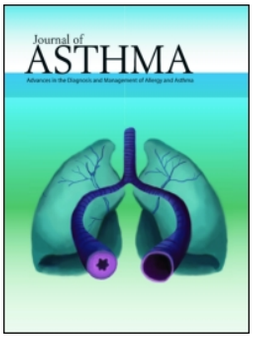

Journal of Asthma

ISSN: 0277-0903 (Print) 1532-4303 (Online) Journal homepage: https://www.tandfonline.com/loi/ijas20

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To cite this article: Siddhartha Singh, Salim Surani, Sue McGuinness, James Eudicone, Ileen Gilbert & Shyam Subramanian (2020): Current practice patterns, challenges, and educational needs of asthma care providers in the United States, Journal of Asthma, DOI: 10.1080/02770903.2020.1761980

To link to this article: https://doi.org/10.1080/02770903.2020.1761980

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Published online: 19 May 2020.

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JOURNAL OF ASTHMA
https://doi.org/10.1080/02770903.2020.1761980

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Current practice patterns, challenges, and educational needs of asthma care providers in the United States

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ABSTRACT

Objective: For severe, uncontrolled asthma (SUA), a gap exists between recent scientific advances and their incorporation into clinical practice. Using a Knowledge-to-Action Framework, new knowledge can be translated into evidence-based interventions to improve outcomes. The AstraZeneca U.S. PRECISION initiative aims to apply this Framework to improve recognition and management of SUA. The study objective was to identify factors contributing to gaps in care for patients with SUA. Results from a needs assessment survey of U.S. pulmonologists and allergists/immunologists were assessed within the Knowledge-to-Action Framework to advance bench-to-bedside care.

Methods: Pulmonologists and allergists/immunologists from across the United States were invited to complete a customized, quantitative severe asthma survey in person at the 2017 American Thoracic Society annual meeting or *via* the Internet. Responses were summarized descriptively, and chi-squared tests evaluated associations between variables of interest.

Results: Overall, 140 U.S. providers responded, most of whom were pulmonologists (84%). Most (60%) practiced in a community-based setting; 40% practiced at an academic medical center. Key challenges to providing care for patients with severe asthma included insurance company requirements and identification of the pathophysiology of an individual patient's severe asthma. Traditional measures of asthma-related morbidity were ranked as highly important by significantly more respondents compared with assessment of biomarkers ($p < 0.0001$). Respondents generally valued online virtual self-education.

Conclusions: Survey results identified unmet needs for the identification and management of patients with SUA and opportunities to improve patient outcomes through evidence-based management of SUA, including testing for biologic eligibility and subsequent use of biologic therapies.

ARTICLE HISTORY
Received 16 May 2019
Revised 6 March 2020
Accepted 23 April 2020

KEYWORDS
Asthma; surveys and questionnaires; health care surveys; pulmonologists; allergists; academic medical centers; continuing medical education; Knowledge-to-Action Framework

Introduction

Several organizations have published guidelines for asthma management, including the National Asthma Education and Prevention Program (NAEPP) (1) and the European Respiratory Society (ERS)/American Thoracic Society (ATS) (2). The Global Initiative for Asthma (GINA) has also published reports outlining clinical practice recommendations based on the latest research (3). Despite the existence of such recommendations, the care of approximately 26 million individuals in the United States (8.3% of the population) with a current diagnosis of asthma (4) may be suboptimal. In 2015, asthma was the primary diagnosis recorded in 1.7 million emergency department (ED) visits in the United States, as well as 11.0 million physician office visits in 2014 (4). Furthermore, asthma was the underlying cause for 10.0 deaths per million (a total of 3518 deaths) in the United States in 2016 (4). For patients with severe asthma, the prevalence of poor control and asthma exacerbations has not decreased within the last decade (5). In the United States, the economic burden of asthma is estimated at $82 billion annually, with $3 billion in asthma-related work/school absenteeism (6).

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Supplemental data for this article can be accessed at publisher's website.

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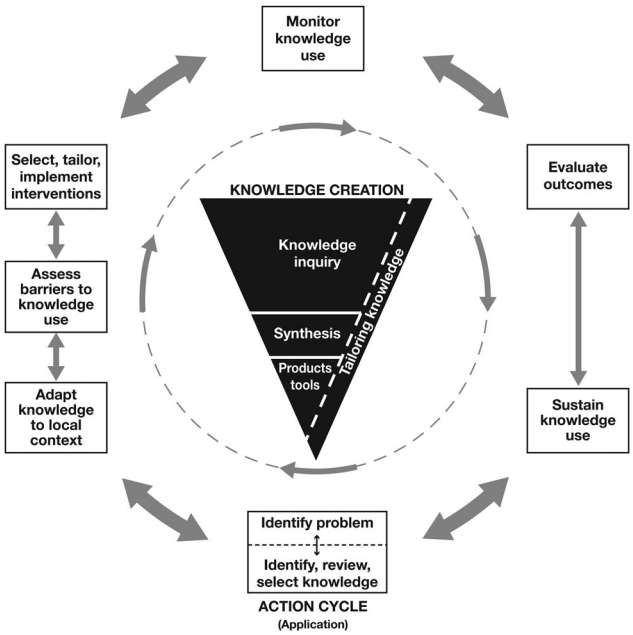

Figure 1. The Knowledge-to-Action Framework (8). The Knowledge-to-Action Framework involves 2 main components: 1) Knowledge Creation and 2) the Action Cycle. Knowledge Creation is represented by a funnel that illustrates the process by which knowledge becomes more refined and, presumably, more useful over time. The Action Cycle refers to the actions necessary to drive the changes in practice that result from application of new knowledge (8). The first step of the Action Cycle is to identify the problem and review knowledge, and this is the part of the cycle addressed in this report. Reprinted with permission from Wolters Kluwer Health, Inc (8). https://journals.lww.com/jcehp/Abstract/2006/26010/Lost_in_knowledge_translation__Time_for_a_map_.3.aspx.

Translation of evidence-based guidelines into clinical practice has been suboptimal for many chronic diseases, preventing untold numbers of patients from realizing the potential benefits of new therapies (7). The Knowledge-to-Action Framework originated in Canada and describes a process to translate new knowledge into sustainable evidence-based interventions that health care practitioners (HCPs) can apply in daily practice to improve outcomes and bridge the care gap (Figure 1) (8). This approach comprises 2 main components: 1) Knowledge Creation and 2) the Action Cycle. Knowledge Creation is the process by which specific knowledge becomes more refined over time, whereas the Action Cycle is an iterative process that develops the strategies necessary to drive changes in practice resulting from the application of new knowledge (8).

