

Evolving patterns in the diagnosis and management of allergy-mediated disorders

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Background: This analysis explores the increasing heterogeneity of trends in allergy management under the premise that the practice of allergy has undergone significant changes in national economics, healthcare delivery, and treatment options from 2007 to 2016.

Methods: Centers for Medicare and Medicaid Services (CMS) data were obtained for: (1) temporal trends in allergy immunotherapy injection (Current Procedural Terminology [CPT] codes 95115, 95117) and testing (CPT 95004, 95024) from 2007 to 2016; (2) geographic trends; and (3) practitioners administering immunotherapy. Although there are no sublingual immunotherapy (SLIT) CPT codes, billing for unlisted allergy/immunologic services (CPT 95199) were obtained.

Results: Since 2007, there were 99.5 million allergy tests and 33.5 million immunotherapy injections billed to Medicare beneficiaries. Increases in testing have outpaced rising immunotherapy administration (49.7% vs 19.6% increase). Significant regional variation in testing rates was noted, with the greatest ratio of testing to immunotherapy in the South (0.35) and smallest ratio in the Northeast (0.18). The maximum unlisted allergy services billed was 594 (of which includes SLIT), compared to annual subcutaneous

immunotherapy (SCIT) totals in the millions. The majority of immunotherapy in 2016 was administered by allergists/immunologists (51.6%) followed by otolaryngologists (31.2%), trends that have remained consistent since 2012.

Conclusion: Physicians have been more aggressive in the workup of allergy-mediated disorders in recent years. Although differences in allergen load exist, there is tremendous geographic variation in the ratio of testing to immunotherapy. While the role otolaryngologists play in immunotherapy remains stable, allergists manage the majority of patients, reinforcing the importance of interdisciplinary cooperation and outreach. SLIT does not appear to play a significant role in this population. © 2018 ARS-AAOA, LLC.

Key Words:

allergy immunotherapy; allergen immunotherapy; Medicare; asthma; allergic rhinitis; geographic disparity

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Allergy-related illness, including allergic rhinitis, rhinosinusitis, and asthma, impact millions of individuals

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worldwide. According to the World Allergy Association, the prevalence of these conditions has continued to rise in the industrialized world for over 50 years.¹ Moreover, allergic rhinitis impacts 20 to 40 million people in the United States.² Among the few specialties that share the role in managing these patients, otolaryngologists play a significant role.³⁻⁵

Allergic disease can be managed through environmental control, pharmacologic intervention and immunotherapy.⁶

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Although these efforts merely provide symptomatic control, allergen immunotherapy (AIT) is the primary disease-modifying treatment currently available for the management of allergic disease.^{7,8} After diagnostic allergic skin testing, patients undergoing AIT are sequentially administered increasing doses of allergen over a period of months to years. In turn, through several proposed immunologic mechanisms, the inappropriate allergic response is modulated and ultimately blunted.⁹ AIT is divided into subcutaneous immunotherapy (SCIT) and sublingual immunotherapy (SLIT), based on route of allergen administration. Although SCIT has been employed for a longer period of time, the use of SLIT has also become of increasing interest. Despite decades of widespread practice in Europe, SLIT has only recently become a component of managing chronic allergic conditions in this country. This is in part due to differences in allergen extract availability and regulations in extract formulation.¹⁰

To our knowledge, there are no previous population-based studies evaluating trends in the diagnosis and management of allergic disease. Our primary objectives were twofold: (1) to investigate nationwide data delineating both temporal and geographic trends in the utility of allergy testing and AIT in light of recent changes in national economics, health-care delivery, and allergy treatment options; and (2) to characterize otolaryngologists' contributions in AIT administration compared to other specialists.

Materials and methods

The most recent available data, as of November 2017, was retrieved from the Centers for Medicare and Medicaid Services (CMS) online site. Statistics provided by CMS have been used in numerous previous studies to characterize national trends.^{11–15} Temporal trends were determined through utilization of Medicare Part B National files for years 2007 through 2015. The following Current Procedural Terminology (CPT) codes were investigated: single and multiple antigen injection immunotherapy (95115 and 95117, respectively); pinprick test (95004); intradermal testing (95024); and unlisted allergy or clinical immunologic service (95199). The latter was included to account for SLIT, a therapy currently not assigned to a unique CPT code. For geographic trends, individual carrier data from 2016, the most recent year available, were retrieved. This is useful as each state is assigned 1 or more carriers codes which in turn provide billing statistics. The total number of allergy immunotherapy and skin testing were collected based on the aforementioned CPT codes. This information was then organized into subregion and regions based on the U.S. Census Bureau. To characterize individual trends among physicians, we accessed Medicare Provider Utilization and Payment Data and compiled a list of providers who billed for our CPT codes of interest. This data was further organized by provider specialty.

