

Severe Asthma in Primary Care: Specialist Referral for Biologic Therapy

Payel Gupta, MD; Reynold A. Panettieri, Jr, MD

doi:10.12788/fp.0789

Sponsorship: This activity is sponsored by Primary Care Education Consortium and Primary Care Respiratory Group and supported by funding from AstraZeneca.

FACULTY

Payel Gupta, MD

Owner and Chief Medical Officer
Ease Allergy
Assistant Clinical Professor
Mount Sinai Medical Center and SUNY
Downstate Medical Center
New York, NY

Reynold A. Panettieri, Jr, MD

Professor of Medicine
Robert Wood Johnson Medical School
Vice Chancellor and Director

Rutgers Institute for Translational Medicine
and Science
Emeritus Professor of Medicine
University of Pennsylvania
New Brunswick, NJ

DISCLOSURES

Dr. Gupta is on the advisory boards of AstraZeneca, Sanofi, and Regeneron and is on the advisory board and speakers bureau of GSK.

Dr. Panettieri is on the speakers bureaus

and advisory boards of AstraZeneca, GSK, and Regeneron. He has received research grants from Areteia, AstraZeneca, Connect Biopharma, GSK, Genentech, Haleon, Origo Biopharma, Pfizer, Syneos Health, and Regeneron.

ACKNOWLEDGMENT

Editorial support was provided by John Dicristofano, PharmD, MBA, and Austin Ulrich, PharmD, BCACP, at Primary Care Education Consortium.

INTRODUCTION

Severe asthma (SA) is asthma that is inadequately controlled despite adherence to optimized high-dose inhaled corticosteroid/long-acting beta₂-agonist (ICS/LABA) therapy and appropriate management of contributory factors, including inhaler technique, medication adherence, environmental exposures, and comorbidities. SA differs from uncontrolled or difficult-to-treat asthma in that symptoms are persistent and exacerbations continue despite the correction of these modifiable factors and the use of maximal guideline-directed therapy.¹ SA affects a relatively small proportion of patients with asthma, with estimates ranging from approximately 3.7% to 10% depending on the population studied and the criteria used to define severe disease, yet SA disproportionately contributes to asthma-related morbidity and mortality, health care utilization, and costs.^{1,2} Asthma-related mortality remains a persistent concern, with 9 to 11 deaths occurring each day in the United States and little meaningful improvement observed over the past decade.³ Although SA is often first recognized and treated in the primary care setting, referral to a specialist for further management is often warranted. Referral by the primary care clinician (PCC) enables collaboration with specialists to manage side effects, prevent exacerbations, preserve lung function, reduce systemic corticosteroid (SCS) use, and prevent medication-related side effects.¹

Key takeaways

- PCCs play a crucial role in distinguishing uncontrolled asthma from SA by first addressing modifiable factors, such as adherence, inhaler technique, comorbidities, and environmental triggers, before escalating therapy or referring to a specialist.
- Structured assessment tools and proactive follow-up after exacerbations, including timely reassessment, reinforcement of action plans, education on inhaler technique, and medication optimization, can help PCCs better track disease control, predict future risk, and support more informed treatment decisions.
- Ongoing symptoms, frequent exacerbations, high short-acting beta₂-agonist (SABA) use, or repeated SCS bursts despite optimized therapy can prompt specialist referral by the PCC. Biomarker assessment identifies type 2 (T2) inflammation and guides biologic eligibility. Further need for SCS-sparing strategies is necessary to reduce the risk of associated adverse effects.
- Early and coordinated collaboration between PCCs and specialists improves outcomes by reducing exacerbations, hospitalizations, and SCS exposure while ensuring timely access to advanced therapies and appropriate follow-up after acute events.

