Hospital, 7 Keunjaebong-gil, Hwaseong 18450, Korea.
Tel: +82-31-8086-2928
Fax: +82-31-8086-2482
Email: mdqueen@hallym.or.kr

ORCID iDs
Hwa Young Lee
https://orcid.org/0000-0002-1582-2256
Sung-Yoon Kang
https://orcid.org/0000-0001-5505-3028
Kyunghoon Kim
https://orcid.org/0000-0002-0707-6839
Ju Hee Kim
https://orcid.org/0000-0002-4945-0753
Gwanghui Ryu
https://orcid.org/0000-0002-3251-399X

ABSTRACT

This study aimed to identify recent changes of AIT treatment behaviors in real-world clinical practice using a questionnaire survey in Korea. The questionnaire on AIT prescriptions and practical experiences was distributed to all members of the Korean Academy of Asthma Allergy and Clinical Immunology in June 2022. The responses were analyzed and compared with the results from 2009 and 2017. In total, 115 responses (10.1%) were collected; 58 (50.4%)

Jin-Young Min
https://orcid.org/0000-0003-1890-2451
Kyung Hee Park
https://orcid.org/0000-0003-3605-5364
So-Young Park
https://orcid.org/0000-0002-5224-3077
Myongsoon Sung
https://orcid.org/0000-0002-6329-286X
Youngsoo Lee
https://orcid.org/0000-0001-8918-9353
Eun-Ae Yang
https://orcid.org/0000-0003-4787-5763
Hye Mi Jee
https://orcid.org/0000-0003-0128-065X
Eun Kyo Ha
https://orcid.org/0000-0001-8863-5729
Yoo Seob Shin
https://orcid.org/0000-0002-9855-3185
Yong Won Lee
https://orcid.org/0000-0002-6174-3479
Eun Hee Chung
https://orcid.org/0000-0001-9380-0151
Sun Hee Choi
https://orcid.org/0000-0002-0554-2250
Young-Il Koh
https://orcid.org/0000-0002-5100-9473
Seon Tae Kim
https://orcid.org/0000-0002-2010-2843
Dong-Ho Nahm
https://orcid.org/0000-0001-5253-6577
Jung Won Park
https://orcid.org/0000-0003-0249-8749
Jung Yeon Shim
https://orcid.org/0000-0001-9367-2233
Doo Hee Han
https://orcid.org/0000-0003-3367-1495
Man Yong Han
https://orcid.org/0000-0002-9077-5779
Sang Min Lee
https://orcid.org/0000-0002-9568-2096
Jeong-Hee Choi
https://orcid.org/0000-0002-0599-875X

Disclosure
There are no financial or other issues that might lead to conflict of interest.

from internal medicine, 34 (29.6%) from pediatricians, and 21 (18.3%) from otolaryngologists. The prescription rate for subcutaneous immunotherapy (SCIT) was 53.8%, showing a decrease from those in 2009 and 2017; however, that for sublingual immunotherapy (SLIT) increased steadily, reaching 17.9% in 2009, 40.3% in 2017, and 46.2% in 2022. The prescription rates for asthma and atopic dermatitis increased by 4.6% and 7.9%, respectively. The most frequently prescribed allergens for SCIT in 2022 were house dust mites (32.9%), pollen (30.6%), and animal dander (28.2%), with the rate for animal dander showing a significant increase from 10.3% in 2009. Most physicians (93%) used mixed allergens for SCIT, with 42.8% using a combination of 5 or more allergens. Fifty-eight (67.4%) respondents reported cases of anaphylaxis during SCIT and 36.2% reported systemic adverse reactions during SLIT. In conclusion, SLIT prescriptions, AIT for asthma and atopic dermatitis, and AIT with animal dander increased significantly from 2009 to 2022. Serial surveys of AIT practices are helpful in identifying the changes of real-world clinical practice of AIT.

Keywords: Allergens; immunotherapy; surveys and questionnaires; asthma; atopic dermatitis; allergic rhinitis

INTRODUCTION

Allergen immunotherapy (AIT) has been used for over 110 years as a specific treatment for allergic diseases, including allergic rhinoconjunctivitis, asthma, and bee venom anaphylaxis.[1] AIT offers benefits such as controlling symptom, improving quality of life, and reducing medication requirements.[2,3] Moreover, AIT alters the progress of allergic diseases by preventing not only new sensitization but also asthma development in patients with allergic rhinitis.[4,5] Despite development of biologics to control allergic diseases, AIT is the only treatment with disease-modifying effects. AIT has been developed to cure allergic diseases in more efficient and safe ways. Although subcutaneous immunotherapy (SCIT) is the traditional method for AIT, sublingual immunotherapy (SLIT) has been developed over 30 years to minimize the systemic adverse reactions of SCIT.[6]

As reported in a survey in 2009, only 69% of the respondents in Korea performed AIT in clinical practice, and barriers such as a lack of facilities and clinical training appear to contribute to negative perceptions.[7] Over the past 13 years, evidence from large-scale clinical trials using AIT and the introduction of new AIT medications to the market have consistently heightened the interest among Korean physicians. Moreover, a questionnaire survey conducted among patients receiving AIT in Korea in 2019 reported a significant satisfaction with the efficacy and safety of AIT (allergic rhinitis, 86.4%; asthma, 85.3%).[8]

In line with these advancements in the level of evidence and awareness of AIT, the working group on AIT and Allergens of the Korean Academy of Asthma Allergy and Clinical Immunology (KAAACI) has published expert opinions on the principles and methods of AIT, which have recently been updated as Korean guidelines.[9-11] Since guideline consensus should reflect the preferences of physicians and prescription patterns in real-world clinical practice, we designed this study during guideline development in 2022 to investigate the changes of AIT practice patterns from the previous survey results conducted in 2009.[7] Questions regarding SLIT were handled separately from SCIT to generate the consensus on SLIT.