Statistical analysis

Our study was conducted using chi-square analysis with 2-tailed *p* values using threshold of values <0.05. Statistical calculations were conducted using SPSS version 20 (IBM Corp., Armonk, NY). Data collection and analysis was completed November 2017.

Results

Temporal trends

From 2007 through 2016, there were 99,523,238 allergy-testing services billed to Medicare compared to 33,533,649 immunotherapies billed. Over the past decade, the number of allergy immunotherapy services billed increased from 3,132,178 in 2007 to 3,746,652 in 2016, an increase of 19.6% (Fig. 1). The amount of diagnostic testing services billed during this time period increased from 8,295,466 in 2007 to 12,419,054 in 2016, an increase of 49.7%. For comparison, the number of Medicare beneficiaries increased from 44,263,111 to 57,130,741 (29.1% increase). As testing increased faster than the growth of beneficiaries while immunotherapy grew at a smaller rate, the ratio of therapy to testing decreased during this decade (Fig. 1).

Specialty characteristics

During the most recent year for which individual practitioner information was available, physicians trained in allergy/immunology comprised a majority (51.6%) practitioners administering immunotherapy, followed by otolaryngologists (31.2%) (Table 1). Comparison between 2012 (the first year for which specialty-specific data were available) and 2015 demonstrated the role of otolaryngologists in allergy immunotherapy has been stable (Table 1). Notably, a portion of allergy immunotherapies was directly billed by physician extenders (1.9% physician assistants, 4.3% nurse practitioners).

Geographic trends

In 2012, the majority of immunotherapy codes were billed in the South (54.0%), followed by the Midwest (17.1%), West (14.7%), and Northeast (14.2%). During the most recent year of geographic data available (2016), the majority of immunotherapy codes were billed in the South (53.3%), followed by the West (17.3%), Midwest (15.7%), and Northeast (13.7%). In 2012, testing codes were mostly billed in the South (44.9%), followed by the Northeast (20.2%), Midwest (18.5%), and West (16.4%). A plurality of testing during 2016 was billed in the South (45.2%) followed by the Northeast (23.0%), West (18.2%), and Midwest (13.6%). This geographic discrepancy in the rates of immunotherapy and testing led to the highest immunotherapy to testing ratio in the South and Midwest in 2016 (Table 2, chi square *p* values <0.001). State by state trends in immunotherapy and testing are demonstrated in Figure 2, with most Southern states having greater immunotherapy to testing ratios.

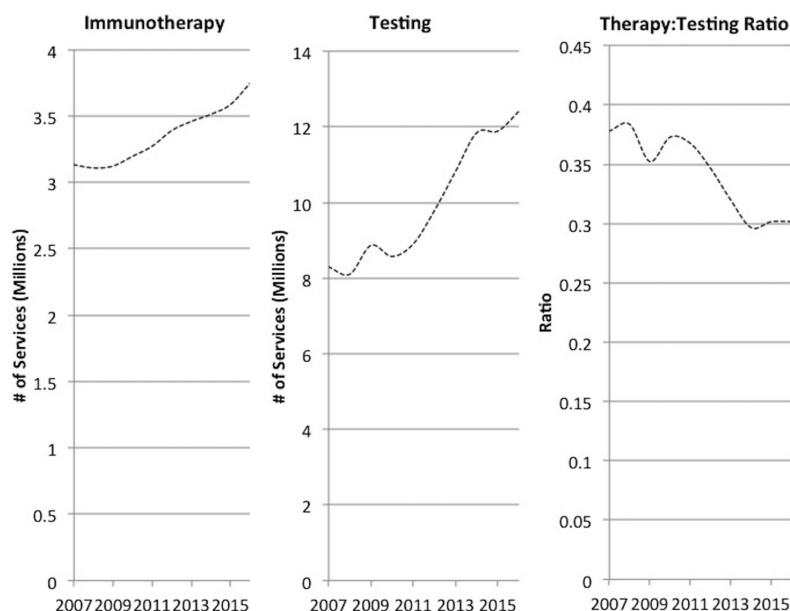


FIGURE 1. Temporal trends in the utilization of immunotherapy and testing from 2007 through 2016.