SCS exposure in asthma management can be limited through the use of targeted biologic therapies that reduce exacerbations, improve symptom control, and decrease ste-

roid dependence.^{1,2,4-6} Evidence has demonstrated that even relatively low cumulative lifetime SCS exposure, estimated at approximately 0.5 to 1.0 g prednisolone equivalent, or roughly 2 to 4 short bursts of daily steroid therapy may significantly increase the risk of adverse effects including osteoporosis, cardiovascular disease, hypertension, diabetes, infections, weight gain, sleep disturbance, and neuropsychiatric complications.⁷⁻⁹ Importantly, these risks go beyond patients receiving chronic daily therapy. Repeated intermittent bursts also are associated with cumulative toxicity and increased health care utilization.⁷ Current SA management strategies increasingly emphasize SCS stewardship, the early identification of uncontrolled disease, optimization of maintenance therapy, and timely referral for phenotype assessment and biologic consideration in appropriate patients.^{1,4,6,8} Repeated SCS exposure signals a need for reassessment and treatment escalation to reduce preventable morbidity and preserve long-term positive patient outcomes.^{1,6,7,8}

National Heart, Lung, and Blood Institute and Global Initiative for Asthma (GINA) recommendations suggest referral to a specialist for an evaluation in all patients with potential severe disease to optimize disease treatment and control, identify, and treat relevant comorbidities.^{1,4} In patients who manifest uncontrolled SA, targeted biologic therapies that reverse specific aspects of the dysregulated immune responses in asthma can effectively reduce exacerbations, including exacerbation-related hospitalizations and emergency department (ED) visits, while improving lung function and symptom control and minimizing SCS use.^{2,5} Biologics for SA are typically initiated in specialist settings and have demonstrated reductions in the frequency of asthma exacerbations along with asthma symptom reduction, reduced dosage of controller medication, and improved quality of life. Additionally, several biologics have been found to improve lung function in patients with SA.¹⁰ Injectable biologic initiation is recommended in those with ≥ 2 asthma exacerbations in a year, 1 asthma hospitalization in the past year, poor symptom control despite high-dose ICS/LABA treatment, or the need for daily maintenance SCS for disease control.⁶ Biologic therapies for asthma have been available since 2003, with 7 biologics currently approved for SA. Biologics can be administered with schedules ranging from every 2 weeks to every 6 months depending on the selected agent and indication.^{1,10}

Despite the benefit of specialist involvement and these targeted therapy options, many patients with SA are not referred to a specialist in the year after an asthma exacerbation. In an analysis conducted from January 2015 to

December 2017, 62% of patients did not have a specialist visit in the year before or after the identification of SA.¹¹ A separate analysis conducted from 2015 to 2020 found that up to 51% of SA patients assessed had no specialist visit or medication escalation following an event indicating uncontrolled disease (hospitalization, ED visit, or outpatient visit for asthma with SCS use).¹² Further, evidence demonstrated that up to 64% of these patients had subsequent exacerbations following the initial occurrence. Specialist visits positively impact patient outcomes, with associated decreases in exacerbations, hospitalizations, ED visits, and SCS use (**TABLE 1**).^{11,12}

PCCs are central to the early identification of patients with SA who would be appropriate candidates for specialist referral and biologic evaluation to better mitigate SA symptoms, reduce health care resource utilization, and improve quality of life.

CASE STUDY

MR is a 46-year-old woman seen in primary care for worsening asthma symptoms over the past 6 months. She reports daily wheezing, nighttime awakenings 3 to 4 times per week, and albuterol inhaler use multiple times per day. Over the past year, she has required 3 courses of SCS for exacerbations, and she went to the ED once as well. Her current medications include high-dose inhaled ICS/LABA therapy, montelukast 10 mg daily, and albuterol as needed. On exam, spirometry shows a forced expiratory volume in 1 second (FEV₁) of 68% predicted, and laboratory evaluation reveals a blood eosinophil count of 320 cells/ μ L.

Despite adherence to optimized inhaled therapy and appropriate inhaler technique, her persistent symptoms, frequent exacerbations, and repeated SCS use suggest uncontrolled SA with underlying eosinophilic inflammation.

