MedEdPORTAL® The AAMC Journal of Teaching and Learning Resources

Original Publication

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Get SMART: Teaching Pediatric Residents the 2020 Focused Asthma Updates' Recommendations for Symptom-Based Medication Increases

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Abstract

Introduction: The 2020 Focused Asthma Updates introduced a paradigm shift in the treatment of asthma that includes symptom-based adjustments to outpatient asthma treatment that vary by age and severity. The length and complexity of the updates have made them challenging to adopt. **Methods:** We implemented an educational session among pediatric residents to increase their familiarity with, comprehension of, and plans to adopt two evidence-based recommendations introduced in the 2020 Updates for symptom-based therapy. Facilitators led groups of four to six pediatric residents in cased-based discussions during a 30-minute, ambulatory care–based session. One week prior, participants and facilitators received synopses of the 2007 Guidelines for the Diagnosis and Management of Asthma and the 2020 Updates. Facilitators also received a guide and scripts explaining new concepts, providing supporting data, and highlighting learning objectives. Retrospective pre/post surveys assessed participants' familiarity with, comprehension of, and planned adoption of recommendations for intermittent steroids and single maintenance and reliever therapy (SMART) before and after the conference. The surveys also assessed prior exposure to the 2020 Updates and reflections on the educational session. **Results:** There were 26 participants. Ratings of familiarity, comprehension, and adoption plans regarding the recommendations significantly improved ($ps < .001$, Wilcoxon signed rank test). The case-based approach was well received, and the material was deemed relevant. **Discussion:** This educational session significantly increased pediatric residents' familiarity with, comprehension of, and plans to adopt two new evidence-based treatments. Dissemination of this educational session may improve outpatient asthma management.

Keywords:
Asthma, Case-Based Learning, Pediatrics

Educational Objectives

By the end of this activity, learners will be able to:

1. Categorize asthma severity by applying impairment and risk criteria, as specified in the 2007 National Asthma Education and Prevention Program Guidelines for the Diagnosis and Management of Asthma.
2. Recommend symptom-based use of inhaled steroids and beta-agonists at the start of respiratory tract infections for children 0-4 years old with intermittent viral-induced asthma, as described in the 2020 Focused Asthma Updates.
3. Recommend symptom-based treatment for adolescents with moderate persistent asthma with SMART (single maintenance and reliever therapy) with an inhaled corticosteroid and formoterol combination pump, as described in the 2020 Focused Asthma Updates.

Citation:
Warman KL, Silver EJ. Get SMART: teaching pediatric residents the 2020 Focused Asthma Updates' recommendations for symptom-based medication increases. *MedEdPORTAL*. 2023;19:11320. https://doi.org/10.15766/mep_2374-8265.11320

Introduction

Asthma is the most common chronic lung disease of childhood, affecting approximately 5 million children in the United States. US asthma prevalence in children (age <18 years) was 6% in 2020, and asthma accounted for 790,478 emergency department visits and 64,525 hospital inpatient stays for children in 2019.[1] Even among children who do not have severe exacerbations requiring acute care, asthma can be poorly controlled, impacting their quality of life. In a multistate, community-based sample of pediatric patients with asthma presenting for routine care, 35% of the children had poorly controlled asthma.[2]

The most recent version of the National Asthma Education Prevention Program's Guidelines for the Diagnosis and

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Management of Asthma was released in 2007.[3] Since that publication 16 years ago, evidence has accumulated supporting new approaches to outpatient asthma management, including moving away from the prior standard practice of using a short-acting beta-agonist alone for rescue therapy and instead giving concomitant inhaled steroids.[4] Some of these changes were reflected in the 2019 Global Initiative for Asthma (GINA),[5] but these recommendations were only recently introduced in the US with the release of the Focused Updates to the Asthma Guidelines in December 2020.[6] These updates introduced important evidence-based changes to recommended outpatient asthma management to reduce asthma morbidity; however, they added additional complexity to guidelines that had already proven difficult to disseminate and adopt into standard practice.[7-10] A variety of barriers to guideline adherence exist, including lack of awareness, lack of familiarity, lack of agreement, lack of self-efficacy, lack of outcome expectancy, the inertia of previous practice with lack of readiness for change, and external barriers.[11,12]