The AstraZeneca U.S. PRECISION initiative is an advisor network of more than 240 scientific experts and HCPs. This network was formed to develop and assess innovative clinical practice-enhancing tools for identification, evaluation, and optimal management of patients with severe, uncontrolled asthma (SUA), defined as meeting the criteria for both severe asthma (according to GINA-based age-specific definitions) and uncontrolled asthma (poor symptom control and/or frequent exacerbations). As advisors involved in U.S. PRECISION, we are applying the Knowledge-to-Action Framework to facilitate implementation of these objectives. Given the aforementioned care gap, we hypothesized that practitioners encounter barriers against the incorporation of new evidence-based interventions (i.e. biologic therapies, appropriate add-on therapies, and bronchial thermoplasty) (9) in the clinical setting. The survey data presented here reflect our initial efforts at entering the Action Cycle by identifying challenges and barriers to identification and management of SUA by practicing pulmonologists and allergists/immunologists with the goal of developing new resources and tools.

Methods

Survey participants

Pulmonologists and allergists/immunologists from across the United States were invited to complete a customized, quantitative severe asthma survey *via* one of the following outreach methods: in person during the 2017 American Thoracic Society annual meeting (May 2017, Washington, DC), through emails from the AstraZeneca field medical and scientific teams, or *via* email and social media outreach to CHEST Foundation members. An estimated 3500 providers were reached through the obstructive lung disease special interest networks of the American College of Chest Physicians (CHEST). Providers were not directly compensated for completing the study; however, for providers who responded through CHEST member outreach, a donation was made to the CHEST Foundation for each survey completed through this mechanism.

Survey development

The survey was developed using the proprietary survey tool 3ConneX^{TM} (Simpson Healthcare Executives, LLC, Old Lyme, CT). The survey comprised 4 multicomponent questions addressing key aspects of the diagnosis and management of severe asthma, namely: 1) "What challenges do you face in providing optimal care for your patients with severe, uncontrolled asthma?" (components included characterizing etiology, insurance company requirements, patient adherence, and resources for patient management and therapy), 2) "Which of the following parameters do

you take into consideration in determining therapy for your patients with severe, uncontrolled asthma?" (components included subjective report of symptoms, objective quantification of symptoms, lung function, oral corticosteroid [OCS] bursts, long-term OCS use, ED visits, hospitalizations, NAEPP and/or GINA guidelines, immunoglobulin E [IgE], skin/radioallergosorbent test [RAST] tests, fractional exhaled nitric oxide [FeNO], serum eosinophils [EOS], sputum EOS, and bronchoscopy), 3) "What resources do you believe are important for you to optimally manage your patients with severe, uncontrolled asthma?" (components included practice team members to educate patients, practice team members to facilitate access to therapies, practice environment for patients to receive injections, and information on new diagnosis/therapy options), and 4) "Which educational opportunities and learning formats would be beneficial in optimizing your capabilities for managing patients with severe, uncontrolled asthma?" (components included national presentations by top experts at congresses, local speaker programs, interactive learning opportunities with experts/peer groups, case-based learning, educational curriculum delivered as small modules over time, initiatives directed to your multidisciplinary practice team, and on-demand learning and practice capability enhancement requests to medical experts). For questions 1, 3, and 4, there were 4 response options for each component. For question 2, respondents were asked to score each component on a scale of 0–5, where 0 was minimally important and 5 was highly important. Additionally, respondents were asked what percentage of their patients with severe asthma were receiving biologic therapy. The full survey and results are available in Supplement 1. Questions and response options were drafted based on expert opinion from U.S. PRECISION national advisors on the challenges experienced in practice for identifying and managing severe asthma and were discussed at 3 regional working group meetings.

Statistical analyses

Respondents were classified by U.S. location, practice type (general pulmonary, allergy/immunology, or both specialties), and practice setting (academic medical center [AMC] or community based [CB], with or without an academic affiliation). Responses were summarized descriptively for the overall sample and by subgroup.

Chi-squared tests were used to assess the association between categorical variables of interest. The analysis of treatment decisions evaluated 2 associations: 1) the association between modality (clinical comorbidity or biomarker) and category of response across all physicians (a rating of 0–3 or 4–5), and 2) the association between physician practice type (AMC or CB) and category of response (a rating of 0–3 or 4–5).

Statistical analyses were performed using SAS Enterprise Guide 7.1.

Results

Respondent and practice characteristics

A total of 140 HCPs from 38 states in the United States responded to this survey (most frequently from North Carolina, $n = 13$; New York, $n = 12$; and California, $n = 11$). The majority practiced in a CB setting (60%); the remaining 40% practiced at an AMC. Most (84%; $n = 118$) respondents were pulmonologists; the other 22 (16%) were allergists/immunologists or had combined pulmonary and allergy practices. A similar percentage of respondents practicing in an AMC or CB setting reported managing the care of >50 patients with severe asthma (39% and 31%, respectively; Supplement 2).

Challenges faced in providing optimal care

This section of the survey asked "What challenges do you face in providing optimal care for your patients with severe, uncontrolled asthma?" and evaluated 4 aspects of managing patients with severe asthma: characterizing etiology, insurance company requirements, patient adherence, and resources for patient management and therapy. For each aspect, respondents were asked to select whether it was always, often, sometimes, or never a challenge for them. Nearly two-thirds (64%) of respondents rated "insurance company requirements in prescribing an optimal treatment plan for a specific patient" as a challenge they often or always face (Figure 2A). More than half of respondents identified "characterizing the etiology of severe, uncontrolled asthma in individual patients" as a challenge that they often or always face, but fewer respondents had challenges with patient adherence to management plans or "practitioner recognition of patients with severe, uncontrolled asthma needing specialist referral." A between-challenge chi-squared test yielded $p < 0.0001$, indicating that the degree of difficulty experienced with these challenges was not equivalent. There was no significant difference between AMC and CB respondents with regard to the frequency of challenges faced, which suggests that