SCS STEWARDSHIP: WHEN REPEATED BURSTS SHOULD TRIGGER ESCALATION

SCS are typically prescribed to help manage acute asthma exacerbations.^{1,7} However, SCS can be utilized as daily maintenance therapy in patients with SA. Step 5 in the GINA recommendations suggests that chronic SCS may be used as a last resort.¹ Frequent corticosteroid bursts and chronic utilization are associated with significant side effects, includ-

TABLE 1. Outcome improvement with specialist intervention.¹¹

	Any exacerbation	Hospitalization	ED visit	SABA use	SCS use
Before intervention	49%	3%	16%	83%	69%
After intervention	38%	1%	11%	67%	54%

Outcomes were evaluated among commercially insured US patients aged ≥ 6 years with SA who had their first observed asthma specialist visit during the study period (N=5988).

Adapted from Most JF et al, 2021.

ing an increased risk for pneumonia, cardiovascular events, hypertension, diabetes, osteoporosis, weight gain, and neuropsychiatric effects such as insomnia, depression, and behavioral disturbance (**FIGURE 1**).⁷ Chronic and frequent SCS use contributes to higher morbidity and mortality, reduced quality of life, and higher health care costs and is associated with higher ED use and inpatient visits.² For these reasons, chronic exposure poses a significant safety issue, and clinicians should adjust symptom management to prevent complications associated with SCS use in patients with SA.

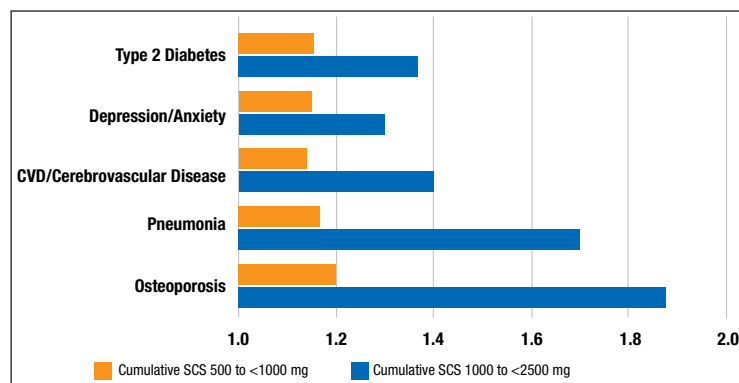
In a 2018 Asthma and Allergy Foundation of America survey, investigators found that 85% of 519 patients with asthma used at least 1 course of SCS in the previous 12 months and 64% had done so ≥ 2 times.⁹ Alarming, 78% of these patients who were seeing an asthma specialist reported having received a different SCS prescription from another provider. PCCs should inform patients and their caregivers about the risks associated with SCS use and asthma maintenance therapy nonadherence. PCCs should also facilitate referral to qualified asthma specialists when available and collaborate closely with those individuals to reinforce SCS-sparing strategies. However, access to specialty care can be limited in some communities; therefore, patients in rural and underserved areas who are experiencing acute worsening of symptoms are often more likely to seek care from their PCC. In these situations, PCCs play a critical role in recognizing patterns of recurrent exacerbations and repeated SCS use, reinforcing adherence to maintenance therapy, reassessing inhaler technique, and identifying when treatment escalation or re-referral may be necessary. By monitoring cumulative SCS exposure and educating patients about the risks associated with repeated SCS use, PCCs can help support earlier intervention and reduce the likelihood of preventable complications associated with redundant prescriptions and long-term SCS exposure.^{4,9}

SCS-sparing techniques create a unique opportunity for the PCC to discuss alternative treatment options such as biologics. Data have shown up to a 61% reduction in SCS-related adverse events in patients with SA on biologic therapy, which is estimated to lead to a 2- to 3-fold higher probability of achieving complete SCS cessation.⁴ Although these agents are usually prescribed by specialists, PCCs can provide patients with education regarding their benefits and limitations.