Two important changes to recommended outpatient asthma management in children include (1) starting inhaled steroids, in addition to short-acting beta-agonists, during upper respiratory infections for intermittent symptom-based treatment for children under 5 years old with intermittent viral-induced wheeze and (2) using a single combination pump (inhaled steroid with the rapid-onset, long-acting beta-agonist formoterol) as both a rescue medicine and controller. We coined the term START for the former. The latter recommendation is referred to as SMART (single maintenance and reliever therapy).

The preponderance of outpatient pediatric asthma management falls to general pediatricians, as most children with asthma do not receive care from specialists, particularly in underresourced settings.[13] Therefore, the target audience for this educational session was pediatricians providing primary care to children with asthma. A formal local needs assessment was not undertaken; however, discussions with practicing pediatricians and pediatric residents made it clear that many found the new recommendations overwhelming and difficult to digest. Didactic sessions trying to cover many aspects of the asthma updates were hard for learners to absorb. For this reason, a decision was made to use a case-based approach and limit the focus to two examples illustrating the paradigm shift introduced in the 2020 Updates. We chose to study the effectiveness of the educational session with pediatric residents, as there was a structure in place for resident education and evaluation of educational sessions during weekly outpatient continuity clinic conferences. General pediatric faculty also participated in these sessions and could benefit as well; however, they did not complete postsession evaluations.

There are very limited educational materials available regarding adoption of the asthma guidelines, and we did not encounter any case-based learning on the topic in the literature. There are no medical education evaluations in the literature introducing either of the two new recommendations. A search of medical education concerning SMART in PubMed between 2009 and 2022 revealed eight publications; however, only one provided guidance in implementation of SMART,[14] and none included evaluation of educational interventions. A search of PubMed for publications between 2020 and 2022 discussing the 2020 Updates and asthma management revealed six, with two specifically focused on the updates relevant to children and/or adolescents.[15,16] A search of *MedEdPORTAL* regarding medical education and asthma revealed 64 results. Of these, only six publications included education on applying the National Asthma Education Guidelines for the outpatient management of asthma. There were no *MedEdPORTAL* publications regarding the 2020 Updates, SMART, or the new recommendation for use of intermittent inhaled steroids in combination with albuterol for viral-induced asthma exacerbations in children 4 years old and younger. While our session focuses on the 2020 Updates, the lessons learned could be applied to teaching future asthma updates or used in other disciplines with complex treatment recommendations.

The goal of this educational session is to increase familiarity with, comprehension of, and plans for adoption of the 2020 Asthma Updates recommendations for two symptom-based strategies of delivering inhaled steroids. These include starting inhaled steroids in addition to short-acting beta-agonists for young children with viral-induced asthma exacerbations and using a single combination pump that delivers both inhaled steroids and formoterol, a rapid-onset, long-acting beta-agonist, for both maintenance and reliever therapy for adolescents with moderate persistent asthma. The educational session uses case-based learning methodologies, delivered during regularly scheduled resident continuity clinics, to help learners comprehend and apply complex new guidelines by introducing selected components of the guidelines with active learning.

