New Developments in the Treatment of Pediatric Allergic Rhinitis and Conjunctivitis

Michelle B. Lierl, MD

Abstract

The primary care physician is the first line of treatment for allergic rhinitis, which affects approximately one-fourth of children in the United States. There is an increasing trend toward self-management by patients or parents due to high-deductible insurance plans and the over-the-counter availability of allergy medications. The primary care physician can offer guidance on appropriate selection of medications and potential adverse effects. Vitamin D deficiency has been proposed as a potential contributing factor in patients with allergic diseases, and studies are underway to determine whether supplementation with vitamin D is helpful for these conditions. Sublingual immunotherapy has recently received US Food and Drug Administration approval for grass and ragweed allergens; many children will be interested in this alternative to allergy shots. The relative advantages and disadvantages of sublingual vs subcutaneous immunotherapy are discussed. [Pediatr Ann. 2014;43(8):e192-e200.]
Allergic rhinitis and conjunctivitis are common chronic conditions in children. Pediatricians responding to the Pediatric Allergies in America survey reported that 24% of their patients have allergic rhinitis, which can affect them seasonally or perennially. This review will focus on recent developments in the treatment of allergic rhinitis and allergic conjunctivitis. These include (1) the increasing trend toward self-management by patients or parents due to high-deductible insurance plans and the over-the-counter availability of allergy medications, (2) the question of vitamin D deficiency in patients with allergic diseases and whether supplementation with vitamin D is helpful, and (3) the option of sublingual immunotherapy, which has recently received US Food and Drug Administration (FDA) approval for grass and ragweed allergens.

SYMPTOMS AND SECONDARY EFFECTS OF ALLERGIC RHINITIS

The symptoms of allergic rhinitis include nasal congestion, headache, postnasal drainage, rhinorrhea, nasal itching, sneezing, scratchy throat, and cough. Allergic conjunctivitis is characterized by itchy, red, watery, and sometimes swollen eyes. The severity of symptoms ranges from mildly annoying to disabling, with some patients unable to attend school or participate in other activities due to their allergy symptoms. Secondary problems, such as sinusitis and recurrent otitis media, are common. A frequently unrecognized consequence of chronic allergic rhinitis is the effect on cognitive and psychiatric functioning. This is caused partially by the chronic physical discomfort, which is irritating and distracting, and partially by sleep-disordered breathing, which is common in patients with allergic rhinitis due to their nasal obstruction. Sleep studies show that patients with allergic rhinitis have ten times more micro-arousals during sleep than control subjects. This is associated with poor sleep quality, daytime fatigue, poor school performance, behavior problems, and attention deficits. Patients with sleep disorders also have a higher incidence of depression, anxiety, and other psychiatric disorders. Thus, effective treatment of allergic rhinitis can lead to significant improvement in quality of life.

TREATMENT OF ALLERGIC RHINITIS

The Basics

The recommended approach to treatment of allergic rhinitis starts with environmental control measures (Table 1) to reduce exposure to the offending allergens. Irritants such as environmental tobacco smoke, automatic air fresheners, scented candles, perfumes and other forms of indoor air pollution should also be avoided. Another preventive measure is to regularly wash the allergens out of the nose and eyes using buffered normal saline nasal spray and/or eye drops. Nasal saline can be homemade or purchased over the counter. For eye lavage, various preparations of natural tears are available but are relatively expensive; a less expensive alternative is contact lens soaking solution labeled “for sensitive eyes.” This solution should be kept in the refrigerator to decrease bacterial growth, and unused saline eye wash solution should be discarded every 2 weeks.

Medication Management

Although it is common sense to reduce allergen exposures, it is not always possible to effectively eliminate exposures to environmental allergens. Along with environmental control measures, medication management is needed. Useful algorithms have been published to assist in the choice of medication management for allergic rhinitis based on symptom severity and response to previous treatment. However, in the case of children, such algorithms must be adapted to the child’s ability to cooperate.

The mainstays of medical management for allergic rhinitis and conjunctivitis are nasal corticosteroid sprays, oral non-sedating antihistamines, and topical (intranasal or intracocular) antihistamines or mast cell stabilizers. Studies show that intranasal steroid sprays are the most effective treatment for allergic rhinitis symptoms. Intranasal antihistamine sprays are also sometimes more effective than oral antihistamines because they have a decongesting effect in addition to reducing rhinorrhea and itching. However, many children will not cooperate with nasal sprays, so oral antihistamines are often the first line of treatment.