CLINICAL REMISSION AND ASTHMA

Clinical remission is defined as a period of >12 months in which the patient has not experienced any asthma exacerbations or significant symptoms and has not received SCS (ICS allowed) in the absence of declining lung function (prebron-

FIGURE 1. Cumulative SCS dose (mg) and likelihood of an adverse effect.⁷



Abbreviation: CVD, cardiovascular disease

Adapted from Price DB et al, 2018. Adults with active asthma from UK primary care databases (N=48,234 [24,117 matched pairs]).

chodilator FEV₁ $>95\%$ of baseline). PCCs can help patients work toward achieving this treatment goal.^{1,8} Importantly, clinical remission is a relatively new and evolving concept that has gained increasing attention with the emergence of biologic therapies capable of reducing exacerbation burden and SCS exposure.⁸ Historically, SA management primarily focused on symptom reduction and prevention of acute exacerbations. More recent expert consensus statements now recognize clinical remission as an achievable treatment target in patients receiving optimized therapy. As frontline clinicians managing patients longitudinally, PCCs play an important role in recognizing when patients may be approaching remission goals, reinforcing adherence to maintenance therapy, monitoring symptom control over time, and coordinating follow-up care with specialists. A key aspect of clinical remission focuses on avoiding SCS use during this 12-month period. PCCs should actively participate in a collaborative effort to curb SCS use to reduce the side effects associated with frequent and chronic use. Clinicians should recognize signs such as repeated rescue prescriptions, SABA overuse, and exacerbations; these signal that a patient may need an updated treatment plan, support with adherence concerns, and reassessment of maintenance therapy.

IDENTIFYING PATIENTS WITH UNCONTROLLED ASTHMA WHO MAY NEED BIOLOGIC THERAPY

SA differs from uncontrolled asthma; some patients may have SA but have controlled disease if persistent symptoms and exacerbations related to SA are improved with treatment. As part of differential diagnosis, PCCs should assess for nonsevere, uncontrolled asthma by evaluating such factors as poor inhaler technique, suboptimal medication adherence, comorbidities, and ongoing exposure to triggers in the patients' homes or social environments. Once these variables have been assessed

and determined not to be the primary driver for symptoms, the clinician can use questionnaires aimed at assessing recent symptom control. A particularly useful assessment is the Asthma Impairment and Risk Questionnaire (AIRQ), available at <https://www.airqscore.com/>.¹³ This 10-item asthma control tool assesses both symptom impairment and exacerbation risk, evaluates patients' asthma control, and supports shared decision-making conversations to optimize management. By assessing patients' asthma medications, respiratory symptoms (including exacerbation history) and lung function, as well as utilization of health care resources (inpatient or ED use), PCCs can develop a treatment plan better tailored to address the issues identified in the assessment, predict potential future exacerbations, and escalate concerns to a specialist for further management. This assessment can help clinicians recognize when therapy modifications with biologics are warranted and guideline-driven recommendations are necessary.^{1,4,13}

Biomarkers

PCCs also play a role in the early assessment of phenotypic and clinical biomarkers. Phenotyping refers to the identification of underlying asthma characteristics that may influence treatment selection, particularly the presence of T2 inflammation and eligibility for biologic therapy. In the primary care setting, initial biomarker assessment can include readily available tests such as a complete blood count (with differential) to obtain a blood eosinophil count (BEC), serum immunoglobulin E (IgE) measurement, and spirometry. These assessments can help identify patients who may benefit from further evaluation. More comprehensive phenotypic characterization, including fractional exhaled nitric oxide (FeNO) testing, advanced pulmonary function testing, assessment of comorbid conditions, and biologic eligibility determination, is often performed in specialist settings where additional diagnostic resources are available.^{1,4,6} SA is often driven by T2 inflammation, which is characterized by highly activated immune cells (eosinophils, mast cells, and T-cells) that release inflammatory mediators such as cytokines (e.g., interleukins 4, 5, and 13) and IgE antibodies, resulting in inflammation in the airways, greater risk for asthma exacerbations, and decreased lung function.^{1,2,4} BEC is a biomarker used to determine if a patient has eosinophilic asthma. Levels >150 cells/ μ L suggest the presence of T2 inflammation and may identify the patients who are more likely to benefit from T2-targeted therapies.¹ In patients with persistently elevated eosinophil counts, particularly those >150 cells/ μ L, alternative or coexisting causes of eosinophilia should be evaluated as part of the diagnostic evaluation, which may include parasitic infection and other eosinophilic disorders. Despite this, one retrospective analysis found that eosinophils were only drawn in around 70% of patients with asthma who had frequent exacerbations.¹⁴ Fur-

ther, it is important for the clinician to recognize that eosinophil levels may vary significantly depending on age, sex, race, time of day (lower in the afternoon than early morning), obesity, and allergen and corticosteroid exposure.¹⁵