TABLE 1. Individual providers billing for allergy immunotherapy

Specialty	n (%) ^a	
Allergy/immunology	1,157 (51.6)	
Otolaryngology	700 (31.2)	
Nurse practitioner	97 (4.3)	
Internal medicine	89 (4.0)	
Family practice	74 (3.3)	
Physician assistant	42 (1.9)	
Pulmonary medicine	31 (1.4)	
Pediatric	16 (0.7)	
Ophthalmology	8 (0.4)	
Other	28 (1.2)	
Immunotherapy	2012 (%)	2015 (%)
Otolaryngologists (CPT 95115)	32.0	31.2
Otolaryngologists (CPT 95117)	28.4	30.1
Beneficiaries treated by ENT (95115)	28.4	28.9
Beneficiaries treated by ENT (95117)	23.0	24.0

^aData for the most recent year available, 2015 (CPT code 95115).
CPT = Current Procedural Terminology; ENT = ear nose and throat.

TABLE 2. Geographic breakdown of allergen immunotherapy and testing*

Region	Immunotherapy	Testing	Ratio ^a
South	1,975,472	5,569,796	0.35
Midwest	582,491	1,672,696	0.35
Northeast	508,836	2,838,993	0.18
West	642,460	2,240,863	0.29

*"Ratio" represents ratio of billed immunotherapy to testing; immunotherapy was single/multiple antigen injection (CPT 95115, 95117); testing was scratch/prick, intradermal dilution testing (CPT 95004, 95024).

^aValues of *p* for chi-square of all direct comparisons (S-MW, S-NE, S-W, MW-NE, MW-W, NE-W) <0.001.

CPT = Current Procedural Terminology; MW = Midwest; NE = Northeast; S = South; W = West.

collaborate. In fact, 1 of Dr. Hansel's own students went on to develop the pin prick test that we still use today to diagnose allergic illness.¹⁶ The very foundation of the American Academy Of Otolaryngologic Allergy (AAOA) is built upon Dr. Hansel's collaborative vision. The AAOA's mission is to enhance the knowledge and skill of physicians and others involved in the care of allergic patients. By 2006, 62% of otolaryngology residency programs reported formal training in allergy built into their curriculum.¹⁷ This is in contrast to the 58% of programs that reported a complete lack of such training 2 decades prior.¹⁸ Moreover, the diagnosis and treatment of allergies have evolved tremendously over the years,⁶ and with it has the role of otolaryngologists. Furthermore, since 2003, nearly \$75 million in National Institutes of Health (NIH) funding has been allocated to allergen immunotherapy research.¹⁹

Given the body of literature validating the efficacy of SCIT and SLIT for modifying the natural course of

Discussion

The role of allergy in otolaryngologic disease dates back to early 1930s through the works of Dr. French Hansel. A pioneer of his time, he was the first otolaryngologist to recognize the need for allergists and otolaryngologists to