MATERIALS AND METHODS

Previously, surveys conducted in 2009 and 2017 had responses from 145 (21.0%) and 143 (21.0%) specialists who were members of the KAAACI, respectively.[7] In 2022, the survey was carried out from June to July using online software (doc.google.com) and email to a total of 1,143 KAAACI members. The questionnaire was comprised of three sections based on previous surveys: demographics, general considerations for AIT, and clinical practices for SCIT and SLIT. There were a total of 46 questions covering personal information, methods, prescription patterns, efficacy measures, and adverse reactions to AIT (Appendix 1). All responses were reviewed and analyzed using descriptive statistics, with results presented as both numbers and their respective percentages.

RESULTS

Changes of the characteristics of the responders and insights for AIT

A total of 115 (10.1%) clinicians who were members of KAAACI responded to the questionnaire over 2 months. **Table 1** presents the variations in respondent characteristics

Table 1. Characteristics of responders to the survey

Variables	2009	2017	2022
No. of responders	145	143	115
Age (yr)			
31–40	67 (46.2)	48 (34.0)	26 (22.6)
41–50	53 (36.6)	47 (33.3)	51 (44.3)
51–60	20 (13.8)	41 (29.1)	31 (27.0)
≥ 61	5 (3.4)	5 (3.5)	7 (6.1)
Specialty			
Internal medicine	62 (42.8)	68 (47.6)	58 (50.4)
Pediatrics	47 (32.4)	46 (32.2)	34 (29.6)
Otolaryngology	30 (32.4)	25 (17.5)	21 (18.3)
Dermatology	2 (1.4)	2 (1.4)	2 (1.7)
Others	4 (2.8)	2 (1.4)	0 (0.0)
Location of work			
Tertiary hospital (≥ 500 beds)	71 (49.0)	100 (69.9)	78 (67.8)
General hospital (30–499 beds)	28 (19.3)	19 (13.3)	14 (12.2)
Private clinic (< 30 beds)	46 (31.7)	24 (16.8)	23 (20.0)
Province in Korea			
Seoul	52 (35.9)	46 (32.2)	38 (33.0)
Gyeonggi	38 (26.2)	37 (25.9)	37 (32.2)
Gwangju	9 (6.2)	2 (1.4)	8 (7.0)
Busan	8 (5.5)	10 (7.0)	4 (3.5)
Daegu	7 (4.8)	8 (5.6)	5 (4.3)
Incheon	5 (3.4)	8 (5.6)	6 (5.2)
Ulsan	3 (2.1)	4 (2.8)	0 (0.0)
Daejeon	2 (1.4)	2 (1.4)	4 (3.5)
Others	21 (14.5)	26 (18.2)	13 (11.3)
AIT prescription			
Yes	100 (69.0)	117 (81.8)	99 (86.1)
No	15 (10.3)	7 (4.9)	3 (2.6)
Currently no, but willing to do	30 (20.7)	19 (13.3)	13 (11.3)
Need for AIT			
Strongly agree	94 (64.8)	123 (86.0)	97 (84.3)
Somewhat agree	49 (33.8)	20 (14.0)	18 (15.7)
Unnecessary	2 (1.4)	0 (0.0)	0 (0.0)

Values are presented as number of patients (%).
AIT, allergen immunotherapy.

https://doi.org/10.4168/aair.2025.17.2.271

according to the year of the survey. The proportion of internal medicine specialists has been continuously increasing over the years, reaching 42.9% in 2009, 47.6% in 2017, and 50.4% in 2022. The distribution of work locations has changed over the years, with an increase in the proportion of tertiary hospitals from 49% (2009) to 69.9% (2017) and 67.8% (2022). The majority of participants (65%) were working in Seoul (33.0%) and Gyeonggi (32.2%) provinces in Korea, with similar distributions in 2022 compared with 2009 or 2017.

Among the participants, 99 (86.1%) were prescribing AIT, representing a significant increase from the number reported in 2009 (69%). The perception of AIT has changed significantly since 2009. In 2017, 86.0% of the participants "strongly agreed" and 14.0% "somewhat agreed" that AIT is needed, and this was a significant shift from the 64.8% "strongly agree" and 33.8% "somewhat agree" figures reported in 2009. The reasons for not undergoing AIT have changed over time. In the three surveys, the most frequent reason for not choosing AIT was a "lack of facilities" (**Fig. 1**). Notably, the participants selected the response option "distrust of therapeutic effects" that decreased by half (5.0%) in 2017 from 10.5% in 2009.