In addition to BEC, FeNO provides complementary information regarding airway inflammation that can further support the identification of T2 disease.¹ Elevated FeNO levels (>50 parts per billion [ppb] in adults) are considered to be consistent with significant T2 airway inflammation, while values between 25 ppb and 50 ppb should be interpreted in the context of the patient's clinical presentation and other biomarkers. It is important for the clinician to understand that these levels are not absolute; FeNO levels can vary based on patient-specific factors such as age, sex, and smoking history. Given the variability in FeNO laboratory tests, they should be repeated a minimum of 3 times before assuming the patient is not eligible for T2-targeted therapy. Another biomarker that can be used for T2 identification is IgE, which can be evaluated using a blood test or a skin prick test. Clinicians should recognize that, regardless of method, there is not a universally accepted IgE cutoff that defines T2 asthma. An elevated IgE level, detectable allergen-specific IgE, or positive allergen skin test could increase the possibility of the presence of T2 asthma when taken into consideration with other clinical findings and biomarkers.

PCCs can establish an SA diagnosis, optimize inhaled treatment, document exacerbation burden, help patients create an action plan, use assessment tools (like the AIRQ), and refer the right patient at the right time to a specialist when further phenotype/biomarker assessment is warranted. Collaboration is essential to investigate comorbidities, examine differential diagnoses, and consider injectable biologic therapy initiation.^{1,6,11}

Biologic therapies

Once the assessment is completed and biologic therapy is deemed necessary, a specialist can choose from among 7 biologics currently approved for SA.^{1,6,11} The choice of agent is based on a variety of factors, including biomarker history, patient comorbidities, exacerbation frequency, SCS dependency, cost, and patient preferences regarding administration frequency and delivery route.^{1,10} Biologic therapies are administered most commonly as subcutaneous injections.¹⁰ Maintenance dosing depends on the choice of agent, with administration schedules ranging from once or twice monthly to every 2 to 6 months. Side effects are typically mild, with injection site soreness, headache, sore throat, and fatigue as the most commonly reported symptoms. Anaphylaxis risk and other adverse events noted in the Prescribing Information for each biologic should be monitored. Monitoring biologic therapy response requires a collaborative partnership between the specialist and

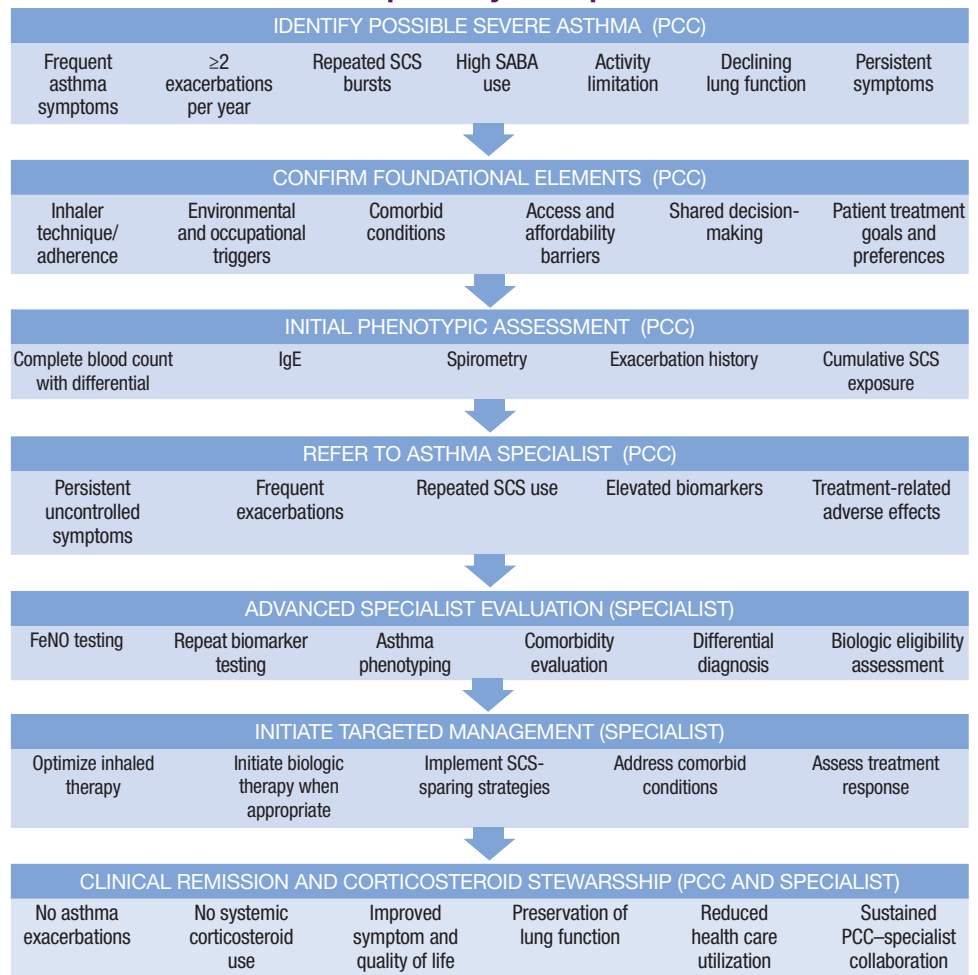
the PCC and includes assessing exacerbation frequency, symptom control, lung function, clinical biomarkers, adverse events, and patient satisfaction (**FIGURE 2**).¹ Based on response, therapy can be modified if needed to further optimize management.