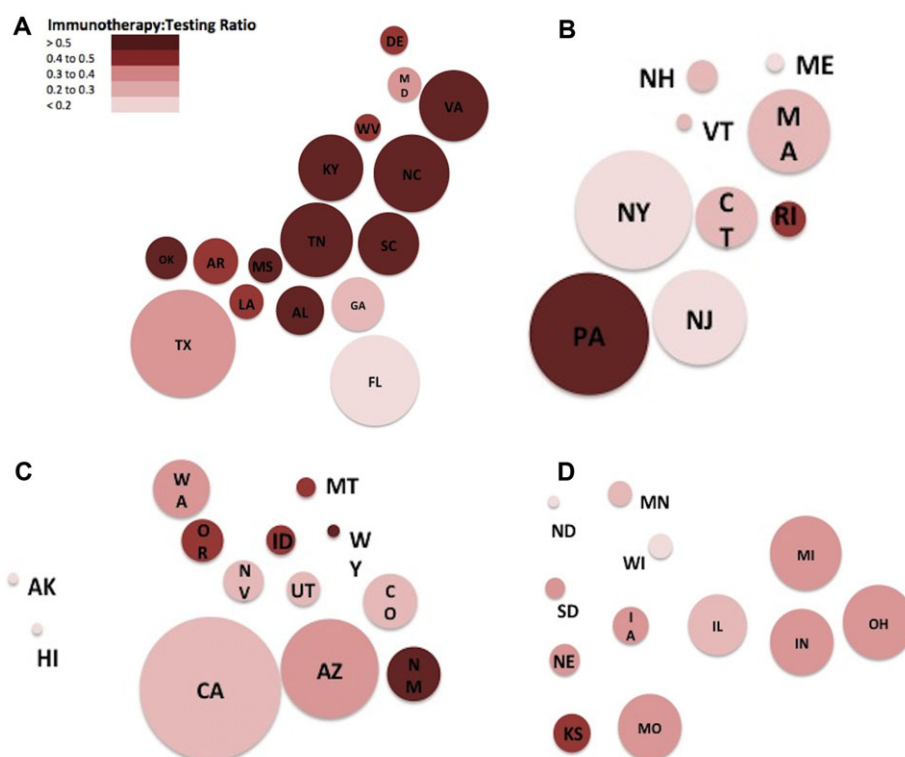


FIGURE 2. Dorling cartogram demonstrating state by state geographic differences in the utilization of immunotherapy and testing in the (A) South, (B) Northeast, (C) West, and (D) Midwest. The area of each circle is proportional to the amount of services billed for allergy immunotherapy (comparison of circle areas is within each region) (CPT codes 95115, 95117), while the shading is related to the immunotherapy to testing ratio (key displayed in image). CPT = Current Procedural Terminology.

allergen-mediated illnesses, we anticipated that our current sample would demonstrate a marked increase in number of allergen testing and AIT billings. However, closer analysis revealed that although there was an increase in both, the increase in immunotherapy was smaller than the rise in Medicare population. On the other hand, testing outpaced Medicare population growth (Fig. 1). The reason for this trend in decreased ratio of AIT to allergy testing is unclear but likely multifaceted. One possibility is that physicians are becoming more aggressive in the recognition and workup of allergic disease. In recent years, numerous analyses have demonstrated advancements in our understanding of allergens as contributors to otolaryngologic disease, and it has been reported that more than one-third of patients with allergic disease remain undiagnosed or untreated.²⁰ Hence, this evolution in disease characterization may be the driving force behind a more aggressive testing strategy.

Although no previous studies have investigated geographic trends in the United States of allergic disease as a whole, numerous analyses have described trends for specific diseases such as allergic rhinitis and asthma. One study reported increasing prevalence of allergic rhinitis from north to south in multiple regions.²¹ These results are consistent with our findings (Table 2). Conversely, the National Center for Health Statistics reported that in 2011 the prevalence of asthma in the United States was higher in the Northeast than in the West and South.

Moreover, prevalence was also higher in the Midwest compared with the South.²² Interestingly, both studies stated that there was no difference in prevalence between urban and nonurban areas.^{21,22} Perhaps our most significant finding is the presence of geographic variability (Fig. 2, Table 2), which has been stable since 2012. These results likely indicate a lack of consensus in diagnosis and treatment of allergic disease. Southern states display significantly greater immunotherapy to testing ratios when compared to other census regions. Several previous studies in other otolaryngologic topics have reported a lack of consensus through demonstration of geographic variability, including thyroid surgery²³ as well as frontal sinus surgery.¹² Geographic discrepancies have also been established in utilization of esophagoscopy and bronchoscopy in the realm of head and neck cancer and vestibular testing in otology.^{14,24} Overall, these analyses reinforce the claim that geographic variability overtones diverging practicing patterns and may indicate a lack of consensus.

Though the scope of otolaryngology has long included the management of allergic disease, with advancements such as AIT in North America, the practicing landscape has changed considerably over the years. In 2014, the Allergies, Immunotherapy, and Rhinoconjunctivitis (AIRS) surveys concluded that depending on the specialty, the percentage of allergic rhinoconjunctivitis patients receiving AIT

ranged from 7% to 33%. Amongst the adult patients, allergists/immunologists reported that 33% were undergoing AIT compared to the 25% reported by otolaryngologists.²⁵ Not surprisingly, otolaryngologists share the role in provision of AIT with allergists/immunologists. Together, otolaryngologist and allergist/immunologists comprise nearly 83% of all AIT providers (Table 1). The shared role between these specialties reinforces the need for continued collaboration in order to foster further advancements in diagnosis and management.