Changes of clinical practice patterns

It is noteworthy that the percentage of respondents prescribing SLIT has continuously increased from 17.9% (2009) to 40.4% (2017) and 46.2% (2022) (**Table 2**). Allergic rhinoconjunctivitis (39.6%) was the most common allergic disease associated with AIT throughout the years. Notably, there have been changes of the indications, with a 4.6% increase in asthma and a 7.9% increase in atopic dermatitis from 2017 to 2022. Over 40% of the participants preferred a skin prick test to identify a specific immunoglobulin E (IgE) before AIT (**Table 2**). Data from 2022 showed that, among 99 participants prescribed AIT, 25 (25.3%) used SCIT only, 13 (13.1%) SLIT only, and 61 (61.6%) both SCIT and SLIT. Specialists in internal medicine (69.8%) and pediatrics (76.9%) preferred to prescribe both SCIT and SLIT, whereas those in otolaryngology (47.4%) tended to prescribe SLIT only. Additionally, the indications for AIT did not differ according to method (data not shown).

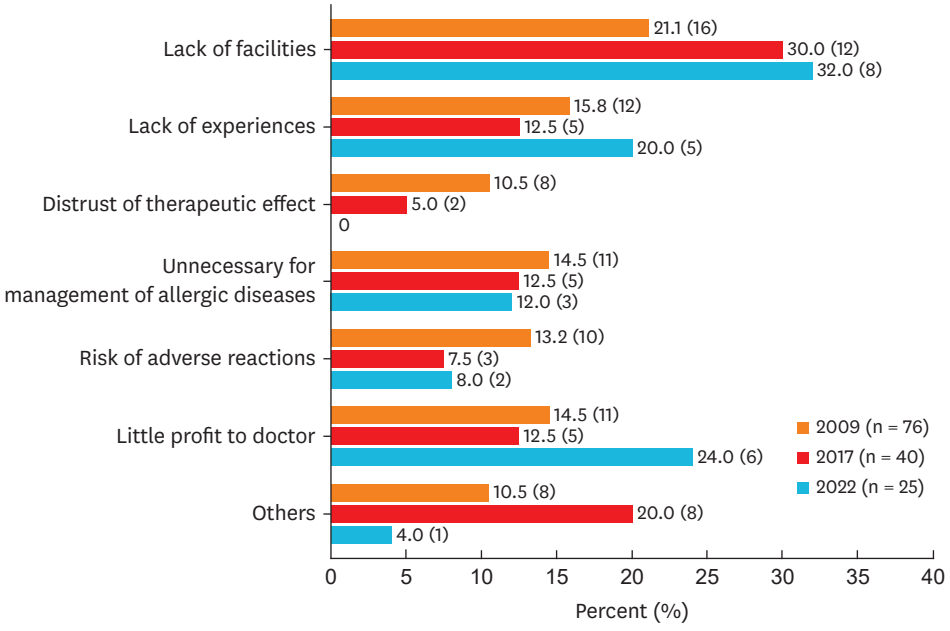

Fig. 1. Reasons for not prescribing allergen immunotherapy.

https://doi.org/10.4168/aair.2025.17.2.271

Table 2. Methods, indications, and tests for AIT (multiple choice answers)

Variables	2009	2017	2022
Methods of AIT			
Subcutaneous immunotherapy	92 (82.1)	83 (59.7)	86 (53.8)
Sublingual immunotherapy	20 (17.9)	56 (40.3)	74 (46.2)
All responders	112 (100.0)	139 (100.0)	160 (100.0)
Diseases indicated for AIT			
Allergic rhinoconjunctivitis		122 (47.7)	97 (39.6)
Asthma		74 (28.9)	82 (33.5)
Atopic dermatitis		32 (12.5)	50 (20.4)
Food allergy		17 (6.6)	10 (4.1)
Bee venom allergy		11 (4.3)	6 (2.4)
All responders		256 (100.0)	245 (100.0)
Preferred tests to identify specific IgE			
Skin prick test	94 (46.1)	103 (42.7)	82 (41.2)
ImmunoCAP™	54 (26.5)	86 (35.7)	85 (42.7)
MAST	53 (26.0)	49 (20.3)	32 (16.1)
Others	3 (1.5)	3 (1.2)	0 (0.0)
All responders	204 (100.0)	241 (100.0)	199 (100.0)

Values are presented as number of patients (%).
AIT, allergen immunotherapy; IgE, immunoglobulin E; MAST, multiple allergen simultaneous test.

Table 3 summarizes the responses regarding allergen selection and AIT methods. The most frequently selected allergens were house dust mite (HDM) throughout the survey periods. Following HDM, pollen and animal dander were also common allergens treated by AIT. Specifically, the proportion of animal dander among selected allergens has more than

Table 3. Prescription and side effects of allergen immunotherapy (Multiple choice answers)

Variables	2009	2017	2022
Allergens for SCIT			
House dust mite	91 (42.5)	80 (37.6)	84 (32.9)
Pollens	67 (31.3)	66 (31.0)	78 (30.6)
Animal dander	22 (10.3)	44 (20.7)	72 (28.2)
Fungus	19 (8.9)	10 (4.7)	10 (4.7)
Bee venom	10 (4.7)	9 (4.2)	3 (1.2)
Cockroach	5 (2.3)	4 (1.9)	6 (2.4)
Food	0 (0.0)	0 (0.0)	1 (0.4)
All responders	214 (100.0)	213 (100.0)	255 (100.0)
No. of mixed allergens for SCIT			
1		9 (12.5)	6 (7.0)
2		26 (36.1)	6 (7.0)
3		13 (18.1)	16 (18.6)
4		10 (13.9)	22 (25.6)
≥ 5		14 (19.4)	36 (42.8)
All responders		72 (100.0)	86 (100.0)
Methods of build-up phase for SCIT			
Conventional	86 (72.3)	67 (69.1)	69 (50.7)
Cluster	14 (11.8)	13 (13.4)	40 (29.4)
Rush (including ultra-rush)	19 (16.0)	17 (17.5)	27 (19.9)
All responders	119 (100.0)	97 (100.0)	136 (100.0)
Premedication use			
SCIT		20/83 (24.1)*	51/86 (59.3)†
SLIT			28/73 (38.4)‡
Anaphylaxis during SCIT	64/92 (69.6)	45/83 (54.2)	58/86 (67.4)
Adverse reactions during SLIT	8/20 (40.0)	25/56 (44.6)	58/74 (78.4)
Local reaction			37/74 (63.8)
Systemic reaction			21/74 (36.2)