MAKING THE REFERRAL

Once a diagnosis of SA is made, a PCC should consider referral to an asthma specialist (e.g., allergist/immunologist and/or pulmonologist), as a collaborative approach will be the best for managing symptoms and developing the future treatment plan. Referral is also necessary in scenarios when there is diagnostic uncertainty, when patients have high-risk disease (e.g., recurrent exacerbations, hospitalization, or lung function decline) or comorbid conditions, in the presence of treatment-related side effects, and in those with persistent uncontrolled symptoms despite proper inhaler technique and adherence.¹ When considering biologic use, specialists should be included, as their practices typically have access to the testing necessary to assess pulmonary function and phenotypic disease types, which will guide future treatment decisions.

PCCs also play an influential role following the discharge of patients who have experienced an asthma exacerbation. Clinicians should encourage follow-up appointments within 2 to 7 days (1 to 2 days for children) and reinforce education aimed at improving asthma management, such as medication adherence, inhaler skills, and a written asthma action plan (**FIGURE 3**).¹ After an exacerbation, patients should be prescribed an ICS-containing treatment and additional guideline-directed treatment as necessary to reduce the risk of further exacerbations. Collaboration between the PCC and specialist is critical as it provides an opportunity for the clinicians to work together to help the patient understand the cause of their exacerbation, while modifying risk factors for future exacerbations through the optimization of guideline-directed therapy options, obtaining lung function tests, and

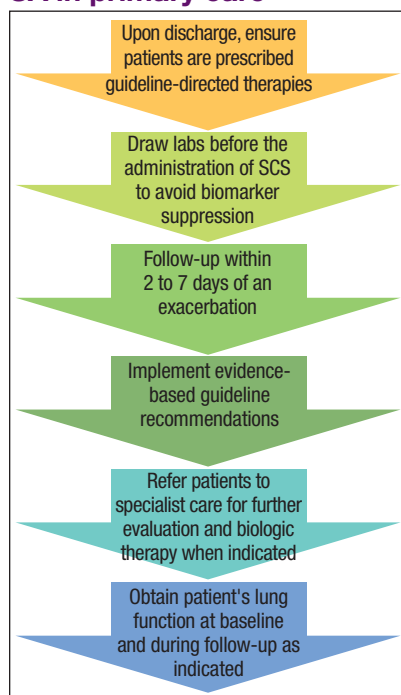
FIGURE 2. Asthma referral pathway and specialist collaboration.¹