The newest treatment option for allergic rhinitis is a combination antihistamine/nasal corticosteroid spray (azelastine/fluticasone propionate). Studies have shown that this combination is more effective than either drug alone in patients with moderate to severe allergic rhinitis. Along with the combined treatment effects, the adverse effects of each component have been reported (somnolence caused by azelastine, epistaxis caused by fluticasone) in a minority of patients. Oral decongestants can be used in conjunction with antihistamines for patients with nasal congestion that is not controlled by intranasal steroids. Intranasal decongestant use should be discouraged for patients with chronic rhinitis because overuse will lead to rebound edema and eventually to rhinitis medicamentosa with chronic, refractory edema. Intranasal anticholinergic medication (ie, ipratropium bromide) is effective for reducing rhinorrhea and postnasal drainage but does not have much of a decongesting effect. Leukotriene receptor antagonists (LTRA) are effective for a subset of children who do not have sufficient
symptom control with oral antihistamines and will not cooperate with nasal sprays. These medications are generally safe and well tolerated. However, rarely children have adverse psychiatric effects while taking these medications. These effects are usually seen within the first few days of treatment with LTRA and are often quite dramatic, with the child becoming angry, depressed, antisocial, violent, or suicidal and/or having nightmares. The psychological effects resolve within a few days of discontinuing the medication. The mechanism of action for these psychiatric effects is unknown, as is the incidence, which is stated to be below 5%. 18,19 Parents should be informed that this is an uncommon but possible adverse effect when their child is started on a LTRA.

Ocular allergy symptoms are often unresponsive to oral medications, which do not reach therapeutic concentrations in the eye. 20 Topical solutions of antihistamine or mast cell–stabilizing agents, and especially medications with both antihistamine and mast cell–stabilizing properties, are more effective. Decongestant eye drops do not alleviate itching but are sometimes used to decrease redness and swelling of the conjunctivae. Corticosteroid eye drops can be used for more severe cases of allergic conjunctivitis but should only be prescribed by an ophthalmologist. Eye drops can usually be administered to young children by laying the child down supine with her eyes closed, placing a drop on the medial canthus of each eye, and then having the child open her eyes to allow the drops to run in.

Anti-immunoglobulin E (IgE) antibody (omalizumab) has been shown to be effective for the treatment of allergic rhinitis21 but is not FDA approved for this indication and is expensive, so it is unlikely to be covered by insurance for the treatment of allergic rhinitis. In patients who also have severe allergic

<table>
<thead>
<tr>
<th>Dust Mite</th>
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<tbody>
<tr>
<td>• Enclose the mattress, pillow, and box springs in plastic/vinyl casings OR special hypoallergenic fabric casings that close with a zipper.</td>
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<tr>
<td>• Wash bedding weekly in hot water; use a dryer rather than line drying.</td>
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<tr>
<td>• Remove stuffed animals or toys from the bed.</td>
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<tr>
<td>• Do not sleep or lie on stuffed, fabric-upholstered furniture. Leather, wood, or vinyl furniture is preferred.</td>
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<tr>
<td>• Do not dust or vacuum while the allergic person is in the home.</td>
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<td>• Remove carpeting, if possible.</td>
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<tr>
<th>Mold</th>
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<tr>
<td>• Use bleach or other mold-killing solution to clean bathrooms, kitchens, and basements.</td>
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<tr>
<td>• Use air conditioning and keep windows closed, if possible.</td>
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<tr>
<td>• Use a dehumidifier, if available, and empty the pan daily.</td>
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<tr>
<td>• Do not use vaporizers.</td>
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<tr>
<td>• Avoid house plants.</td>
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<tr>
<td>• The allergic person should avoid mowing grass or raking leaves.</td>
</tr>
<tr>
<td>• Repair water leaks.</td>
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<td>• Run a room HEPA filter air cleaner in the bedroom, with the door closed.</td>
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<th>Pets</th>
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<tr>
<td>• Remove animal(s) from the home or keep them strictly outdoors.</td>
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<td>• Wash pet every week.</td>
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<tr>
<td>• Choose a pet without fur or feathers.</td>
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<tr>
<td>• If you cannot remove the pet from the home, keep it out of the patient’s bedroom and run a HEPA filter in the bedroom, with the door closed.</td>
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<th>Cigarette Smoke</th>
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<td>• Do not allow cigarette, cigar, or pipe smoking in the home or car.</td>
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<th>Cockroaches</th>
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<tr>
<td>• Have home treated regularly or use insect spray while the allergic person is out of the home for 24 hours. Cockroach traps may also be helpful.</td>
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<tr>
<td>• Keep kitchen counters and floors free of food and crumbs.</td>
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<tr>
<td>• Keep foods in airtight containers.</td>
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<tr>
<td>• Trash bags should be kept closed.</td>
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<tr>
<td>• Throw away piles of paper and grocery bags.</td>
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<th>Strong Odors and Sprays</th>
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<td>• Avoid burning of wood, incense and scented candles.</td>
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<td>• Avoid perfumes, air fresheners, hairspray, and strong-smelling cleaning products.</td>
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<th>Pollens and Outdoor Molds</th>
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<tr>
<td>• Keep the windows closed during the pollen seasons.</td>
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<tr>
<td>• Change the air conditioning filters monthly during the pollen season, and use a good-quality filter.</td>
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These instructions can be tailored for each patient based on his or her specific aeroallergen sensitivities.
asthma or chronic urticaria, the two FDA-approved indications, omalizumab could be prescribed and would be expected to also improve the patient’s allergic rhinitis.