We chose to have pediatric residents or general pediatric faculty, who were not asthma specialists, lead the sessions using a cased-based learning approach. The facilitators follow a prescribed script to introduce a problem-based approach for adult learning. The case-based learning methodology is in

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keeping with the Carnegie Foundation for the Advancement of Teaching's recommendations in that it implements active learning pedagogy to encourage integration of curricular content with application of knowledge into clinical practice.[17]

Methods

This 30-minute, case-based session was implemented in ambulatory care conferences for pediatric residents in training at an urban medical center in November 2021. The case conferences were held on four separate afternoons during the same week, with new learners participating in each session. Sessions were held in person on two different campuses. One week prior to the conference, facilitators on both campuses were provided with the PowerPoint presentation (Appendix A). It included a script highlighting important learning objectives and the rationale and evidence supporting the changes. Facilitators also received an orientation guide with an overview of the educational session content (Appendix B). One week prior to the conference, the facilitators and learners were also provided with a brief synopsis of the 2020 Updates, the *At-a-Glance Guide,*[18] and the *Asthma Care Quick Reference,*[19] which included charts for classifying asthma severity and for identifying the step of care for the different age categories based upon the 2007 Asthma Guidelines.

The participants were given the two previously mentioned resources to review before the session. The facilitators were expected to review the facilitators' guide and the PowerPoint slides prior to leading the trainees in small-group, interactive discussion. The presenters were all pediatric residents except one, who was an attending and presented one of the conferences. None of the presenters were experts in the field, and no prior knowledge was required. The residents did not receive formal training in case-based learning; however, they were familiar with case-based learning and with leading residents in small-group discussions.

The participants met around a conference table, and the PowerPoint presentation was projected onto a screen. The facilitators followed the script and instructions in the guide, which included posing questions to the participants, facilitating small-group discussions, and highlighting specific learning objectives.

After the conference, learners completed a brief retrospective pre/post survey (Appendix C) based on 5-point Likert scales assessing familiarity with, comfort in, and plans for adoption of two new asthma management recommendations introduced in the 2020 Updates: (1) starting intermittent inhaled steroids with albuterol for children 0-4 years old with intermittent asthma and (2) SMART for adolescents with moderate persistent asthma. Learners also answered multiple-choice questions on their prior exposure to the 2020 Updates and their level of training and offered open-ended reflections on the value of the educational session. The survey was developed by one of the authors (Karen L. Warman). The decision to use a retrospective pre/post assessment was supported by work by McLeod, Steinert, and Snell,[20] as this assessment methodology helped to avoid the response shift bias inherent in traditional pre/post self-assessments. The survey's formation was informed by work by Lang and Savageau describing measuring learning using retrospective pre/post evaluations.[21] The questionnaires were administered by linking the surveys to a scanned QR code at the end of the PowerPoint presentation. The 5-point Likert-scale response anchors were adopted from Vagias.[22] The Wilcoxon signed rank test, a statistical test for determining whether two measurements from a single group are significantly different, was used to compare pre/post scores for participants.

Results

There were six facilitators (five residents and one general pediatric attending) and 26 learners (nine pediatric interns, 11 second-year residents, five third-year residents, and one third-year medical student). The goal of the educational session was knowledge transfer, increased understanding, and making adoption plans regarding two new outpatient asthma management recommendations. The overall results of the retrospective pre/post surveys are shown in the Table. Only the 26 learners completed the evaluations. On a 5-point Likert scale (1 = *not at all familiar,* 5 = *extremely familiar*), learner familiarity with the new recommendations for intermittent inhaled steroids for children 0-4 years old with intermittent viral-induced asthma increased after the conference (2.4 vs. 4.1, $p < .001$). Familiarity with the use of SMART for adolescents with moderate persistent asthma also increased after the conference (2.2 vs. 3.8, $p < .001$). On a 5-point Likert scale (1 = *poor,* 5 = *excellent*), ratings of understanding of intermittent inhaled steroids for children 0-4 years old with intermittent viral-induced asthma increased after the conference (1.9 vs. 3.5, $p < .001$), as did ratings for use of SMART for adolescents with moderate persistent asthma (2.0 vs. 3.5, $p < .001$). On a 5-point Likert scale (1 = *never*, 5 = *always*), learners' ratings of their own plans for adoption of the recommendations for intermittent inhaled steroids for children 0-4 years old with intermittent viral-induced asthma increased after participating in the educational session (2.0 vs. 3.6, $p < .001$), as did ratings of adoption of SMART for adolescents with moderate persistent asthma (1.9 vs. 3.6, $p < .001$).