Adapted conceptually from the Global Initiative for Asthma (GINA) Severe Asthma Guide.¹

ordering follow-up biomarker laboratory testing and monitoring. Additionally, as of 2026, a new Healthcare Effectiveness Data and Information Set metric has been added to measure follow-up after acute care and urgent care visits for asthma, with the intent of incentivizing coordination of timely follow-up care for patients who have experienced an asthma exacerbation.^{1,4,16}

Collaboration among PCCs and specialists can improve SA patient outcomes, reduce medication errors, optimize therapy, and lower health care utilization and costs. As the first practitioner to see an asthma patient, PCCs are in a critical position to collect key information (e.g., symptom frequency, exacerbation history, lung function, biomarker results, prior therapies, comorbidities, and evidence of SCS burden) that is necessary to diagnose SA and rule out confounding conditions.¹⁷ Specialist settings typically have the infrastructure and resources required to further evaluate patients and address phenotypic data and biomarker values, investigate comorbid-

FIGURE 3. Call to action for SA in primary care^{1,2,4,16}

vention results in a significant decrease in ED visits and all-cause hospitalization.^{19,20} Consequently, when specialist referral is delayed, there is a greater likelihood of persistent symptoms, improper management, frequent ED visits, and irreversible lung damage.^{1,4}

CASE STUDY (CONTINUED)

In MR's case, her PCC refers her to a pulmonologist due to persistent symptoms, frequent exacerbations, and repeated SCS use despite optimized therapy. At the specialist visit, severe eosinophilic asthma is confirmed after testing shows repeated eosinophil counts >150 cells/ μ L, an elevated FeNO of 45 ppb, and an IgE of 210 IU/mL. Inhaler technique and comorbidities are also reassessed. Based on her clinical profile and biomarker findings, she is identified as an appropriate candidate for biologic therapy and is initiated on guideline-indicated biologic treatment. An SCS-sparing strategy is implemented with close follow-up, while her PCC continues to reinforce adherence and coordinate care. Over the next few years, she experiences improved symptom control, reduced rescue inhaler use, and no further exacerbations.

SUMMARY

SA is defined as uncontrolled asthma despite maximally optimized therapy and treatment of contributory factors, or asthma that worsens when high-dose ICS is reduced. SA

ities, perform differential diagnoses, and adjust medication regimens, which often will involve the prescribing and administration of biologic therapies.¹¹ Despite these added benefits of specialist involvement, it has been reported that fewer than half of US patients with SA are evaluated by a specialist, with the smallest frequency observed in older adult patients with greater non-respiratory comorbidities.^{11,18} Multiple studies have found that specialist inter-

affects up to 10% of patients living with asthma and accounts for a disproportionate share of asthma-related health care utilization. Because these patients are often first seen in the primary care setting, PCCs play a central role in early identification, initial evaluation, and ongoing management. Specialist referral is essential for patients with persistent symptoms and those who may benefit from advanced therapies. Biologic treatments, typically initiated in specialist settings, have demonstrated reductions in exacerbations, hospitalizations, and SCS use while improving symptom control and quality of life. ●