**TRENDS IN HEALTH CARE COVERAGE AND THEIR EFFECTS ON SELF-MANAGEMENT**

The Pediatric Allergies in America Survey, conducted in 2007, found that 54% of children with allergic rhinitis were using an over-the-counter medication, whereas 48% were taking prescription medications. However, since 2007, the insurance landscape has changed significantly, with a much larger percentage of families having high-deductible insurance plans. The number of individuals in the United States covered by health savings accounts/high-deductible plans increased from 1 million in 2005 to 15.5 million in 2013, and this number will probably continue to rise. Because families with high-deductible plans must pay out of pocket for doctor visits and prescription medications, there is a definite trend toward deferring physician visits and self-medicating using the less expensive medications available over-the-counter. Patients with traditional insurance plans are also purchasing medications for allergic rhinitis over-the-counter much more often than previously because their insurance will no longer cover the prescription versions of these drugs. Thus, in many cases the role of the physician has changed from prescriber of medications to advisor regarding the best choice of medication, correct dosing, and potential adverse effects.

**POSSIBLE ADVERSE EFFECTS OF OVER-THE-COUNTER ALLERGY MEDICATIONS**

Potential adverse effects of nasal decongestants are well known: use of these medications for more than 2 to 3 days leads to rebound edema of the nasal mucosa, encouraging more and more frequent dosing until the patient has chronic, refractory nasal mucosal edema (rhinitis medicamentosa). Ocular decongestant drops can have a similar rebound effect, resulting in increased conjunctival erythema and edema with overuse. Oral decongestants are less prone to cause rebound edema with long-term use, but use of oral decongestants can lead to adverse effects, such as insomnia, hyperactive behavior, and palpitations, and overdosage can cause hypertension, tachycardia, cardiac arrhythmias, and central nervous system effects.

The second-generation antihistamines (cetirizine, fexofenadine, loratadine) are generally safe in the recommended doses but can cause somnolence, palpitations, and extrapyramidal signs if taken in excessive doses. Triamcinolone acetonide nasal spray is the first nasal corticosteroid spray to be made available over-the-counter. With seasonal use of the recommended dosage, adverse effects are rare with nasal corticosteroid sprays; however, some children develop nasal mucosal irritation and nose bleeds. If a nose bleed or nasal trauma occurs, the use of nasal corticosteroid spray should be discontinued until the lesion has healed. With excessive use, nasal irritation and epistaxis become more common, and rare cases of septal perforation have been reported.

Another concern with the long-term use of nasal corticosteroid sprays is the potential for growth suppression. Studies have shown that with the use of recommended doses, no growth suppression occurs with intranasal fluticasone propionate or mometasone; however, some growth suppression was seen with intranasal beclomethasone. Triamcinolone acetonide nasal spray at a dose of 110 μg per day (the recommended starting dose for children) was found to decrease growth velocity by 0.45 cm per year during a 1-year double-blind, placebo-controlled trial in 298 pediatric patients aged 3 to 9 years. However, a smaller uncontrolled trial of 39 children taking triamcinolone acetonide nasal spray for 1 to 2 years found growth rates to be normal. Longer-term studies have not been published, so it is unknown if ultimate adult height would be affected. It is also unknown whether the short-term use of this medication for a few weeks during the peak pollen season would cause any detrimental effect on growth. Thus, it would be reasonable to recommend that children with allergic rhinitis use fluticasone propionate or mometasone nasal spray if they require long-term treatment; however, patients who cannot afford the prescription nasal sprays could use the over-the-counter sprays seasonally with monitoring of linear growth.

