Contents lists available at ScienceDirect

The Journal for Nurse Practitioners

Antibiotic Stewardship for Patients With Pharyngitis: Implementing the Centor Tool

Crystal S. Earp

A B S T R A C T

Pharyngitis is a common complaint seen in outpatient clinics, and patients are often sent home with antibiotics when not deemed necessary. The Centor clinical tool is an established, but seldom employed, resource to aid providers in decision-making and determining the likelihood of bacterial strep pharyngitis. The purpose of this paper is to describe a project conducted at 3 urgent care centers with a goal to decrease unnecessary testing and inappropriate antibiotic prescribing. The intervention included implementing the Centor scoring tool when evaluating patients with complaints of pharyngitis. Results indicated that as Centor documentation improved, antibiotic rates decreased.

© 2024 Elsevier Inc. All rights reserved.

Introduction

Problem

Pharyngitis continues to be one the most frequent complaints in outpatient settings, accounting for more than 12 million United States healthcare visits annually.[1] Young et al[2] found that viral upper respiratory symptoms were among the top 3 conditions in which antibiotics were inappropriately prescribed, including strep pharyngitis. The updated 2018 Infectious Disease Society of America and the American Society for Microbiology guidelines stress the importance of using laboratory testing to diagnose strep pharyngitis.[3] Furthermore, pharyngitis should only be treated with antibiotics if proven to be of bacterial origin.[4]

Available Knowledge

Distinguishing between viral and bacterial causes of sore throat symptoms can pose a challenge; however, several key findings help clinicians distinguish the difference between the two. Group A beta-hemolytic strep pharyngitis (GABHS) typically does not present with a runny nose, cough, conjunctivitis, or diarrhea, which often are seen when the origin is viral.[4] Although a significant percentage of pharyngitis complaints are viral, according to the World Health Organization, Group A Strep accounts for more than 500,000 deaths annually worldwide,[5] thus necessitating appropriate treatment when diagnosed. GABHS is also a large driver of increased health care costs related to testing, treating, and caring for these patients. Mustafa and Ghaffari[6] estimated that the average cost of testing, diagnosing, and treating children with strep throat in the United States can be as high as $539 million per year.

Antibiotic stewardship is defined as an effort to measure and improve how antibiotics are prescribed with the goal of improving prescribing methods while effectively treating patients and reducing the concerns for antibiotic resistance.[7] More than 2 million antibiotic resistant infections have been reported in the United States because of overprescribing.[8,9] Although most cases of pharyngitis are viral in nature, the Institute for Clinical Systems Improvement noted antibiotics are prescribed for more than 60% of those cases. Antibiotics do not improve viral symptoms and can lead to multidrug resistant organisms, bacteria that over time become harder to treat and more impervious to antibiotics.[7] Antibiotic rates in the United States tend to be highest in the southern states compared with those in the Northeast, Midwest, and West. Per the Centers for Disease Control and Prevention (CDC),[10] 644 prescriptions were written per 1,000 persons in North Carolina, which is where this project took place, reiterating the need for antibiotic stewardship.

The 4 elements set forth by the 2016 CDC's "Core Elements of Outpatient Antibiotic Stewardship" are commitment, action for policy and practice, tracking and reporting, and education and expertise.[9] The CDC further states that making one slight change in practice can improve overall health outcomes and decrease inappropriate antibiotic use and should be in accordance with evidence-based practice.[8,9] The Centers for Medicare and Medicaid Services[11] recommended that a diagnostic test be used to differentiate between bacterial and viral pharyngitis to decrease inappropriate antibiotic prescribing. The Centor scoring tool is based on multiple factors, and the score (−1 to 5) determines the necessity of a strep test as well as the likelihood of a bacterial strep infection.[12] The CDC, American Academy of Family Physicians, and the American College of Physicians—American Society of Internal Medicine (ACP-ASIM) recommend that the Centor tool be used to determine

the necessity of a rapid strep test and/or culture based on presenting symptoms.[6,13] Mustafa and Ghaffari[6] noted that the lack of such tools in ambulatory settings has led to overprescribing for viral pharyngitis.