Values are presented as number of patients (%).
SCIT, subcutaneous immunotherapy; SLIT, sublingual immunotherapy.
*Total n = 83, †Total n = 86, ‡Total n = 73.

https://doi.org/10.4168/aair.2025.17.2.271

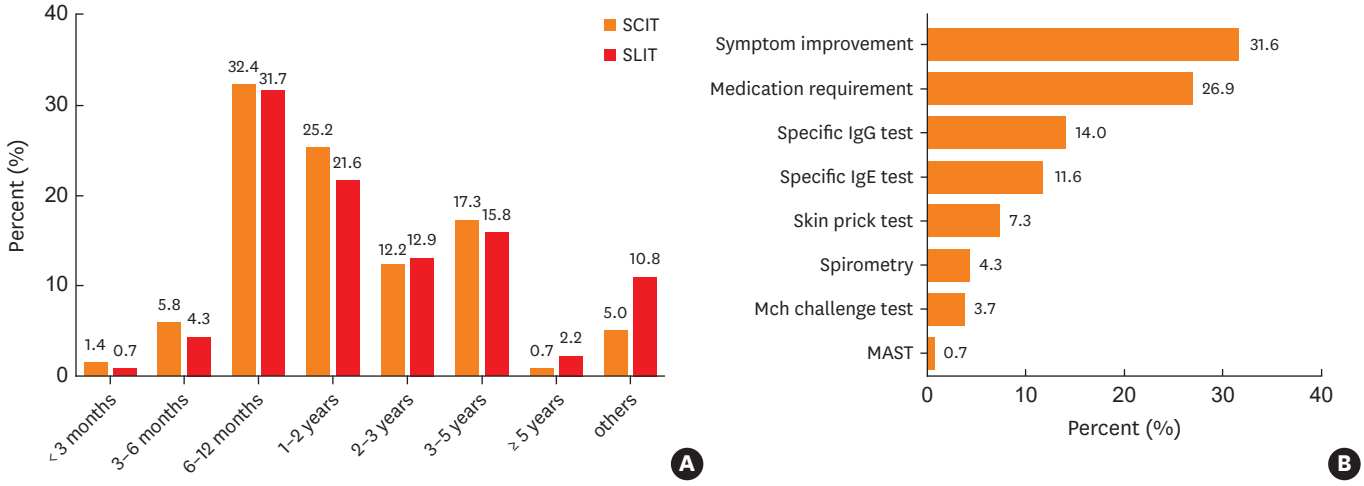

Fig. 2. Measurement of AIT efficacy. (A) Time points and (B) preferred tests for the measurement of AIT efficacy.
AIT, allergen immunotherapy; SCIT, subcutaneous immunotherapy; SLIT, sublingual immunotherapy; IgG, immunoglobulin G; IgE, immunoglobulin E; Mch, methacholine; MAST, multiple allergen simultaneous test.

doubled in 2022 compared to 2009 (10.3% in 2009 and 28.2% in 2022). In 2022, 93% of the respondents used mixed allergens for SCIT, with 42.8% using mixtures composed of 5 or more allergens. This marked a significant change from 2017, when the most frequent number of allergens used was two (36.1%). Regarding the schedules for the build-up phase of SCIT, participants using the cluster method significantly increased in 2022 (29.4%) compared with 2009 (11.8%) and 2017 (13.4%). Approximately 20% of the participants were using the rush (or ultra-rush) method in 2022.

Adverse reactions and efficacy measures in AIT

Fifty-nine percent of the study participants reported that they prescribed premedication for SCIT, and 38.4% gave premedication for SLIT (**Table 3**). The most common premedications were H1-anitihistamine (SCIT: 51 [59.3%] vs. SCIT: 28 [38.4%]) and oral corticosteroids (SCIT: 12 [14.1%] vs. SLIT: 1 [1.4%]), both were used significantly more frequently in SCIT. The prescription rates of H1-antihistamine, leukotriene antagonist and oral corticosteroid were significantly higher in participants who used cluster or rush (ultra-rush) protocols than in those who used the conventional method only (**Supplementary Table S1**). Regarding adverse reactions during SCIT, 67.4% of participants experienced anaphylaxis. During SLIT, systemic adverse reactions were reported by 36.2% of participants including one with anaphylaxis.

Fig. 2 illustrates the time points and the preferred tests for measuring AIT efficacy. One-third of the participants measured efficacy in 6–12 months, with similar distributions for both SCIT and SLIT (**Fig. 2A**). As shown in **Fig. 2B**, the most frequently used parameters for determining efficacy were symptom improvement (31.6%) and medication requirements (26.9%).