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Table. Mean Differences in Paired Retrospective Pre/Post Scores Among All Participants ($N = 26$)

Rating	Pre		Post		p[a]
	M	*SD*	*M*	*SD*	
Familiarity with recommendation for:					
Intermittent inhaled steroids for 0- to 4-year-olds with intermittent asthma[b]	2.4	0.9	4.1	0.4	<.001
SMART for adolescents with moderate persistent asthma[b]	2.2	0.9	3.8	0.5	<.001
Understanding of the 2020 Asthma Updates recommendation for:					
Intermittent inhaled steroids for 0- to 4-year-olds with intermittent asthma[c]	1.9	0.9	3.5	0.8	<.001
SMART for adolescents with moderate persistent asthma[c]	2.0	0.8	3.5	0.7	<.001
Their own adoption of recommendations for:					
Intermittent inhaled steroids for 0- to 4-year-olds with intermittent asthma[d]	2.0	0.9	3.6	0.9	<.001
SMART for adolescents with moderate persistent asthma[d]	1.9	0.9	3.6	0.9	<.001

Abbreviation: SMART, single maintenance and reliever therapy.
[a]Wilcoxon signed rank test.
[b]Rated on a 5-point Likert scale (1 = *not at all familiar,* 5 = *extremely familiar*).
[c]Rated on a 5-point Likert scale (1 = *poor,* 5 = *excellent*).
[d]Rated on a 5-point Likert scale (1 = *never,* 5 = *always*).

The proportion of participants who reported that they were at least moderately familiar with the recommendations for intermittent inhaled corticosteroids (ICSs) for children under age 4 with intermittent viral-induced wheeze increased from 8% to 96% after participation in the educational session. Before the conference, only 31% of participants reported having a good understanding of intermittent ICS use, whereas, after the conference, 42% of participants reported good and 50% reported very good or excellent understanding. Prior to the conference, only 38% reported occasionally following the recommendation for intermittent inhaled steroids for children 0-4 years old with intermittent viral-induced wheeze, and none reported more frequent use, whereas, after the conference, plans for adoption of intermittent inhaled steroids for children with intermittent viral-induced wheeze increased to 93% (27% occasionally, 58% almost every time, and 8% frequently).

The proportion of participants who reported feeling at least moderately familiar with the recommendations for SMART in adolescents with moderate persistent asthma increased from 4% to 77% after participating in the educational session. The proportion of participants who reported good or greater understanding of the recommendations for SMART in adolescents with moderate persistent asthma increased from 31% to 96%, with no one reporting very good or excellent understanding before the conference and 50% reporting very good or excellent understanding after the conference. Prior to the conference, 35% of participants reported recommending SMART for adolescents with moderate persistent asthma occasionally and none more frequently, whereas, after the conference, participants reporting plans to recommend SMART increased to 95% (48% almost every time, 12% frequently, and 35% occasionally).

Most participants reported that prior to the conference, they became aware of the 2020 Updates informally from other physicians (62%). Only a few reported having read them (8%), having attended a lecture about them (4%), or having read a journal article about them (12%). Some of the participants reported that they were unfamiliar with the updates (12%).

Reflections on the case-based learning were all very positive, including that it was “incredibly relevant” and that there was appreciation for the case-based approach. Participants were asked the open-ended question “What, if anything, did you find valuable about the training?” Respondents reported that they found value in focusing on two major changes in the asthma updates: the use of SMART for older children with moderate persistent asthma and START for children 0-4 years old. Respondents found the material clear and highly relevant. They liked the case-based approach and found the session helpful in learning how to apply complex material. Recommendations to improve the training were largely to expand the scope of the learning session. Suggestions included having additional cases, further discussion of insurance coverage, and including how to apply these new treatment approaches in the inpatient setting.