Otolaryngologists represent 31.2% of all AIT providers (Table 1). In 2013, it was reported that 9642 active otolaryngologists 70 years and younger were practicing in the United States.²⁶ Although limited by discrepancies in date, our results report only 700 otolaryngologists who billed for AIT (CPT 95115) (Table 1). Moreover, the American Board of Allergy and Immunology reported 5,692 active board-certified allergy and/or immunology physicians in 2015.²⁷ Comparing this to the 1157 who billed for AIT in 2015, this represents approximately 20% of allergy/immunology practitioners. Not surprisingly, this is greater than the 7% of otolaryngologists that provide AIT at high enough volumes for inclusion into CMS datasets. Our data demonstrates that the contributions of otolaryngologists in delivering AIT remained stable from 2012 to 2015 (Table 1); access to data from prior years may prove otherwise and be of interest but is not currently available through CMS.

Physician extenders play a large role in diagnosing and managing otolaryngologic illness, particularly in the outpatient setting.²⁸ Specifically, physician extenders may be trained to either administer AIT and/or supervise other members of the care team.²⁹ Furthermore, these providers are often also involved allergen extract preparation.³⁰ Our data further support the contribution of physician extenders to allergy immunotherapies (Table 1). Further clarification into the role of these providers would be invaluable particularly with the rise in SLIT where patients self-administer at home without direct medical supervision.

Currently the only U.S. Food and Drug Administration (FDA)-approved form of SLIT is absorbable tablets containing ragweed, grass pollen, and house dust mite allergens. Although aqueous forms of extracts are not FDA-approved, many U.S. physicians prescribe them off-label.²⁰ There is a rise in interest in SLIT for treatment of allergic disease including allergic rhinitis and asthma.^{20,31–34} Compared to SCIT, SLIT has been shown to contain a higher safety profile. While patients benefit by less office visits and foregoing injections, patient education is crucial.^{31,34} Unfortunately, there is currently no unique CPT code for SLIT billing purposes.³⁴ Therefore, we also examined the billing code for unlisted immunologic service, CPT 95199.

Because this billing code includes other immunologic services outside of SLIT, our study is limited in investigating SLIT utilization trends. Nevertheless, it is worth mentioning that national total billings for CPT 95199 consistently remained in values in the 100s, which significantly differs from SCIT national totals that annually surpass 1 million. Therefore, there has likely not been widespread adoption of SLIT in this population.

To the best of our knowledge, this is the first population-based analysis to characterize temporal, geographic, and specialist provider trends in allergy diagnosis and management. Nevertheless, our study design includes limitations. CMS does not provide data regarding patient level data such as comorbidities or socioeconomic status due to privacy concerns, which would be valuable in delineating the effect of provider-induced demand or patient characteristics on receiving testing or treatment. This would be better explored through a multi-institutional study design with access to individual patient data to allow for further insight into national trends. Our data is restricted to Medicare beneficiaries, a population that comprises mostly U.S. citizens over the age of 65 years. Given the prevalence of allergic disease among children and adolescents, it is possible that these trends would differ if evaluating a younger population. However, it is projected that by 2030, 20% of the population will be older than 65 years of age.³⁵ Moreover, of payers that reimburse for healthcare procedures, Medicare remains the largest. Regardless, many physicians are still reluctant to prescribe AIT to elderly patients.³⁶ This is despite numerous studies having confirmed that the efficacy of AIT in the geriatric population is no different from the non-geriatric population.^{36,37} Therefore, notwithstanding these limitations, we feel that results from our large-scale analysis provide insight on trends that may in turn impact any multiple contributors our healthcare system, including physicians, patients, and policymakers.

Conclusion

In recent years, physicians have become more aggressive in the diagnostic workup of allergy-mediated disorders. However, as evidenced by geographic variation in the ratio of testing to immunotherapy administration, there is a lack of consensus. Although the role of otolaryngologists in allergy diagnosis and immunotherapy has remained stable over 4 years, they are still the second largest contributor after allergists. This reinforces the importance of interdisciplinary cooperation and outreach. SLIT does not currently appear to play a significant role in this population; however, with rapid advancements in immunotherapy it may be of interest to revisit these trends in coming years. 🌐

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