DISCUSSION

This study describes changes of the patterns of AIT prescription over 13 years since 2009 through surveys conducted among allergy specialists in Korea. The clinical implementation rate of AIT and an awareness of its necessity have steadily increased since 2009. Notably, the

https://doi.org/10.4168/aair.2025.17.2.271

prescription rates of SLIT increased by more than 2.5 times compared to 2009. Moreover, the proportions of asthma and atopic dermatitis as indications for AIT increased, and those for animal dander doubled compared with 2009. These changes of AIT prescription patterns reflect recent advancements in SLIT medications, changes in the level of clinical evidence, and awareness of the usefulness of AIT for different diseases.

In 1998, SLIT was recognized by the World Health Organization as a treatment that could replace SCIT because of its lower frequency of systemic adverse reactions.[6,10,12,13] Subsequently, evidence has accumulated regarding the efficacy and safety of SLIT through Cochrane and systematic literature reviews.[14,15] The European Academy of Allergy and Clinical Immunology recommended SLIT for achieving symptom improvement (Grade A) in adult patients with moderate to severe allergic rhinoconjunctivitis, and for asthma prevention in pediatric patients (Grade B).[16] Currently, 4 different SLIT medications are available in Korea for HDM allergen. The phenomenon of more than doubling the number of SLIT treatments from 2009 to 2017 and 2022, as observed in this study, appears to be due to mproved levels of evidence for SLIT and the introduction of various medications into the market.

AIT for asthma treatment has been proven to control symptoms, reduce medication requirements, and decrease airway hyper-responsivenss.[17,18] SLIT for treating HDM is recommended for patients with asthma from step 1 treatment based on the results of a large scale randomized controlled clinical trial published in 2016, which showed reductions in inhaled corticosteroid doses.[19,20] The results of our present survey also revealed that asthma was the second most frequent indication for AIT following allergic rhinoconjunctivitis. A notable observation was that the prescription rate for patients with atopic dermatitis has been increasing since 2017. While there has been controversy regarding the efficacy of AIT for atopic dermatitis due to the heterogeneity in results from clinical trials, a meta-analysis published in 2023 reported reductions in SCORing Atopic Dermatitis scores and improvements in quality of life.[21] As a result, the KAAACI guidelines upgraded the level of evidence to moderate in 2023.[9] Moreover, a recent clinical trial performed in Korea reported symptom improvement, decreased medication use, and changes in levels of blood-specific IgE or immunoglobulin G by AIT for animal dander in patients with atopic dermatitis.[22] Future clinical trials of AIT for treating atopic dermatitis should provide additional evidence.

The increase in allergen mixing for SCIT, from 64% in 2017 to 93% in 2022 is noteworthy, especially as 42.5% of respondents used mixtures containing ≥ 5 allergens. Previous literature indicated that polysensitization is common (60%-80%) among patients with respiratory allergic diseases.[23] While recommendations regarding the number of mixed allergens differ between Europe and the US,[24-26] recent Korean guideline recommends the selection a single or minimal number of clinically relevant allergens due to diminished therapeutic efficacy with multiple allergens and comparable effects between 2 approaches in real-world observational studies.[9,27,28] Although debate persists regarding AIT efficacy based on allergen mixtures, physicians should consider the clinical relevance of including allergens and minimize their number within SCIT.

Another interesting finding from the present study was the substantial increase in the prescription rates of premedication prior to initiation of AIT, and the changes of methods for the build-up phase, from conventional to cluster or rush in 2022 (**Table 3**). Although this study has limited ability to suggest causal relationships, the increased premedication prescription rates in 2022 versus 2017 could be attributed to the introduction of new SCIT

https://doi.org/10.4168/aair.2025.17.2.271

agents and changes of build-up treatment methods. Given that cluster or rush therapy requires intensive monitoring and preparation for adverse reactions, these results may be feasible due to the characteristics of the respondents, with over 60% working at tertiary hospitals. Since there were higher agreement rates for AIT in 2022 compared with 2009, and over 80% of the respondents were currently carrying out AIT, it seems that allergists in Korea have been actively embracing AIT beyond conventional methods by integrating proactive management strategies.

Our study has several limitations. First, this is a descriptive study of the results of a survey conducted in KAAACI members. We were unable to analyze statistical differences due to the inconsistent responses from individual questionnaires across different years. Second, the expansion of private medical insurance or availability of new therapeutic options, including novel AIT drugs or biologics, may have influenced the observed outcomes. Third, there may be selection bias caused by the demographics of the respondents, who lived predominantly in Seoul/Gyeonggi province and worked in tertiary hospitals, as the survey was conducted among current KAAACI members, and excluded non-members. However, a strength of this study lies in its ability to compare sequential survey results from 2009, 2017 and 2022 among Korean allergy specialists.

In conclusion, patterns of clinical practice and prescription rates for AIT have changed in response to elevated levels of evidence for AIT globally and the availability of AIT medications in the market. Furthermore, the clinical application of biologics has recently expanded, both in the treatment of allergic diseases and in combination with AIT, to enhance its safety, efficacy, and tolerability.[29-32] Future studies are warranted to address unmet needs, including the clinical implications of biologics combined with AIT.