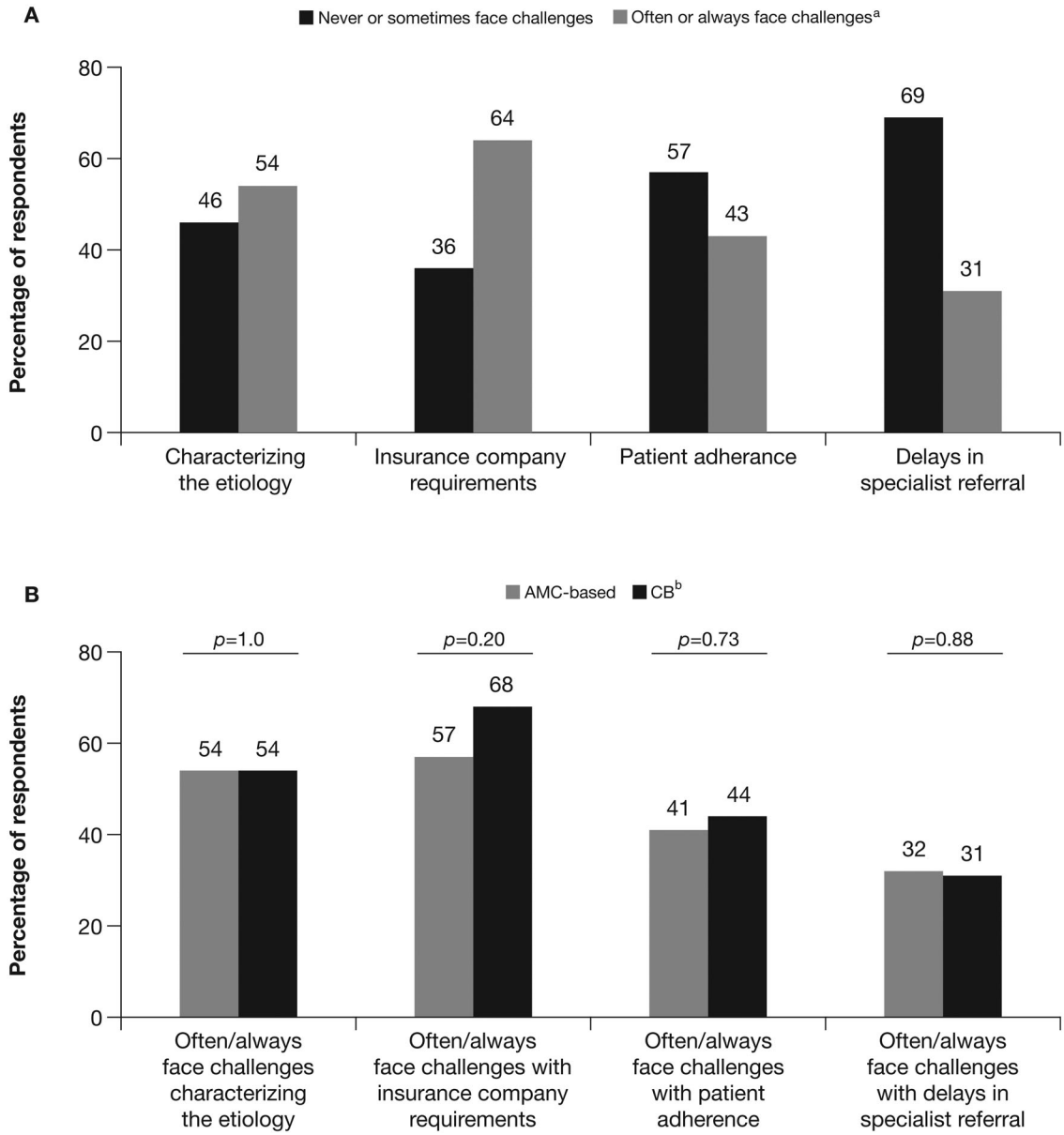

Figure 2. Frequency of challenges to provision of optimal care for patients with severe asthma. A) The types of challenges and the frequency with which providers experience them[c] for all respondents. B) Challenges "often" or "always" faced by respondents by practice type are shown. AMC, academic medical center; CB, community-based. [a]$p < 0.0001$ across all 4 challenges. [b]Comparisons were made for AMC and CB practitioners for each of the 4 individual challenges using chi-square to evaluate 2×2 frequency tables displaying Frequency of Physician Practice Setting $\times$ Difficulty, where Difficulty was dichotomously categorized as Often/Always a Challenge (response of 2 or 3) vs. Not Often/Always a Challenge (response of 0 or 1); however, none of these associations were significant. [c]Survey respondents were asked: "What challenges do you face in providing optimal care for your patients with severe, uncontrolled asthma?" Response choices were "never," "sometimes," "often," or "always." *p*-values are determined using a chi-squared test for the percentage of respondents who "never" or "sometimes" compared with "often" or "always" face particular challenges.

providers face the same challenges regardless of practice setting (Figure 2B).

Factors considered in therapy decisions

Respondents were next asked about factors they consider when making therapy decisions. Both conventional measures and biomarkers were included in the evaluation (full details are provided in Supplement 1). Response options were on a 0–5 scale, representing minimally important to highly important. Hospitalizations were cited as the most important factor considered in making therapy decisions (94% of all respondents rated 4 or 5; 93% for CB and 95% for AMC). Other traditional measures of morbidity in SUA (ED visits, OCS bursts, and long-term or cumulative OCS use) were