Discussion

We chose a case-based learning strategy to help pediatric residents better understand and apply two new asthma management recommendations to care for two common clinical scenarios that they would be likely to encounter in the ambulatory care setting. As defined by Thistlewaite et al.,[23] the goal of case-based learning “is to prepare students for clinical practice, through the use of authentic clinical cases. It links theory to practice, through the application of knowledge to the cases, using inquiry-based learning methods.” We had fellow

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residents serve as the primary facilitators for the educational session. We believe this approach was important to signal that this knowledge was appropriate for residents to master and also to validate that a pediatric resident, with no prior expertise, could effectively and efficiently facilitate other learners in working through understanding and applying new evidence-based recommendations in the 2020 Updates to patient care.

The retrospective pre/post analysis suggested that the educational session was very effective in achieving its goal of increasing residents' self-reported familiarity with, understanding of, and plans to adopt these two new recommendations for outpatient asthma management. There were significant increases in all measured scores before and after participation in the educational session ($ps < .001$). These included increases in familiarity, understanding, and adopting plans regarding both START for young children and SMART for teenagers with moderate persistent asthma.

While plans to adopt START increased, there were still 26% of respondents who reported that they would only use START occasionally. While we do not know why, it may be because of concerns regarding dosing of ICSs and growth suppression. One study using nebulized budesonide solution did not demonstrate growth suppression.[24] However, another study using a high-dose, inhaled steroid delivered by a metered-dose inhaler did.[25] Additional studies supporting the safety of this practice and recommended regimens using metered-dose inhalers may help to increase physicians' plans to adopt these recommendations. Similarly, with SMART, providing residents with a chart showing specific recommended doses of medications and instructions on how often they can administer rescue doses, such as specified in a review by Reddel et al.,[14] may help with adoption of the guideline recommendations. In addition, decision support with dosing instructions would make it easier for residents in terms of implementation. Using smart phrases—built-in links to text within electronic medical records that import prewritten medication plans—can help clinicians prescribe and communicate medications plans with families. We subsequently created these for SMART and START.

The analysis revealed that prior to the conference, exposure to the 2020 Updates was very limited, with most participants reporting only word-of-mouth exposure. A challenge with practicing physicians or residents reading the updates is that even though they are focused, they are 322 pages long. Interpretating the updates is also predicated on knowledge of the past guidelines' recommendations for asthma classification. The charts also contain many abbreviations and terms, such as SABA (short-acting beta-agonist), LABA (long-acting beta-2 agonist), ICSs, and SMART, which may be challenging for a reader unfamiliar with the literature to digest. We chose to send synopses of the 2020 Updates and of the existing asthma guidelines to the residents 1 week prior to the conference. This time frame was chosen in keeping with our ongoing curriculum in which new topics were presented each week. We did not measure how much time, if any, residents spent reviewing the materials sent to them before the session. There is an increasing body of literature regarding the educational benefits of using flipped classroom approaches, in which learners review materials prior to the learning session, to help promote active learning and higher-order thinking.[26] Given the benefits of flipped classroom educational programs in helping learners assimilate and apply complex materials, more time and effort may be needed to ensure participants review materials prior to the case-based learning session.[27,28] The complexity of the 2020 Updates and the effort required to synthesize and apply the information suggest a tremendous need for case-based learning sessions, such as this one, to increase learners' familiarity with, understanding of, and adoption of complex new treatment recommendations. This educational session's design and evaluation could be useful for other educators aiming to help learners move towards adopting new complex clinical guidelines or treatment plans.

Satisfaction with the educational session was very high. Learners reported that the material was very relevant and that they enjoyed the interactive case-based learning session. Reflections raised important areas to pursue, such as a more thorough discussion of insurance coverage, additional cases, and how to apply the information in the inpatient setting.