SUPPLEMENTARY MATERIAL

Supplementary Table S1

Comparison of premedication agents among respondents using conventional, non-conventional methods and SLIT

REFERENCES

1. Jutel M, Agache I, Bonini S, Burks AW, Calderon M, Canonica W, et al. International consensus on allergy immunotherapy. J Allergy Clin Immunol 2015;136:556-68. PUBMED | CROSSREF
2. Durham SR, Emminger W, Kapp A, de Monchy JG, Rak S, Scadding GK, et al. SQ-standardized sublingual grass immunotherapy: confirmation of disease modification 2 years after 3 years of treatment in a randomized trial. J Allergy Clin Immunol 2012;129:717-25.e5. PUBMED | CROSSREF
3. Jutel M, Kosowska A, Smolinska S. Allergen immunotherapy: past, present, and future. Allergy Asthma Immunol Res 2016;8:191-7. PUBMED | CROSSREF
4. Niggemann B, Jacobsen L, Dreborg S, Ferdousi HA, Halken S, Høst A, et al. Five-year follow-up on the PAT study: specific immunotherapy and long-term prevention of asthma in children. Allergy 2006;61:855-9. PUBMED | CROSSREF
5. Di Bona D, Plaia A, Leto-Barone MS, La Piana S, Macchia L, Di Lorenzo G. Efficacy of allergen immunotherapy in reducing the likelihood of developing new allergen sensitizations: a systematic review. Allergy 2017;72:691-704. PUBMED | CROSSREF
6. Passalacqua G, Bagnasco D, Canonica GW. 30 years of sublingual immunotherapy. Allergy 2020;75:1107-20. PUBMED | CROSSREF

7. Hur GY, Kim TB, Han MY, Nahm DH, Park JW;; Allergen and Immunotherapy Work Group of the Korean Academy of Asthma, Allergy and Clinical Immunology (KAAACI). A survey of the prescription patterns of allergen immunotherapy in Korea. Allergy Asthma Immunol Res 2013;5:277-82. PUBMED | CROSSREF
8. Shin YS, Jung JW, Park JW, Choi JH, Kwon JW, Lee S, et al. Clinical efficacy of allergen-specific immunotherapy from patient and physician perspectives. Yonsei Med J 2019;60:446-53. PUBMED | CROSSREF
9. Lee HY, Lee SM, Kang SY, Kim K, Kim JH, Ryu G, et al. KAAACI guidelines for allergen immunotherapy. Allergy Asthma Immunol Res 2023;15:725-56. PUBMED | CROSSREF
10. Min JY, Jee HM, Lee HY, Kang SY, Kim K, Kim JH, et al. The KAAACI guidelines for sublingual immunotherapy. Allergy Asthma Immunol Res 2024;16:9-21. PUBMED | CROSSREF
11. Hur GY, Kim TB, Kim ST, Han MY, Nahm DH, Lee YW, et al. Allergy immunotherapy. Korean J Asthma Allergy Clin Immunol 2010;30:153-83.
12. Scadding GK, Brostoff J. Low dose sublingual therapy in patients with allergic rhinitis due to house dust mite. Clin Allergy 1986;16:483-91. PUBMED | CROSSREF
13. Bagnasco M, Mariani G, Passalacqua G, Motta C, Bartolomei M, Falagiani P, et al. Absorption and distribution kinetics of the major Parietaria judaica allergen (Par j 1) administered by noninjectable routes in healthy human beings. J Allergy Clin Immunol 1997;100:122-9. PUBMED | CROSSREF
14. Radulovic S, Calderon MA, Wilson D, Durham S. Sublingual immunotherapy for allergic rhinitis. Cochrane Database Syst Rev 2010;2010:CD002893. PUBMED | CROSSREF
15. Nelson H, Cartier S, Allen-Ramey F, Lawton S, Calderon MA. Network meta-analysis shows commercialized subcutaneous and sublingual grass products have comparable efficacy. J Allergy Clin Immunol Pract 2015;3:256-66.e3. PUBMED | CROSSREF
16. Roberts G, Pfaar O, Akdis CA, Ansotegui IJ, Durham SR, Gerth van Wijk R, et al. EAACI guidelines on allergen immunotherapy: allergic rhinoconjunctivitis. Allergy 2018;73:765-98. PUBMED | CROSSREF
17. Lin SY, Erekosima N, Kim JM, Ramanathan M, Suarez-Cuervo C, Chelladurai Y, et al. Sublingual immunotherapy for the treatment of allergic rhinoconjunctivitis and asthma: a systematic review. JAMA 2013;309:1278-88. PUBMED | CROSSREF
18. Abramson MJ, Puy RM, Weiner JM. Injection allergen immunotherapy for asthma. Cochrane Database Syst Rev 2010;4:CD001186. PUBMED | CROSSREF
19. Global initiative for Asthma. Global strategy for the diagnosis, management and prevention strategy document [Internet]. Fontana (WI): Global initiative for Asthma; 2024 [cited 2024 May 25]. Available from: https://ginasthma.org/.
20. Virchow JC, Backer V, Kuna P, Prieto L, Nolte H, Villesen HH, et al. Efficacy of a house dust mite sublingual allergen immunotherapy tablet in adults with allergic asthma: a randomized clinical trial. JAMA 2016;315:1715-25. PUBMED | CROSSREF
21. Yepes-Nuñez JJ, Guyatt GH, Gómez-Escobar LG, Pérez-Herrera LC, Chu AWL, Ceccaci R, et al. Allergen immunotherapy for atopic dermatitis: systematic review and meta-analysis of benefits and harms. J Allergy Clin Immunol 2023;151:147-58. PUBMED | CROSSREF
22. Chu H, Park KH, Kim SM, Lee JH, Park JW, Lee KH, et al. Allergen-specific immunotherapy for patients with atopic dermatitis sensitized to animal dander. Immun Inflamm Dis 2020;8:165-9. PUBMED | CROSSREF
23. Demoly P, Passalacqua G, Pfaar O, Sastre J, Wahn U. Management of the polyallergic patient with allergy immunotherapy: a practice-based approach. Allergy Asthma Clin Immunol 2016;12:2. PUBMED | CROSSREF
24. Burbach GJ, Heinzerling LM, Edenharter G, Bachert C, Bindslev-Jensen C, Bonini S, et al. GA(2)LEN skin test study II: clinical relevance of inhalant allergen sensitizations in Europe. Allergy 2009;64:1507-15. PUBMED | CROSSREF
25. Mahler V, Esch RE, Kleine-Tebbe J, Lavery WJ, Plunkett G, Vieths S, et al. Understanding differences in allergen immunotherapy products and practices in North America and Europe. J Allergy Clin Immunol 2019;143:813-28. PUBMED | CROSSREF
26. Cox L, Jacobsen L. Comparison of allergen immunotherapy practice patterns in the United States and Europe. Ann Allergy Asthma Immunol 2009;103:451-59. PUBMED | CROSSREF
27. Shah-Hosseini K, Mioc K, Hadler M, Karagiannis E, Mösges R. Optimum treatment strategies for polyallergic patients - analysis of a large observational trial. Curr Med Res Opin 2015;31:2249-59. PUBMED | CROSSREF
28. Ciprandi G, Incorvaia C, Puccinelli P, Scurati S, Masieri S, Frati F. The POLISMAIL lesson: sublingual immunotherapy may be prescribed also in polysensitized patients. Int J Immunopathol Pharmacol 2010;23:637-40. PUBMED | CROSSREF
29. Casale TB, Busse WW, Kline JN, Ballas ZK, Moss MH, Townley RG, et al. Omalizumab pretreatment decreases acute reactions after rush immunotherapy for ragweed-induced seasonal allergic rhinitis. J Allergy Clin Immunol 2006;117:134-40. PUBMED | CROSSREF