This project employed the Centor/McIsaac scoring tool for screening and testing recommendations for patients who presented to 3 local urgent care clinics, in southeastern North Carolina, with pharyngitis complaints. Before the project, the clinics at this project site had no standardized guidelines for testing and treating patients presenting with pharyngitis. The lack of guidelines for when to order a rapid strep test resulted in many tests being completed. Eighty-nine percent of patients ($n = 82$) presenting with pharyngitis complaints during the 3 weeks of pre-implementation received a rapid strep test, and 40% of those were followed with a throat culture. There were no diagnostic evidence-based screening tools being used which indicated a need for implementing the Centor tool into practice.

Specific Aims

The purpose of this project was to decrease unnecessary testing and inappropriate antibiotic prescribing by incorporating the Centor scoring tool into a protocol for provider use when evaluating patients with pharyngitis. The measurable outcomes were as follows: decrease the number of strep tests and throat cultures ordered when providers used the Centor tool, decrease in antibiotic prescribing rates, and overall compliance with implementation of the Centor tool into practice.

Methods

Context

Due to the recent COVID pandemic, these 3 urgent care clinics offered telehealth appointments using Zoom, Doximity, video visits via the electronic patient portal (EMR), and phone calls in addition to office visits. Each clinic was staffed by 1 clinician (nurse practitioner, physician assistant, or medical doctor) per shift as well as support staff (medical assistants and licensed practical nurses). These clinics ran multiple tests on site, including rapid strep tests. The project team consisted of the project lead, project site champion, clinicians, and support staff with implementation occurring over a period of 12 weeks.

Intervention

The Centor scoring tool, as illustrated in Figure 1, is the most widely accepted scoring tool used by clinicians when caring for patients with pharyngitis due to its sensitivity and high specificity for effectiveness. Additionally, the tool is easy to implement, does not require specialized equipment, and can be completed in a matter of seconds. The Centor tool was developed to help identify those patients at increased risk of GABHS[14] and later modified to include age given that GABHS bacterial infection varies with age, being more prominent in those aged 3 to 14. The CDC and ACP-ASIM both endorse the use of the Centor Score as a guide for clinical decision-making.[15,16] The Centor tool consists of 5 criterion including age, lymphadenopathy, presence of cough, temperature, and tonsillar exudate. Age is divided into 3 categories: 3 to 14, 15 to 44, and 45 and older. According to whether the patient meets each criterion, a point is either added or deducted to determine the final score. The score can range from −1 to 5 and determines whether a strep test and/or culture is warranted or if the patient could be treated for a presumed strep pharyngitis based on increased probability of a bacterial infection and presenting symptoms. Antibiotics and testing are not

Figure 1. Centor Score Tool
From MedCalc.[12] Centor Score (Modified/McIsaac) for Strep Pharyngitis. https://www.mdcalc.com/centor-score-modified-mcisaac-strep-pharyngitis

indicated with a score of −1 to 1. A score of 2 recommends optional rapid strep testing or throat culture, whereas a score of 3 indicates that testing be considered. However, a score of 4 to 5 indicates a higher probability of strep and suggests that empiric antibiotics may be considered based on the scenario. Due to the COVID pandemic, a 6th criterion has also been included to note whether a COVID diagnosis is likely but does not affect scoring.

Pre-implementation began with the incorporation of the Centor tool being placed into the EMR which was completed on behalf of the analytics team. Additional meetings were held with analytics to ensure that the project lead could access and generate reports using the EMRs self-reporting tool before tracking data. This involved setting up multiple criteria to limit the search (ie, clinic, provider, diagnosis codes for strep pharyngitis [JO2.0] and sore throat [JO2.9], and patient age). At this point, using this criterion, a list of charts was generated and reviewed to determine how many tests, throat cultures, and antibiotics were being prescribed. Although the EMR did not initially include the Centor tool, provider documentation was also reviewed to see whether there was an awareness of the tool or if Centor Score was noted. It was clear there was an abundance of tests being ordered without a clear rationale.