This educational session and its evaluation had important limitations. Ideally, residents would have reviewed the material prior to the session to be best prepared to participate and learn at a higher level. We did not query the residents about whether they reviewed the material sent before the session. We also did not observe all sessions to know how closely their delivery followed the script. The teaching session was limited to 30 minutes so as to be easily incorporated into our existing continuity clinic. More time and additional cases might help residents gain practice in applying the concepts. We did not conduct a formal local needs assessment. This might have strengthened the design of the educational session. We did not include a knowledge assessment to measure gaps in knowledge or changes in knowledge scores. We did not have faculty complete the pre/post surveys. This may have increased our

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awareness of faculties' educational needs and led to additional suggestions to improve the session. Finally, we did not resurvey participants several months later to assess retention of the material.

While this educational session constitutes the important first step of introducing the new recommendations and increasing residents' plans to adopt them, there may be barriers that require additional work. The current infrastructure has not yet changed to help with adoption of these recommendations. For example, printed materials for patients need to be developed to share the concept of starting therapy for young children with wheezing during colds. Likewise, asthma action plans that incorporate recommendations for SMART need to be readily available. In the US, use of ICS-formoterol as a rescue pump for SMART has not yet received approval from the Federal Drug Administration; however, this is already standard practice in Europe and was previously adopted in the GINA guidelines. In addition, not all insurances cover the recommended ICS-formoterol combination for SMART or give an extra metered-dose inhaler for use above the prescribed maintenance medication. Reddel et al.[14] offered valuable practical information to help with implementation, and some of these recommendations and patient materials, such as a SMART asthma actions plan, could be included in a future iteration of this educational session.

The 2020 Asthma Updates were released in December 2020 at a time when the COVID pandemic was the health care system's main focus. Due to the severe COVID surge in the Bronx early in the pandemic, our pediatric residents assisted with adult COVID inpatient care and did not participate in outpatient care or conferences. These educational sessions took place almost a year later, in November 2021. The groups met in person, masked. In addition to competing priorities during the pandemic, there was an unusually low rate of reported asthma symptoms during this period.[29] Reductions in asthma exacerbations corresponded with an overall decrease in respiratory viral infections.[30] The finding that viral respiratory infections appear to be a key driver of asthma exacerbations[30] gives further impetus for us to train physicians to prepare patients to administer symptom-based titration of medications during viral exacerbations, as recommended in the 2020 Updates.

This educational session was implemented in a residency program at an institution based in a low-income, urban environment with a high prevalence of asthma and asthma morbidity; however, the cases were written without any specific geographic or sociodemographic references. This case-based learning session could therefore be implemented in any region of the US. The session could be introduced in pediatric and family practice residency programs to teach trainees about outpatient asthma management. The facilitator guide presumes no previous knowledge regarding the asthma guidelines or updates, and our residents were able to facilitate effective educational sessions and stay within the allotted 30-minute time interval. The materials are all digital, and therefore, the educational session could be easily replicated in residency programs throughout the US. While our participants were residents in training, more experienced physicians could also benefit from this case-based educational session, which has helped learners efficiently digest a complex topic and increased their plans to apply these new recommendations to improve asthma care.

Appendices

A. Get SMART Selected 2020 Asthma Updates.pptx

B. Get SMART Facilitator Orientation Guide.docx

C. Get SMART Session Evaluation.docx

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Disclosures
None to report.

Funding/Support
None to report.

Prior Presentations
Warman KL, Silver EJ. Get SMART: teaching selected recommendations from the 2020 Focused Asthma Updates. Presented at: Pediatric Academic Societies (PAS) Meeting; April 24, 2022; Denver, CO.

Ethical Approval
Reported as not applicable.