30. Corren J, Larson D, Altman MC, Segnitz RM, Avila PC, Greenberger PA, et al. Effects of combination treatment with tezepelumab and allergen immunotherapy on nasal responses to allergen: a randomized controlled trial. J Allergy Clin Immunol 2023;151:192-201. PUBMED | CROSSREF

31. Corren J, Saini SS, Gagnon R, Moss MH, Sussman G, Jacobs J, et al. Short-term subcutaneous allergy immunotherapy and dupilumab are well tolerated in allergic rhinitis: a randomized trial. J Asthma Allergy 2021;14:1045-63. PUBMED | CROSSREF

32. Olivieri B, Günaydın FE, Corren J, Senna G, Durham SR. The combination of allergen immunotherapy and biologics for inhalant allergies: exploring the synergy. Ann Allergy Asthma Immunol 2024;S1081-1206(24)00365-X. PUBMED | CROSSREF

Appendix 1. Contents of the survey

1. Please select your age.

① 21–30 ② 31–40 ③ 41–50 ④ 51–60 ⑤ ≥ 61 years

2. Please select your specialty.

① Internal medicine ② Pediatrics ③ Otolaryngology ④ Dermatology ⑤ Others

3. Please select the classification of your current medical institution.

① Private clinic (< 30 beds) ② Hospital (30–99 beds) ③ General hospital (100–499 beds)
④ Tertiary hospital (≥ 500 beds) ⑤ Others

4. Please select the current location of your institution.

① Seoul ② Busan ③ Daegu ④ Incheon ⑤ Gwangju ⑥ Daejun ⑦ Ulsan ⑧ Sejong
⑨ Gyeonggi ⑩ Gangwon ⑪ Chungcheong ⑫ Jeolla ⑬ Gyeongsang ⑭ Jeju

5. Do you agree about the need of allergen immunotherapy?

① Strongly agree ② Somewhat agree ③ Unnecessary

6. Are you currently performing allergen immunotherapy?

① Yes ② No ③ Currently no, but willing to do

7. Please select the reason of not performing allergen immunotherapy.

① Lack of facilities ② Lack of experiences ③ Distrust of therapeutic effect ④ Risk of adverse reactions
⑤ Little profit to doctors ⑥ Others

8. Do you get a permission from patients before starting allergen immunotherapy?

① Yes ② No

9. Please select the allergic diseases for which you prescribe allergen immunotherapy. (multiple choice)

① Asthma ② Rhinoconjunctivitis ③ Atopic dermatitis ④ Bee venom allergy
⑤ Food allergy ⑥ Others

10. What is the most frequent allergic disease for which you prescribe allergen immunotherapy?

① Asthma ② Rhinoconjunctivitis ③ Atopic dermatitis ④ Bee venom allergy ⑤ Food allergy

(continued to the next page)