**IS VITAMIN D SUPPLEMENTATION HELPFUL FOR CHILDREN WITH ALLERGIES?**

The role of vitamin D deficiency in immunologic dysfunction has been a hot topic in recent years. Vitamin D has numerous effects on gene transcription and cytokine production, affecting many systems throughout the body. One of the most relevant effects with regard to development and severity of allergic diseases is the effect of vitamin D in promoting the production of interleukin-10 (IL-10), a cytokine that downregulates immune responses. Deficiencies in IL-10 production have been associated with severe autoimmune and allergic disease (Immune dysregulation, Polyendocrinopathy, Enteropathy, X-linked syndrome), and relatively low levels of IL-10 have been found to be associated with corticosteroid resistant asthma. Numerous studies have shown that patients with allergic rhinitis, severe asthma and airway remodeling, eczema, and food allergy have, on average, lower levels of vitamin D compared with healthy children, although other studies have found no such correlation. Fewer studies have tested the effectiveness of
vitamin D supplementation for treatment of these conditions, although some trials are currently underway. Treatment with vitamin D has been shown to improve corticosteroid responsiveness of regulatory T cells in corticosteroid-resistant asthma patients by enhancing IL-10 production. It remains to be seen whether vitamin D supplementation in patients with vitamin D deficiency will improve outcomes for children with allergic rhinitis.

**ALLERGEN IMMUNOTHERAPY FOR ALLERGIC RHINITIS: SUBCUTANEOUS OR SUBLINGUAL?**

For children whose allergic rhinoconjunctivitis is not adequately controlled by medications or who do not tolerate medications, allergen immunotherapy is an option. Traditionally, allergen immunotherapy has used subcutaneous injections of allergen. Sublingual immunotherapy (SLIT), in which allergen extract in liquid or dissolvable tablet form is placed under the tongue, held in place for a defined period of time, and then swallowed, is a more recently developed method of allergen immunotherapy. SLIT has been in use in Europe for several years, and the off-label use of allergen extract solutions for SLIT has been prescribed by a small but increasing percentage of allergists in the United States in recent years. The first FDA-approved products for SLIT (grass and ragweed extracts) became available this year (Table 2), and additional allergen products for SLIT are in development. The relative advantages and disadvantages of each method of allergen immunotherapy are summarized in Table 3.

**Efficacy**

Subcutaneous immunotherapy (SCIT) is an effective disease-modifying intervention. The reduction of allergic rhinitis symptoms in children treated with SCIT for 3 years vs a control group was still evident 7 years later; this study and others also found a decreased likelihood of developing asthma in children treated with SCIT vs controls over the subsequent 10 years.

SLIT has also been shown to be effective for decreasing the symptoms of seasonal allergic rhinitis, although so far, only one study of long-term effectiveness after discontinuation of SLIT has been completed. This study followed 47 patients receiving SLIT for house dust mite and 12 control subjects for 15 years. Patients who completed 3 years of SLIT had persistence of clinical improvement of the allergic rhinitis symptoms for 6 years after treatment, and patients who completed 4 or 5 years of treatment had persistence of improvement for 8 years after treatment.
Meta-analyses of studies comparing the overall efficacy of SCIT vs SLIT have found that SCIT is more effective in reducing symptoms and medication use of patients with seasonal allergic rhinitis.\(^{49-51}\) This may change as more information is gained regarding optimal dosing regimens and duration of treatment with SLIT.

**Optimal Dosing**

For SCIT, effective doses have been identified for many of the important aeroallergens. The practice parameters clearly state the target maintenance doses for grass pollen, ragweed pollen, cat, dust mite, and dog.\(^{40}\) The other pollens (weeds, trees), fungal spores, and cockroach extracts are recommended to be given in the highest tolerated dose because target doses have not been established for them.