Education was provided to all participants during a virtual staff meeting including a PowerPoint presentation and time for questions. Each participant also received the PowerPoint in an email. Education was continuous throughout the project to ensure that all participants understood how and when to use the tool with the project lead readily available via phone and email if questions arose. Charts were analyzed weekly using the self-generated reporting tool within the EMR with data tracked on an Excel-protected spreadsheet. The data recorded included the diagnoses code documented, patient age, whether Centor Score was documented, numerical score for those documented, strep testing, throat cultures, and whether antibiotics were prescribed. If antibiotics were prescribed, the medication name was documented along with any additional notes that might be pertinent (eg, positive COVID results).

Data was continuously analyzed and reviewed using the Plan−Do−Study−Act (PDSA) model to make improvements in screening and tracking data. One of these improvements included

the creation of a smart phrase that allowed clinicians to document the score easily in the chart using standard documentation. After 3 weeks of data collection, it was determined that the captured encounters were much lower than expected. Conversations with analytics and project participants determined that screenings were being done, but not captured, based on the ICD-10 codes being used. Clinicians reported often using additional primary diagnosis codes (suspected COVID-19 [Z20.822] and nasal congestion [R09.81]) when ordering a strep test or culture. To ensure data were concisely captured, these codes were added to the criterion when generating the weekly reports as the program used could only produce a list based on the primary diagnosis code rather than all codes documented within the chart. The COVID pandemic played a part in the use of these additional codes being documented in the charts; however, only those who also had a sore throat, acute pharyngitis, or throat pain as a primary or secondary diagnosis were included for review. Data were sent to the project team at the end of each week, along with reminders to complete the Centor tool when patients presented with a sore throat complaint. Overall outcomes were measured after running statistical tests based on the collected data.

Measures

Data during implementation were tracked weekly and compared with pre-implementation data to analyze trends to determine whether Centor documentation and scoring recommendations resulted in a significant difference in the number of strep tests, throat cultures, and antibiotics prescribed. Qualitative data tracked included whether a Centor Score was documented, the numerical score, and whether a strep test and culture were completed. Before implementation, it was evident that there was no Centor documentation, and many strep tests were ordered. Screenings, testing, and prescribing rates were measured by looking at the number of patients tested compared with those who met Centor criteria as well as looking at antibiotics prescribed compared with those who qualified based on Centor criteria, positive strep, or cultures results.

The CDC recommends that strep pharyngitis be treated with oral penicillin VK, oral amoxicillin, or intramuscular penicillin G. Patients with a penicillin allergy can be treated with a cephalosporin or macrolide antibiotic.[17] The antibiotics prescribed were also tracked to ensure alignment with the CDC recommendations. Although the type of antibiotic prescribed was not the primary purpose of this project, but rather the number of antibiotics written, data comparing pre- and post-implementation concluded that fewer antibiotics were prescribed when screenings were completed. As evidenced in Figure 2, those written as a direct result

of a positive strep test, positive culture, or a Centor Score of 4 or greater were given the appropriate antibiotic.

All 19 participants (clinicians and clinical staff) were sent a post implementation 10-question survey indicating their comfort using the Centor tool. This survey also included questions as well as their perspective on its use. Questions included job title, years' experience, Centor familiarity, ease of use, and questions on likelihood of continued use. Additional questions focused on rationale for ordering strep tests and antibiotic prescribing awareness. There were no direct monetary costs associated with the development of this project.