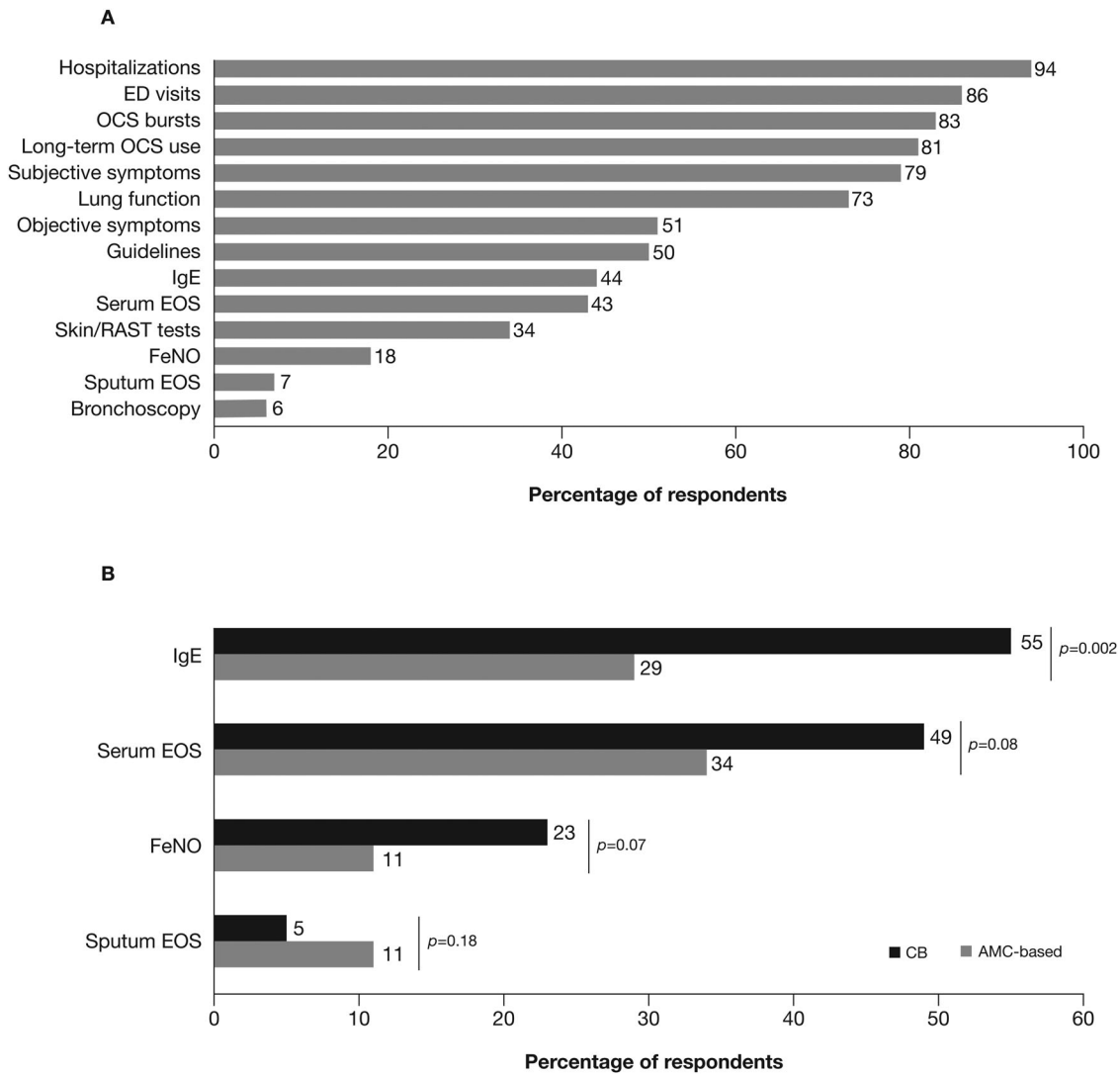

Figure 3. Factors considered in making therapy decisions. The importance of each factor in making decisions about therapy[a] was ranked by A) all respondents and B) respondents separated by practice type.[b] AMC, academic medical center; CB, community-based; ED, emergency department; EOS, eosinophils; FeNO, fractional exhaled nitric oxide; IgE, immunoglobulin E; OCS, oral corticosteroids; RAST, radioallergosorbent test. [a]Survey respondents were asked: "When determining therapy for patients with severe, uncontrolled asthma, please rate the degree to which you take into consideration each of the following parameters." Response choices were 0–5 (0 = minimally important; 5 = highly important). [b]*p*-values are determined using a chi-squared test for the percentage of respondents who rate each factor with a score of 4–5 compared with 0–3 between practice types. The dichotomization for the degree of consideration for each parameter was tested via chi-square for association with practice type (CB vs. AMC), traditional measures of morbidity vs. biomarkers.

ranked as important (4 or 5 rating) by >80% of respondents (Figure 3A), with no significant differences between practice settings. However, significantly more AMC respondents (63%) ranked objective symptom measures, such as Asthma Control Questionnaire or Asthma Control Test scores, with an importance of 4 or 5 compared with CB respondents (43%; $p = 0.02$).

Overall, traditional measures of morbidity were ranked with an importance of 4 or 5 by significantly more respondents compared with the use of biomarkers ($p < 0.0001$). However, significantly more respondents from CB practices (55%) than from AMCs (29%) ranked the use of IgE as important or highly important ($p = 0.003$; Figure 3B). For overall use of biomarkers compared with clinical morbidities, significantly more CB respondents (29%) ranked biomarkers as highly important compared with AMC respondents (20%; $p = 0.003$).

Overall, almost 60% of respondents prescribed a biologic for less than 10% of their patients with severe asthma. Only 20% of AMC respondents and 15% of CB respondents reported having more than one-third of the patients in their practice with severe asthma treated with a biologic therapy; this difference was not significant.