For SLIT, no consensus has been reached on effective target doses. Studies have identified a widely varying range of effective doses.\(^{52}\) The products currently approved by the FDA include doses similar to or higher than the maintenance dosage used in SCIT. Further studies are needed to clarify the most effective dose for each allergen and the most effective dosing schedule (preseasonal and seasonal vs year-round dosing).

**Inclusion of Relevant Allergens**

Most children whose allergic rhinitis is difficult to control with medication management are polysensitized, and the inclusion of each of the child’s clinically relevant aeroallergens in the immunotherapy mix is a common practice in the United States. This often involves inclusion of several pollens, fungal spores, and/or indoor aeroallergens. Only a few studies have been done to validate the use of multiallergen SCIT, but these studies have demonstrated efficacy.\(^{53}\) Most studies on SLIT have involved single allergen treatment, but there have been two studies in which two allergens were administered. A trial of dual therapy with sublingual extracts of timothy grass and dust mite daily for 1 year found efficacy vs placebo.\(^{54}\) A comparison of clinical response to SLIT with grass or birch pollen extract alone vs combined grass and birch pollen extract found greater efficacy of the combined regimen in patients sensitized to both allergens.\(^{55}\) However, another study compared SLIT with a timothy grass extract alone with the same extract plus nine tree and weed pollens and found that only the timothy monotherapy group had significant changes in nasal allergen challenge responses and serologic markers of tolerance to the allergen.\(^{56}\) Thus, it is not yet known whether multiallergen SLIT will be safe and effective.

To date, the only SLIT products approved in the United States are two grass pollen products and one ragweed pollen product. Grass and ragweed pollens are important seasonal allergens, but most patients who are allergic to these pollens are also allergic to other allergens, such as tree pollens, other weed pollens, fungal spores, dust mites, cockroach, or animal danders. Thus, SLIT with grass or ragweed extract can be expected to improve the patient’s allergic rhinitis symptoms during the seasons when these are the major aeroallergens (late spring and early fall, respectively) but cannot be expected to improve symptoms during the rest of the year. In patients whose major allergen sensitivities are grass pollen and/or ragweed pollen, SLIT with one or both of these is a reasonable option if SCIT is not feasible.

The use of individual allergens in SLIT products should also take into account the geographic variations in pollen distribution. Timothy grass, the extract used in Grastek (Merck Sharp & Dohme Corp, Whitehouse Station, New Jersey) is widely distributed throughout the United States, as are the five meadow grasses (sweet vernal, orchard, perennial ryegrass, timothy, and Kentucky blue grass) included in Oralair (Stallergenes S.A., Antony, France). These grasses cross-react with each other extensively.

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**TABLE 3.**

**Comparison of Subcutaneous Immunotherapy (SCIT) Versus Sublingual Immunotherapy (SLIT)**

<table>
<thead>
<tr>
<th></th>
<th>Efficacy</th>
<th>Optimal Dosing and Duration of Treatment Known</th>
<th>Multiallergen Immunotherapy Effective</th>
<th>Safety</th>
<th>Convenience</th>
<th>Adherence</th>
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<tbody>
<tr>
<td><strong>SCIT</strong></td>
<td>Yes; MA suggest SCIT more effective than SLIT</td>
<td>Yes, for some allergens</td>
<td>Yes</td>
<td>0.1% of visits with systemic allergic reaction; rare fatalities</td>
<td>Inconvenient; numerous office visits required</td>
<td>Poor: 11%-77% of patients do not complete 3 years of treatment</td>
</tr>
<tr>
<td><strong>SLIT</strong></td>
<td>Yes</td>
<td>No</td>
<td>Unknown; only 2 allergens available so far in US</td>
<td>Lower incidence of systemic allergic reaction; no reported fatalities</td>
<td>More convenient; in-home dosing after first dose</td>
<td>Poor: 2%-93% of patients do not complete 3 years of treatment</td>
</tr>
</tbody>
</table>

MA = meta-analyses.
However, patients living in southern and western states are sometimes also sensitized to grasses such as Bermuda, Johnson, Bahia, velvet, salt grass, and western wheat grass. These grasses have distinctive allergens that are not included in the available SLIT grass tablets, so patients sensitized to the southern and western grasses might not have as good a response to SLIT with the currently available products. Short ragweed pollen is an important early fall seasonal allergen found throughout the United States, except for Alaska. Other species of ragweed pollen cross-react with short ragweed allergen, so inclusion of short ragweed extract should be effective for ragweed-allergic patients in any of the lower 49 states.