REFERENCES

1. Global Initiative for Asthma. Global strategy for asthma management and prevention, 2026. Available from: www.ginasthma.org
2. Chen W, Tran TN, Townend J, et al. Impact of biologics initiation on oral corticosteroid use in the international severe asthma registry and the optimum patient care research database: A pooled analysis of real-world data. *J Allergy Clin Immunol Pract*. 2025;13(8):2033-2048. doi:10.1016/j.jaip.2025.04.032
3. Asthma capitals: health outcomes that impact ranking. Asthma and Allergy Foundation of America. Accessed June 29, 2026. <https://aafa.org/asthma-allergy-research/our-research/asthma-capitals/asthma-health-outcomes/>
4. Expert Panel Working Group of the National Heart, Lung, and Blood Institute (NHLBI), Cloutier MM, Baptist AP, et al. 2020 focused updates to the asthma management guidelines: A report from the national asthma education and prevention program coordinating committee expert panel working group. *J Allergy Clin Immunol*. 2020;146(6):1217-1270. doi:10.1016/j.jaci.2020.10.003
5. Trevor J, Lugogo N, Carr W, et al. Severe asthma exacerbations in the United States: Incidence, characteristics, predictors, and effects of biologic treatments. *Ann Allergy Asthma Immunol*. 2021;127(5):579-587.e1. doi:10.1016/j.anai.2021.07.010
6. Holguin E, Cardet JC, Chung KF, et al. Management of severe asthma: a European Respiratory Society/American Thoracic Society guideline. *Eur Respir J*. 2020;55(1):1900588. doi:10.1183/13993003.00588-2019.
7. Price DB, Trudo F, Voorham J, et al. Adverse outcomes from initiation of systemic corticosteroids for asthma: long-term observational study. *J Asthma Allergy*. 2018;11:193-204. doi:10.2147/JAA.S176026
8. Blaiss M, Oppenheimer J, Corbett M, et al. Consensus of an American College of Allergy, Asthma, and Immunology, American Academy of Allergy, Asthma, and Immunology, and American Thoracic Society workgroup on definition of clinical remission in asthma on treatment. *Ann Allergy Asthma Immunol*. 2023;131(6):782-785. doi:10.1016/j.anai.2023.08.609
9. Oral corticosteroids. Allergy and Asthma Foundation of America. Accessed June 29, 2026. <https://aafa.org/asthma/asthma-treatment/asthma-treatment-oral-corticosteroids-prednisone/>
10. Biologics for the management of severe asthma. Academy of Allergy, Asthma, and Immunology. Accessed June 29, 2026. <https://www.aaaai.org/tools-for-the-public/conditions-library/asthma/biologics-for-the-management-of-severe-asthma>
11. Most JE, Ambrose CS, Chung Y, et al. Real-world assessment of asthma specialist visits among U.S. patients with severe asthma. *J Allergy Clin Immunol Pract*. 2021;9(10):3662-3671.e1. doi:10.1016/j.jaip.2021.05.003
12. Carr T, Tkacz J, Chung Y, et al. Gaps in care among uncontrolled severe asthma patients in the United States. *J Allergy Clin Immunol Pract*. 2024;12:1775-1782.e2. doi:10.1016/j.jaip.2024.03.018
13. Beuther DA, Murphy KR, Zeiger RS, et al. The asthma impairment and risk questionnaire (AIRQ) control level predicts future risk of asthma exacerbations. *J Allergy Clin Immunol Pract*. 2022;10(12):3204-3212.e2. doi:10.1016/j.jaip.2022.08.017
14. Mathur S, Corbridge T, Packnett E, et al. Eosinophil count testing in patients with asthma varies by healthcare provider type in the US: a retrospective study. *Allergy Asthma Clin Immunol*. 2024;20(1):56. doi:10.1186/s13223-024-00917-4
15. Caspard H, Ambrose C, Tran T, et al. Associations between individual characteristics and blood eosinophil counts in adults with asthma or COPD. *J Allergy Clin Immunol Pract*. 2020;8(5):1606-1613. doi:10.1016/j.jaip.2019.12.019
16. HEDIS MY 2026: what's new, what's changed, what's retired. NCQA. Accessed June 29, 2026. <https://www.ncqa.org/blog/hedis-my-2026-whats-new-whats-changed-whats-retired/>
17. Trevor J, Chipps B. Severe asthma in primary care: identification and management. *Am J Med*. 2018;131:484-491. doi:10.1016/j.amjmed.2017.12.034
18. Cardet JC, Patel B, Bradford P, et al. Primary care provider referral patterns and awareness of biologic therapy for uncontrolled asthma. *J Allergy Clin Immunol Glob*. 2025;5(2):100607. doi:10.1016/j.jacig.2025.100607
19. Ambrose CS, Chipps BE, Moore WC, et al. The CHRONICLE study of US adults with subspecialist-treated severe asthma: objectives, design, and initial results. *Pragmat Obs Res*. 2020;11:77-90. doi:10.2147/POR.S251120
20. Rosman Y, Hornik-Lurie T, Meir-Shafir K, et al. The effect of asthma specialist intervention on asthma control among adults. *World Allergy Organ J*. 2022;15(11):100712. doi:10.1016/j.waojou.2022.100712