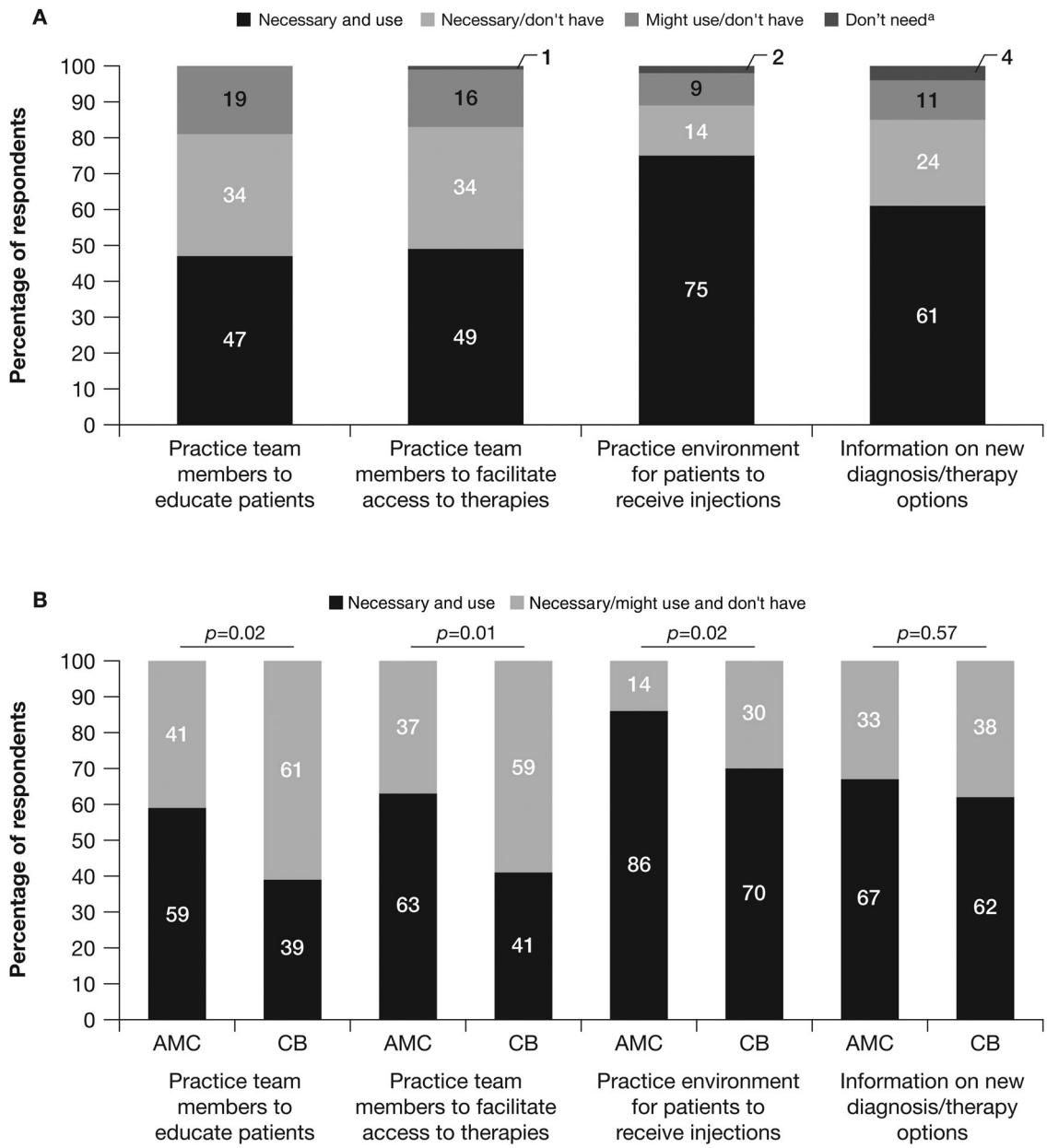

Figure 4. Characterization of resources necessary for optimal management of severe asthma.[b] The percentages of A) all respondents and B) respondents by practice type[c] who considered each resource necessary for severe asthma management are shown. AMC, academic medical center; CB, community-based. [a]$p < 0.0001$ across all 4 resources. [b]Survey respondents were asked: "What resources do you believe are important for you to optimally manage your patients with severe, uncontrolled asthma?" Response choices were: "necessary and use," "necessary but don't have," "might use but don't have," and "don't need." [c]*p*-values are determined using a chi-squared test for the percentage of respondents who rate each factor as "necessary and use" compared with "necessary/might use but don't have" (which is the result of combining the "necessary but don't have" and the "might use but don't have" response options) between practice types.

Necessary resources for optimal care

This section of the survey evaluated the importance of 4 specific resources for optimal management of patients with severe asthma: 1) practice team members to educate patients, 2) practice team members to facilitate access to therapies, 3) practice environment for patients to receive injections, and 4) information on new diagnosis/therapy options. For each resource, response choices were the following: "necessary and currently use," "necessary but don't have," "might use but don't have," and "don't need." Respondents from both practice types (AMC and CB combined; Figure 4A) rated each of these as similarly necessary resources (combined "necessary but don't have" and "might

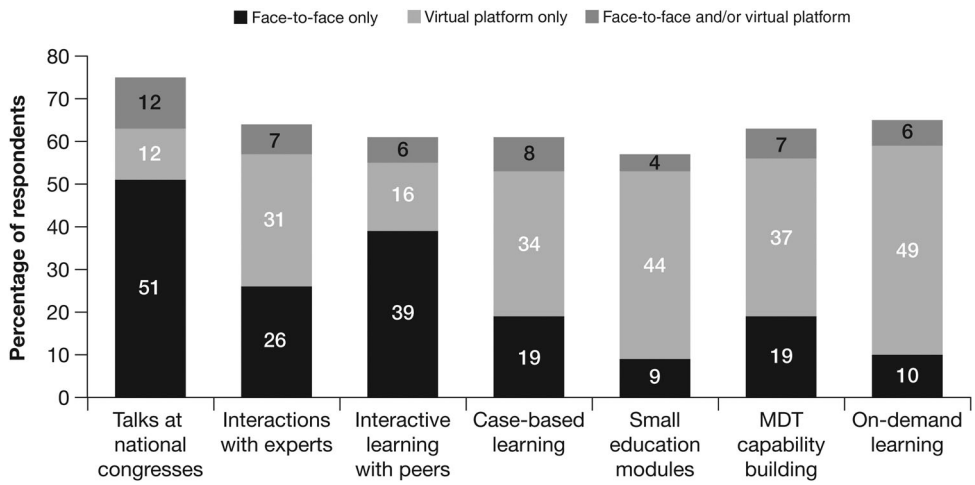

Figure 5. Value of different types of educational opportunities and formats.[a,b] The percentages of respondents who preferred each type of format for each educational opportunity are shown. AMC, academic medical center; CB, community-based; MDT, multidisciplinary team. [a]Survey respondents were asked: "How valuable are each of the following educational opportunities/formats to assist you in effectively managing your patients with severe, uncontrolled asthma?" Response choices were "face-to-face only," "virtual platform only," and "face-to-face and/or virtual platform." Responses were dichotomized into face-to-face or virtual (combining "highly valuable face-to-face" and "highly valuable virtually") and neither/none (combining "somewhat valuable ± virtual access" and "of no value to me"), and chi-square was used to test the association with practice type (AMC or CB). No significant associations were found. This figure shows simple percentages of respondents. [b]Bars did not total 100% because some respondents selected that these educational opportunities were "of no benefit to me."

use but don't have" response options into "necessary/might use [but don't have]"; this category was compared to the "necessary and use" category in the frequency tables via chi-square). However, some respondents stated that they did not have items considered necessary, such as a practice environment suitable for patients to receive injectable treatments or practice team members who can facilitate access to therapies and to educate patients. Overall, the level of importance was significantly different across the resources used to manage patients with SUA ($p < 0.0001$). The percentages of respondents who believed they did not need any of these resources were very low.

When these data were analyzed according to practice setting, the percentage of respondents who stated that resources were necessary or they might use but don't have them was consistently greater for those in CB practices than for those in AMC practices with the exception of information on new diagnosis and treatment options, for which there were no significant differences (Figure 4B).