Analyses

Data was analyzed using a series of chi squared tests of hypotheses to examine patterns and frequencies. Our variables of interest were decreasing the number of strep tests and throat cultures ordered when providers used the Centor tool, antibiotic prescribing rates, and overall compliance with implementation of the Centor tool into practice. Data have not been tracked post-implementation to ensure if compliance continued; however, providers and support staff now have an awareness of the Centor tool, recommendations for use in clinic, and the tool remains housed in the EMR.

Ethical Considerations

Human subjects' protection was reviewed by the organization's institutional review board, which deemed the study exempt. Participating clinicians and clinical staff were provided information about the study purpose and procedures; written informed consent was not obtained. Employing the Centor Score tool necessitated that participants ask patients questions and note physical examination characteristics as an additional clinical screening component. It was believed that initiating the tool would help ensure that all clinicians were screening in a consistent manner using the same documentation. Bias was limited because charts were reviewed exclusively on specific ICD-10 code criteria. No personal identifying information such as patient name, gender, or race was collected. Additionally, collected data were not linked to specific providers to protect confidentiality.

Results

A total of 216 patient encounters were reviewed during implementation. Of these, 169 strep tests were ordered, 53 throat cultures, and 33 prescriptions written. Demographically, patients aged 15 to 44 accounted for the highest number of patients screened ($n = 114$). A score of 2 accounted for the most comprehensive Centor Score; the additional results are shown in Figure 3. Chi-square tests of independence were performed to determine
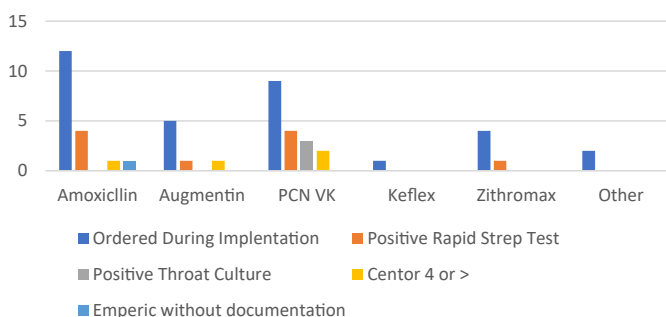

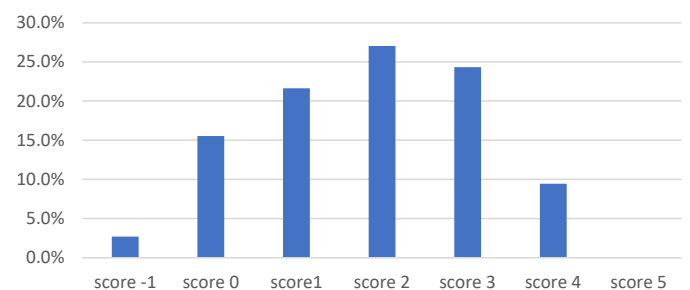**Figure 2.** Antibiotics Prescribed
PCN VK = penicillin V potassium.

Figure 3. Documented Centor Scores

Table 1
Total Number of Strep Tests, Throat Cultures, Antibiotics and Centor

| Variables	Pre-Implementation $N = 82$		Post-Implementation $N = 216$	
	n	%	n	%
Strep test ordered	73	89	169	78.2
Throat culture ordered	33	40.2	52	24.1
Antibiotics prescribed	19	23.1	33	15.3
Centor documentation	0	0	148	68.5

relationships of Centor Scores in relation to strep testing for compliance purposes, as seen in the Table 1. Although the findings were only marginally significant when looking at antibiotic prescribing rates and Centor tool screening during this period, the use of an evidence-based tool is clinically significant and recommended for best practice. Patients seen during the 12 weeks of implementation with a valid Centor Score did receive orders for culture and antibiotic prescriptions (51.5%). These findings support the value of using the Centor tool to improve evidence-based practice in the evaluation and treatment of acute pharyngitis, as evidenced in Figure 2. The overall rate of Centor documentation improved and the percentage of antibiotic prescriptions written decreased, indicating successful outcomes as evidenced in Figure 4.