Safety

Allergic reactions to SLIT include oral itching and sometimes swelling, which occurs in up to 75% of patients at the beginning of a course of treatment but decreases in frequency as treatment is continued. In a meta-analysis of 50 studies of SLIT, approximately 0.8% of patients had moderate systemic reactions requiring dose adjustment or withdrawal from the study.57 Systemic anaphylactic reactions are rare but have been reported in some patients.40,45,46 No fatal anaphylactic reactions have been reported. It is recommended that patients receiving SLIT have epinephrine injectors available, and they should be instructed in the administration of epinephrine and other emergency measures to be taken in the event of a systemic allergic reaction or significant airway compromise. A special concern with SLIT is the potential for development or worsening of eosinophilic esophagitis because the allergen is swallowed. The use of SLIT is contraindicated for patients with a history of eosinophilic esophagitis. In placebo-controlled trials of SLIT, there was a slightly higher rate of abdominal pain, dysphagia, or nausea noted in the active treatment patients vs placebo subjects.58-60

SCIT causes a higher rate of systemic allergic reactions than SLIT; surveys show that systemic reactions occurred with 0.1% of injection visits.61 The majority of these are mild reactions; only 0.01 severe systemic allergic reactions occur for every 10,000 injection visits.61 There was one fatal anaphylactic reaction after allergy shots, reported during the 4 years covered in the most recent survey (2008-2012).61 Due to the low but real risk for anaphylaxis, it is recommended that all patients receive SCIT injections in a medical office with the responsible physician present and appropriate emergency medications and equipment available.40

Convenience

SCIT is a demanding course of treatment requiring weekly allergy shots in the physician’s office for many weeks while the dose is being built up to maintenance, followed by gradual increase in interval to monthly injections. Maximum long-term benefit occurs when SCIT is continued for a total of 5 years. Not all families are able to commit to such frequent appointments.

One of the major advantages of SLIT is that, after the initial dose is given in the physician’s office, all subsequent doses are given at home. The dosing is daily rather than weekly but takes only approximately 1 minute each day. Although the optimal dosing and duration of treatment with SLIT has not been definitively established, the best evidence indicates that, as with SCIT, 3 to 5 years of consistent treatment with SLIT are needed to achieve long-term improvement in allergic rhinitis.48

Adherence to Allergen Immunotherapy Schedules

Despite the apparent convenience of in-home administration of SLIT, adherence to treatment with SLIT is not better than adherence with SCIT. In 4 studies comparing SCIT vs SLIT, the rate of premature discontinuation (prior to completing 3 years of treatment) ranged from 22% to 93% for SLIT vs 11% to 77% for SCIT.62

Fear of Shots

Many children have a strong aversion to shots. This is often a reason for referral of SCIT, although most children receiving SCIT get over their fear of shots within the first few weeks.63 The avoidance of the weekly shots is a further inducement for children with allergic rhinitis to choose SLIT over SCIT.

Overall Patient Satisfaction

In the Allergies, Immunotherapy and Rhinoconjunctivitis Survey, 68.1% of respondents who received SCIT vs 58.3% who received SLIT stated that they were somewhat or very satisfied with their allergen immunotherapy.64 The respondents receiving SCIT stated effective relief of allergy symptoms as the primary benefit of treatment and inconvenience as the primary drawback. Conversely, convenience was the major benefit reported by the respondents receiving SLIT, although surprisingly they also reported inconvenience as the primary drawback. However, overall, 57.7% of SCIT recipients and 50% of SLIT recipi-
ents stated that the benefits outweighed the drawbacks of treatment.54

CONCLUSION
Allergic rhinitis is a common condition in children and has significant deleterious effects on physical health, mental health, cognitive functioning, and quality of life. Recent developments in the treatment of allergic rhinitis show promise for improving outcomes, although more information is needed. The role of vitamin D deficiency and supplementation for patients with allergies remains to be defined. SLIT shows promise as a potentially safer and more convenient method of immunotherapy; however, there is a need for more information regarding optimal dosing regimens, the feasibility and safety of multi-allergen SLIT, and the optimal duration of treatment needed to achieve long-lasting desensitization. With the trend toward increasing self-management and use of over-the-counter medications for allergic rhinitis, the primary care physician can play a useful role in advising on appropriate treatment regimens and monitoring for adverse effects of medications.

REFERENCES