References

1. Most recent national asthma data. Centers for Disease Control and Prevention. Updated December 12, 2022. Accessed April

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13, 2023. https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm

2. Liu AH, Gilsenan AW, Stanford RH, Lincourt W, Ziemiecki R, Ortega H. Status of asthma control in pediatric primary care: results from the pediatric Asthma Control Characteristics and Prevalence Survey Study (ACCESS). *J Pediatr*. 2010;157(2):276-281.E3. https://doi.org/10.1016/j.jpeds.2010.02.017

3. National Heart, Lung, and Blood Institute. *National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma*. National Institutes of Health; 2007. NIH publication 08-5846. Accessed April 13, 2023. https://www.nhlbi.nih.gov/sites/default/files/media/docs/asthsumm.pdf

4. Reddel HK, FitzGerald JM, Bateman ED, et al. GINA 2019: a fundamental change in asthma management. *Eur Respir J*. 2019;53(6):1901046. https://doi.org/10.1183/13993003.01046-2019

5. Reddel HK, Bacharier LB, Bateman ED, et al. Global Initiative for Asthma Strategy 2021: executive summary and rationale for key changes. *Eur Respir J*. 2022;59(1):2102730. https://doi.org/10.1183/13993003.02730-2021

6. Expert Panel Working Group of the National Heart, Lung and Blood Institute. 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. https://doi.org/10.1016/j.jaci.2020.10.003

7. Finkelstein JA, Lozano P, Shulruff R, et al. Self-reported physician practices for children with asthma: are national guidelines followed? *Pediatrics*. 2000;106(suppl 3):886-896. https://doi.org/10.1542/peds.106.S3.886

8. Legorreta AP, Christian-Herman J, O'Connor RD, Hasan MM, Evans R, Leung KM. Compliance with national asthma management guidelines and specialty care: a health maintenance organization experience. *Arch Intern Med*. 1998;158(5):457-464. https://doi.org/10.1001/archinte.158.5.457

9. Doerschug KC, Peterson MW, Dayton CS, Kline JN. Asthma guidelines: an assessment of physician understanding and practice. *Am J Respir Crit Care Med*. 1999;159(6):1735-1741. https://doi.org/10.1164/ajrccm.159.6.9809051

10. Cloutier MM, Salo PM, Akinbami LJ, et al. Clinician agreement, self-efficacy, and adherence with the Guidelines for the Diagnosis and Management of Asthma. *J Allergy Clin Immunol Pract*. 2018;6(3):886-894.E4. https://doi.org/10.1016/j.jaip.2018.01.018

11. Cabana MD, Rand CS, Becher OJ, Rubin HR. Reasons for pediatrician nonadherence to asthma guidelines. *Arch Pediatr Adolesc Med*. 2001;155(9):1057-1062. https://doi.org/10.1001/archpedi.155.9.1057

12. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA*. 1999;282(15):1458-1465. https://doi.org/10.1001/jama.282.15.1458

13. Warman KL, Silver EJ. Are inner-city children with asthma receiving specialty care as recommended in national asthma guidelines? *J Asthma*. 2018;55(5):517-524. https://doi.org/10.1080/02770903.2017.1350966

14. Reddel HK, Bateman ED, Schatz M, Krishnan JA, Cloutier MM. A practical guide to implementing SMART in asthma management. *J Allergy Clin Immunol Pract*. 2022;10(1)(suppl):S31-S38. https://doi.org/10.1016/j.jaip.2021.10.011

15. Cloutier MM, Teach SJ, Lemanske RF Jr, Blake KV. The 2020 Focused Updates to the NIH Asthma Management Guidelines: key points for pediatricians. *Pediatrics*. 2021;147(6):e2021050286. https://doi.org/10.1542/peds.2021-050286

16. Cloutier MM, Dixon AE, Krishnan JA, Lemanske RF Jr, Pace W, Schatz M. Managing asthma in adolescents and adults: 2020 Asthma Guideline Update from the National Asthma Education and Prevention Program. *JAMA*. 2020;324(22):2301-2317. https://doi.org/10.1001/jama.2020.21974

17. O'Brien BC, Irby DM. Enacting the Carnegie Foundation call for reform of medical school and residency. *Teach Learn Med*. 2013;25(suppl 1):S1-S8. https://doi.org/10.1080/10401334.2013.842915