Value of educational opportunities to assist in effective management

Respondents were asked to rate the value of specific educational opportunities and/or formats (Figure 5). Educational opportunities evaluated included national presentations by top experts at congresses, local speaker programs, interactive learning opportunities with experts/peer groups, case-based learning, educational curriculum delivered as small modules over time, initiatives directed to your multidisciplinary practice team, and on-demand learning and practice capability enhancement requests to medical experts. Response options were "highly beneficial at my practice site," "highly beneficial virtually," "occasionally beneficial ± virtual access," and "no benefit to me." Other than learning with peers and talks at national congresses, online virtual educational opportunities were considered by respondents to be as valuable as or more valuable than face-to-face interactions (Figure 5). There was no significant difference in educational opportunities preferred by respondents from CB practices compared with AMC respondents (data not shown).

Discussion

Clinical and systemic barriers to action

This survey identified 2 key challenges for HCPs who manage patients with SUA, namely dealing with insurance companies to obtain approval of treatment plans and understanding the pathophysiology of a given patient with severe asthma. The latter reflects the heterogeneous nature of severe asthma (10).

The greatest unmet needs ("necessary/might use but don't have") were an insufficient number of practice team members to both educate patients and facilitate access to care. Notably, unmet needs for resources were more common in the CB setting. The need for practice team members to facilitate access to therapies and deliver patient education may be an indicator of workload burden, coupled with a need for education among other team members so that such responsibilities can be shared. As a result of increasing caseloads and conflicting priorities, clinicians have a limited amount of time to spend with each patient (11). In a 2013 survey of hospital-based physicians, 22% of respondents indicated that they had ordered unnecessary tests or procedures because of inadequate time to assess patients, which also has implications for putting new medical knowledge into practice. In addition, insufficient support for nonclinical tasks, together with the lack of effective tools that could facilitate decision making, can impact clinical practice (12).

Factors influencing treatment decisions

Biomarkers can be used to gain mechanistic information and allow for individualization of treatment. Our results demonstrated that consideration of biomarkers for therapy decisions was low; less than 30% of respondents rated these as important or highly important. Notably, a greater percentage of respondents in the CB setting than in the AMC setting rated the use of biomarkers as highly important. Overall, use of currently available biologics was very low: the majority of respondents reported that less than 10% of their patients with severe asthma were receiving biologic therapy. However, a recent analysis of medication adherence among patients with SUA and an eosinophilic or allergic phenotype reported 43.5% and 55% of patients were eligible for anti-IgE therapy or both anti-IgE and anti–interleukin 5 therapy, respectively (13). It should be noted that ∼50% of patients with symptomatic asthma have noneosinophilic asthma (14,15). Only one-third of respondents claimed a need for information regarding novel diagnostics and/or new therapies, suggesting a poor awareness of biomarker tests that could lead to effective treatment with novel targeted agents. Our findings confirm a need for greater efforts to translate knowledge into clinical practice, as well as a need for better understanding of the reasons behind low uptake of biologics into clinical practice.

There remains a reliance on conventional measures of clinical morbidity (primarily those associated with exacerbations) to guide therapeutic decision making, particularly in AMC practices. Objective measures of asthma control (e.g. Asthma Control Test, Asthma Control Questionnaire, Asthma Therapy Assessment Questionnaire) and guidelines were considered highly important by only one-half of all respondents. Our data are consistent with results from a Canadian study that found that 33% of specialists surveyed had suboptimal knowledge of GINA and 28% had incomplete knowledge of national asthma management guidelines (16).

Educational approaches

Understanding which communication methods are most effective in changing clinician behavior in everyday practice is vital, given the known challenges of implementing new medical knowledge. Survey respondents reported that they believed learning with peers and attending conferences remains a valuable educational method. Virtual platform (not face-to-face) learning opportunities were also considered valuable, especially when they could access such resources at a time of their choosing. This may reflect the lack of time specialists have for their professional development and suggests that multiple modalities for delivering continuing medical education and point-of-care information are needed. On-demand point-of-care education provided at the time of clinical decision making may help close care gaps (17).

The Knowledge-to-Action Framework in asthma

Most often applied in Canada to date, the Knowledge-to-Action Framework to drive change in clinical practice is gradually being adopted globally in a variety of therapeutic areas (18–21). A small number of studies have applied the Knowledge-to-Action Framework in asthma to translate GINA or national/regional guidelines into improved management. One Canadian study identified key barriers to delivering a regional guideline-based multidisciplinary asthma patient program; these encompassed issues at the health system, practice, and individual patient levels (12). A set of practical tools was then developed, including standardized asthma-related assessments and decision support. At 6 months after implementation, the delivery of guideline-recommended asthma education and appropriate prescribing of controller medications had improved.

The 10-year Finnish National Asthma Program set specific goals and measures, which included early diagnosis and active treatment of asthma and implementation of individualized patient education (22,23). Importantly, the program was based upon enhancement of existing practices and employed a network of asthma coordinators. This program improved primary and secondary health care delivery and resource use.

Simple tools have also been evaluated. In one study, a self-inking stamp that printed a short checklist based on key points from the Canadian national guidelines was developed for use by primary care providers (PCPs) on a patient's chart (17). This measure increased investigation of asthma control per national guideline recommendations, and the PCPs reported that they used this tool in more than 50% of interactions with their patients with asthma (17). In another study, PCPs were provided 4-page, highly visual summaries adapted from guidelines (24). Although the majority of participants viewed the tool as useful and relevant to their practice, only one-third actually used it. Reasons reported were time constraints, lack of resources (24), and possibly a lack of ownership in development of the tool. Building on these findings, the U.S. PRECISION initiative directly involves HCPs in the development of point-of-care tools to address the challenges identified in managing severe asthma.

Limitations

This study, including the development of the practitioner survey, which was an unbranded survey, was funded by AstraZeneca. Although the needs assessment survey respondents reflected U.S. geographic diversity, the sample size was relatively small. Of the 12 000 pulmonologists and 4500 allergists/immunologists in the United States, 118 pulmonologists and 22 allergists/immunologists (or physicians with combined pulmonary and allergy practices) were surveyed (25,26). The physicians who responded to the survey—mostly pulmonologists—may not represent the views of PCPs (who still treat a majority of patients with asthma). Moreover, the individuals who responded to the survey may represent the most motivated providers in the field and may not represent the experience of physicians who chose not to respond to the survey. The involvement of a large, diverse group of U.S. PRECISION advisors and multiple focus groups are being used to overcome some of these limitations and to ensure the development of relevant tools and resources. In addition to the barriers to optimizing management of SUA faced by providers that are previously described, the cost of therapy can also be a barrier to treatment optimization (27). However, there remains a paucity of data looking at the effect size of both direct and indirect costs of care for patients with asthma. In fact, for those patients with truly refractory asthma that is not due to under-treatment or comorbid conditions, the cost in morbidity to the patient compared with the cost of these therapies must be taken into consideration given the worldwide recognition by experts that patients who truly have SUA have a right to the proper diagnosis and treatment (28).