Appendix 1. (Continued) Contents of the survey

11. What is the mean, the highest, the lowest age of your patients ongoing allergen immunotherapy?
(1) Subcutaneous immunotherapy
① Mean age ( ) ② Lowest age ( ) ③ Highest age ( )
(2) Sublingual immunotherapy
① Mean age ( ) ② Lowest age ( ) ③ Highest age ( )

12. What is your primary reason for prescribing allergen immunotherapy? (multiple choice)
① Disease severity ② Quality of life ③ To decrease medication requirements
④ Adverse reaction of allergic medication ⑤ To prevent further allergen sensitization
⑥ To prevent the development of asthma from rhinitis ⑦ Requests from patients/their family members
⑧ Low compliance to allergic medication

13. Please select the methods to identify the presence of allergen specific IgE. (multiple choice)
① Skin prick test ② Specific IgE test (immunocap, IMMULITE)
③ Multiple specific IgE test (MAST, Advansure) ④ Others

14. Please select your currently prescribing immunotherapy (multiple choice)
① Subcutaneous immunotherapy (SCIT) ② Sublingual immunotherapy (SLIT)

15. What is the number of patients currently prescribing SCIT?
① ≤ 10 ② 11–30 ③ 31–50 ④ 51–100 ⑤ > 100

16. Please select allergens for SCIT (multiple choice)
① House dust mite ② Fungus ③ Pollens ④ Cockroach ⑤ Animal dander ⑥ Food
⑦ Bee venom ⑧ Others

17. Please select the manufacturers of the allergens you are prescribing. (multiple choice)
① Allergopharma (Novo-Helisen®) ② Allergy Therapeutics (Tyrosine®) ③ Hollister-Stier ④ Others

18. Do you usually use mixtures of two or more allergens?
① Yes ② No

19. If you use mixtures, how many allergens (in maximum) do you mix?
① 2 ② 3 ③ 4 ④ 5 ⑤ ≥ 6 species

20. Do you mix the allergens yourself?
① Yes (doctors, nurses, pharmacist) ② No

(continued to the next page)

Appendix 1. (Continued) Contents of the survey

21. Who decides the dose of maintenance therapy?
① Doctors ② Follow manufactures' directions

22. Please select the methods of build-up phase. (multiple choice)
① Conventional ② Cluster ③ Rush (including ultra-rush)

23. Please select the interval of maintenance dose injections.
① 2 weeks ② 3 weeks ③ 4 weeks ④ 6 weeks ⑤ 8 weeks ⑥ Others

24. Who performs the subcutaneous injection for immunotherapy?
① Doctors ② Nurses ③ Nursing assistants ④ Others

25. What kinds of premedication do you prescribe before SCIT? (multiple choice)
① H1-antihistamine ② Pseudoephedrine ③ Leukotriene antagonist ④ Oral corticosteroid
⑤ None ⑥ Others

26. Have you ever experienced anaphylaxis during SCIT?
① Yes ② No

27. Have you ever stopped prescribing SCIT due to the experience of anaphylaxis?
① Yes (Permanently stop) ② Yes (Change to SLIT) ③ No (Continue SCIT)

28. Please select the manufactures of SLIT medication you are currently prescribing. (multiple choice)
① Actair ② Staloral ③ Lais ④ Acarizax

29. What is the number of patients currently prescribing SLIT?
① ≤ 10 ② 11–30 ③ 31–50 ④ 51–100 ⑤ > 100

30. Have you ever experienced any adverse reactions during SLIT?
① Yes ② No

31. Please select the symptoms of adverse reactions caused by SLIT. (multiple choice)
① Oral itching/edema ② Systemic urticaria ③ Dyspnea ④ Abdominal pain ⑤ Anaphylaxis ⑥ Others

32. What kinds of premedication do you prescribe before SLIT? (multiple choice)
① H1-antihistamine ② Pseudoephedrine ③ Leukotriene antagonist ④ Oral corticosteroid
⑤ None ⑥ Others

(continued to the next page)

Appendix 1. (Continued) Contents of the survey

33. Have you ever stopped prescribing SLIT due to the experience of adverse reactions?
① Yes (Permanently stop) ② Yes (Change to SCIT) ③ No (Continue SLIT)

34. What was the main adverse reaction which made you stop prescribing SLIT permanently? ( )

35. Please select the methods you prefer to measure the efficacy of allergen immunotherapy. (multiple choice)
① Patients' symptom improvement ② Patients' medication requirements ③ Skin prick test
④ Specific IgE test ⑤ MAST ⑥ Specific IgE test ⑦ Spirometry ⑧ Methacholine challenge test
⑨ Others

36. Please select the time-points of the efficacy measure after starting allergen immunotherapy. (multiple choice)
(1) SCIT
① < 3 months ② 3–6 months ③ 6 months-1 year ④ 1–2 years ⑤ 2–3 years ⑥ 3–5 years
⑦ ≥ 5 years ⑧ Others
(2) SLIT
① < 3 months ② 3–6 months ③ 6 months–1 year ④ 1–2 years ⑤ 2–3 years ⑥ 3–5 years
⑦ ≥ 5 years ⑧ Others

37. How long do you recommend patients to maintain the allergen immunotherapy? (multiple choice)
(1) SCIT
① 1–2 years ② 2–3 years ③ 3–5 years ④ ≥ 5 years ⑤ Others
(1) SLIT
① 1–2 years ② 2–3 years ③ 3–5 years ④ ≥ 5 years ⑤ Others

https://doi.org/10.4168/aair.2025.17.2.271