18. National Heart, Lung, and Blood Institute. *At-a-Glance Guide*. National Institutes of Health; 2020. NIH publication 20-HL-8142. Accessed April 13, 2023. https://www.nhlbi.nih.gov/sites/default/files/publications/Asthma%20Clinicians%20At-a-Glance%20508_02-03-21.pdf

19. National Heart, Lung, and Blood Institute. *Asthma Care Quick Reference: Diagnosing and Managing Asthma*. National Institutes of Health; 2012. NIH publication 12-5075. Accessed April 13, 2023. https://www.nhlbi.nih.gov/files/docs/guidelines/asthma_qrg.pdf

20. McLeod PJ, Steinert Y, Snell L. Use of retrospective pre/post assessments in faculty development. *Med Educ*. 2008;42(5):543. https://doi.org/10.1111/j.1365-2923.2008.03060.x

21. Lang D, Savageau J. Starting at the end: measuring learning using retrospective pre-post evaluations. *AEA365* blog. July 31, 2017. Accessed April 13, 2023. http://aea365.org/blog/starting-at-the-end-measuring-learning-using-retrospective-pre-post-evaluations-by-debi-lang-and-judy-savageau/

22. Vagias WM. *Likert-Type Scale Response Anchors*. Clemson University; 2006. Accessed April 13, 2023. http://media.clemson.edu/cbshs/prtm/research/resources-for-research-page-2/Vagias-Likert-Type-Scale-Response-Anchors.pdf

23. Thistlewaite JE, Davies D, Ekeocha S, et al. The effectiveness of case-based learning in health professional education. A BEME

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systematic review: BEME Guide no. 23. *Med Teach*. 2012;34(6):e421-e444. https://doi.org/10.3109/0142159X.2012.680939

24. Bacharier LB, Phillips BR, Zeiger RS, et al; Childhood Asthma Research and Education Network. Episodic use of an inhaled corticosteroid or leukotriene receptor antagonist in preschool children with moderate-to-severe intermittent wheezing. *J Allergy Clin Immunol*. 2008;122(6):1127-1135.E8. https://doi.org/10.1016/j.jaci.2008.09.029

25. Ducharme FM, Lemire C, Noya FJD, et al. Preemptive use of high-dose fluticasone for virus-induced wheezing in young children. *N Engl J Med*. 2009;360(4):339-353. https://doi.org/10.1056/NEJMoa0808907

26. Hwang GJ, Yin C, Chu HC. The era of flipped learning: promoting active learning and higher order thinking with innovative flipped learning strategies and supporting systems. *Interact Learn Environ*. 2019;27(8):991-994. https://doi.org/10.1080/10494820.2019.1667150

27. Brame CJ. Flipping the classroom. Vanderbilt University Center for Teaching. 2013. Accessed April 13, 2023. http://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom/

28. Wolff M, Wagner MJ, Poznanski S, Schiller J, Santen S. Not another boring lecture: engaging learners with active learning techniques. *J Emerg Med*. 2015;48(1):85-93. https://doi.org/10.1016/j.jemermed.2014.09.010

29. Hurst JH, Zhao C, Fitzpatrick NS, Goldstein BA, Lang JE. Reduced pediatric urgent asthma utilization and exacerbations during the COVID-19 pandemic. *Pediatr Pulmonol*. 2021;56(10):3166-3173. https://doi.org/10.1002/ppul.25578

30. Sayed S, Diwadkar AR, Dudley JW, et al. COVID-19 pandemic–related reductions in pediatric asthma exacerbations corresponded with an overall decrease in respiratory viral infections. *J Allergy Clin Immunol Pract*. 2022;10(1):91-99.E12. https://doi.org/10.1016/j.jaip.2021.10.067

Received: August 3, 2022
Accepted: March 15, 2023
Published: July 11, 2023

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