Conclusions

This study quantified unmet needs for pulmonologists and allergists/immunologists in the management of patients with SUA. Key challenges included insurance company requirements in prescribing optimal treatment for specific patients and identifying the pathophysiology of an individual patient's severe asthma. Looking at these provider challenges in conjunction with the significant burden of poor asthma control and exacerbations that have not decreased within the last decade (5) suggests a need for accelerated implementation of new precision medicine into practice.

Acknowledgements

Medical writing support was provided by Katie Gersh, PhD, of MedErgy (Yardley, PA, USA), which was in accordance with Good Publication Practice (GPP3) guidelines and funded by AstraZeneca (Wilmington, DE, USA). The investigational team would also like to acknowledge regional U.S. PRECISION advisors for their participation and CHEST for their outreach assistance in administering the survey.

Disclosure statement

S. Singh is a consultant for AstraZeneca. S. Surani has served as a National Advisor for the U.S. PRECISION Program. S. McGuinness, J. Eudicone, and I. Gilbert are employees of AstraZeneca. All authors are collaborators with the ongoing U.S. AstraZeneca PRECISION program.

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Supplement 2. Summary of Survey Results For All Respondents (N=140)[a]

Question/component	Response options	Responses for all participants (N=140), n (%)
1. What challenges do you face in providing optimal care for your patients with severe, uncontrolled asthma?		
a. Characterizing the etiology of severe, uncontrolled asthma in a given patient	No challenges	1 (0.7)
	Some challenges	64 (45.7)
	Often face challenges	54 (38.6)
	Almost always encounter challenges	21 (15.0)
b. Insurance company requirements in prescribing an optimal treatment plan for a specific patient	No challenges	4 (2.9)
	Some challenges	47 (33.6)
	Often face challenges	60 (42.9)
	Almost always encounter challenges	29 (20.7)
c. Patient adherence with management plans	No challenges with patient nonadherence	2 (1.4)
	Challenges with some patients	78 (55.7)
	Challenges with many patients	54 (38.6)
	Challenges with almost all my patients	6 (4.3)
d. Practitioner recognition of patients with severe, uncontrolled asthma needing specialist referral	No challenges with PCPs in my network	18 (12.9)
	Challenges with some PCPs	78 (55.7)
	Challenges with many PCPs	36 (25.7)
	Challenges with almost all PCPs	8 (5.7)
2. Which of the following parameters do you take into consideration in determining therapy for your patients with severe, uncontrolled asthma? (0=minimally important to 5=highly important)		
a. Patients' subjective report of symptoms	0–3	29 (20.7)
	4–5	111 (79.3)
b. Objective quantification of symptoms (ACT, ACQ, ATAQ)	0–3	69 (49.3)
	4–5	71 (50.7)
c. Objective measures of lung function	0–3	38 (27.1)
	4–5	102 (72.9)
d. Bursts of oral steroids	0–3	24 (17.1)

	4–5	116 (82.9)
e. Long-term use of oral steroids	0–3 4–5	26 (18.6) 114 (81.4)
f. Emergency department visits	0–3 4–5	19 (13.6) 121 (86.4)
g. Hospitalizations	0–3 4–5	9 (6.4) 131 (93.6)
h. NAEPP and/or GINA guidelines recommendations	0–3 4–5	70 (50.0) 70 (50.0)
i. IgE concentrations	0–3 4–5	78 (55.7) 62 (44.3)
j. Skin/RAST testing results	0–3 4–5	93 (66.4) 47 (33.6)
k. FeNO measures	0–3 4–5	115 (82.1) 25 (17.9)
l. Serum eosinophil counts	0–3 4–5	80 (57.1) 60 (42.9)
m. Sputum eosinophil counts	0–3 4–5	130 (92.9) 10 (7.1)
n. Bronchoscopy	0–3 4–5	131 (93.6) 9 (6.4)
3. What resources do you believe are important for you to optimally manage your patients with severe, uncontrolled asthma?		
a. Practice team member(s) educating patients on their disease and management plans	Necessary and currently use Necessary, but don’t have Might use, but don’t have Don’t need	66 (47.1) 47 (33.6) 27 (19.3) 0
b. Practice team member(s) facilitating patient access to therapies for optimal management	Necessary and currently use Necessary, but don’t have Might use, but don’t have Don’t need	69 (49.3) 47 (33.6) 22 (15.7) 2 (1.4)

c. Staffing and/or facilities within your practice environment for patients to receive injectable therapies	Necessary and currently use Necessary, but don't have Might use, but don't have Don't need	105 (75.0) 20 (14.3) 13 (9.3) 2 (1.4)
d. Easily accessible, practical information for you and your practice's MDT on new diagnostic and therapeutic options for identification and management of your patients with severe, uncontrolled asthma	Necessary and currently use Necessary, but don't have Might use, but don't have Don't need	86 (61.4) 33 (23.6) 16 (11.4) 5 (3.6)
4. Which educational opportunities and learning formats would you find valuable in optimizing your capabilities for managing patients with severe, uncontrolled asthma?		
a. Expert talks at national congresses	Face-to-face only Virtual platform only Face-to-face and/or virtual platform Of no value to me	71 (50.7) 17 (12.1) 17 (12.1) 35 (25.0)
b. Interactive learning opportunities with experts	Face-to-face only Virtual platform only Face-to-face and/or virtual platform Of no value to me	37 (26.4) 44 (31.4) 10 (7.1) 49 (35.0)
c. Interactive learning opportunities with my peer group	Face-to-face only Virtual platform only Face-to-face and/or virtual platform Of no value to me	54 (38.6) 22 (15.7) 9 (6.4) 55 (39.3)
d. Case-based learning	Face-to-face only Virtual platform only Face-to-face and/or virtual platform Of no value to me	26 (18.6) 48 (34.3) 11 (7.9) 55 (39.3)
e. Educational curriculum delivered as small modules over time	Face-to-face only Virtual platform only Face-to-face and/or virtual platform	12 (8.6) 61 (43.6) 6 (4.3)

	Of no value to me	61 (43.6)
f. Educational and/or capacity-building initiatives directed to your multidisciplinary practice team	Face-to-face only Virtual platform only Face-to-face and/or virtual platform Of no value to me	27 (19.3) 52 (37.1) 10 (7.1) 51 (36.4)
g. On-demand learning and practice capability enhancement requests to medical experts	Face-to-face only Virtual platform only Face-to-face and/or virtual platform Of no value to me	14 (10.0) 68 (48.6) 9 (6.4) 49 (35.0)
5. Percent of patients in your practice who have severe asthma	0%–25% 25%–50% >50%	59 (42.1) 33 (23.6) 48 (34.3)
6. Percent of your severe asthma patients who are receiving biologic therapy	0%–10% 10%–33% >33%	82 (58.6) 34 (24.3) 24 (17.1)

ACQ, Asthma Control Questionnaire; ACT, Asthma Control Test; ATAQ, Asthma Therapy Assessment Questionnaire; FeNO, fractional exhaled nitric oxide; GINA, Global Initiative for Asthma; IgE, immunoglobulin E; MDT, multidisciplinary team; NAEPP, National Asthma Education and Prevention Program; PCP, primary care provider; RAST, radioallergosorbent test.

[a]Percentages have been rounded so may not sum to 100%

AstraZeneca

What challenges do you face in providing optimal care for your patients with severe uncontrolled asthma?
Characterizing the etiology of severe uncontrolled asthma in a given patient

- No challenges
- Some challenges
- Often face challenges
- Almost always encounter challenges

Insurance company requirements in prescribing an optimal treatment plan for a specific patient

- No challenges
- Some challenges
- Often face challenges
- Almost always encounter challenges

Patient adherence with management plans

- No challenges with patient non-adherence
- Challenges with some patients
- Challenges with many patients
- Challenges with almost all of my patients

Resources to optimally manage and obtain therapies for patients with severe uncontrolled asthma

- No challenges with resources
- Sometimes challenged by inadequate resources
- Often challenged by a lack of resources
- Almost always face challenges because of lack of necessary resources

Practitioner recognition of patients with severe uncontrolled asthma needing specialist referral

- No challenges with PCPs in my network
- Challenges with some PCPS
- Challenges with many PCPs
- Challenges with almost all PCPs

Which of the following parameters do you take into consideration in determining therapy for your patients with severe uncontrolled asthma?
Patients' subjective report of symptoms

- Always consider
- Often consider
- Sometimes consider
- Never consider

Objective quantification of symptoms (ACT, ACQ, ATAQ)

- Always consider
- Often consider
- Sometimes consider
- Never consider

Objective measures of lung function

- Always consider
- Often consider
- Sometimes consider
- Never consider

Bursts of oral steroids

- Always consider
- Often consider
- Sometimes consider
- Never consider

Chronic use of oral steroids

- Always consider
- Often consider
- Sometimes consider
- Never consider

Emergency department visits

- Always consider
- Often consider
- Sometimes consider
- Never consider

Hospitalizations

- Always consider
- Often consider
- Sometimes consider
- Never consider

NAEEP or GINA Guidlines recommendations

- Always consider
- Often consider
- Sometimes consider
- Never consider

IgE levels

- Always consider
- Often consider
- Sometimes consider
- Never consider

Skin/RAST testing results

- Always consider
- Often consider
- Sometimes consider
- Never consider

FeNO measures

- Always consider
- Often consider
- Sometimes consider
- Never consider

Serum eosinophil levels

- Always consider
- Often consider
- Sometimes consider
- Never consider

Sputum eosinophil levels

- Always consider
- Often consider
- Sometimes consider
- Never consider

Bronchoscopic evaluation

- Always consider
- Often consider
- Sometimes consider
- Never consider

What resources do you believe are important for you to optimally manage your patients with severe uncontrolled asthma?
Practice team member(s) educating patients on their disease and management plans

- Necessary and currently use
- Necessary, but don't have
- Might use, but don't have
- Don't need

Practice team member(s) facilitating patient access to therapies for optimal management

- Necessary and currently use
- Necessary, but don't have
- Might use, but don't have
- Don't need

Staffing and/or facilities within your practice environment for patients to receive injectable therapies

- Necessary and currently use
- Necessary, but don't have
- Might use, but don't have
- Don't need

Specialty referral network for managing comorbidities of patients with severe uncontrolled asthma

- Necessary and currently use
- Necessary, but don't have
- Might use, but don't have
- Don't need

Easily accessible, practical information for you and your practice's multidisciplinary team on new diagnostic and therapeutic options for identification and management of your patients with severe uncontrolled asthma.

- Necessary and currently use
- Necessary, but don't have
- Might use, but don't have
- Don't need

Which educational opportunities and learning formats would be beneficial in optimizing your capabilities for managing patients with severe uncontrolled asthma. (Please mark as many options as applicable for your practice situation).
National presentations by top experts at Congresses

- Highly beneficial
- Highly beneficial—with virtual access
- Occasionally beneficial ± with virtual access
- No benefit to me

Local speakers programs

- Highly beneficial to me and my multidisciplinary practice team
- Highly beneficial only to my multidisciplinary team
- Of occasional benefit to my practice
- No benefit to me

Interactive learning opportunities with experts

- Highly beneficial in a face-to-face encounter at my practice site
- Highly beneficial if can be done virtually
- Occasionally beneficial ± virtual access
- Of no benefit to me

Interactive learning opportunities with my peer group

- Highly beneficial in a face-to-face meeting
- Highly beneficial virtually
- Occasionally beneficial ± virtual access
- No benefit to me

Case-based learning

- Highly beneficial at my practice site
- Highly beneficial virtually
- Occasionally beneficial ± virtual access
- No benefit to me

Educational curriculum delivered as small modules over time

- Highly beneficial at my practice site
- Highly beneficial virtually
- Occasionally beneficial ± virtual access
- No benefit to me

Educational and/or capacity-building initiatives directed to your multidisciplinary practice team

- Highly beneficial if occurs at my practice site
- Highly beneficial virtually
- Occasionally beneficial ± virtual access
- No benefit to me

On-demand learning and practice capability enhancement requests to medical experts

- Highly beneficial at my practice site
- Highly beneficial virtually
- Occasionally beneficial ± virtual access
- No benefit to me

Percent of your Severe Asthma Patients who are receiving biologic therapy
Number of Severe Asthma Patients seen in your practice monthly:

- 0-5%
- 5-10%
- 10-15%
- 15-20%
- 20-40%
- 40%>

Would you be interested in having AstraZeneca contact you about a program to assist Pulmonologists and Allergists with optimizing approaches in the management of patients with severe asthma through networking with experts and peers, provider and patient education, and/or practice team development?

- Yes
- No

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