The use of the Centor screening tool was clinically significant because it enabled clinicians to apply evidence-based practice to guide clinical decision-making. Additionally, it strengthened documentation and rationale to determine whether rapid strep test or culture was indicated. Smart phrases were developed and placed in the EMR standardized language for use when documenting Centor results, thus streamlining the application of evidence-based practices in these clinics. Use of standard language improved the ability to evaluate the effectiveness of the intervention and can be used in future application.

Discussion

Summary

Overall antibiotic stewardship rates improved throughout the 12-week period. Of the 33 prescriptions written during this time, just over half were justified with a positive strep test, positive throat culture, or empiric treatment based on physical examination findings. The additional prescriptions were due to other exam findings or diagnoses warranting treatment (otitis media, uvulitis, parotitis, sinusitis), except for 3 situations. Two of those cases were based solely on exposure, and the Centor criteria was not
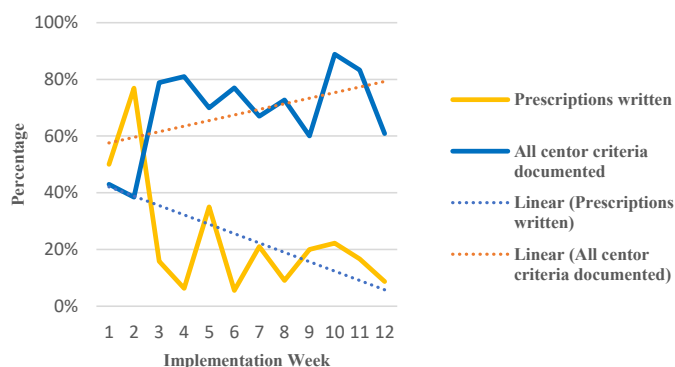
Figure 4. Prescriptions Written and Centor Documentation

documented. These data indicated that there was not an abundance of prescriptions written, as might be expected on the basis of prior literature and CDC concerns for antibiotic overuse; it does show, however, that antibiotic prescribing rates continued to decrease when the Centor tool was implemented and furthermore, the prescriptions that were written were justified with documentation. This was a significant clinical improvement compared with pre-implementation because during that time, there were no Centor documentation, all strep tests completed were negative, and the rationale for those tests ordered and the antibiotics that were prescribed was not clear from the chart reviews. The recent COVID pandemic is also worth mentioning because this project proved that although many patient encounters occurred virtually, the Centor tool was still able to be employed and effective. At the time of implementation, prior publications regarding this tool included minimal data on its use in a virtual setting.

Interpretation

Patients remain the top priority in health care, thus care must always be with their best interest in mind. Shared decision-making between the provider and patient can help build the provider–patient relationship and may leave the patient feeling that they are part of the health care team. For this to be effective, the provider is encouraged to take time to educate patients as to why evidence-based guidelines, such as the Centor tool, are used for predicting likelihood of bacterial strep infections versus viral syndromes. Because of the increase in the use and accessibility of telehealth, additional concepts that could improve virtual screening would include allowing patients to upload pictures (tonsillar exudate), if warranted. These visits also prevent delays in screening and treating patients without access to clinic visits due to location or those that may be in confinement. Delays in patient treatment can also be prevented when providers incorporate the Centor criteria in their decision-making because those with higher scores could be treated empirically at time of these visits.[18] Centor Scores of 4 or higher indicate a higher risk (53%) of bacterial infection, thus empiric treatment can be justified along with physical findings that lead to this score. Algorithms such as the Centor were developed to help guide clinicians in decision-making and prevent overprescribing by assigning signs and symptoms that indicated the likelihood of a pharyngitis being from a bacterial source while aiming to prevent potential complications from the *Streptococcus* bacteria.[19]

The use of this tool in practice resulted in improvement in provider documentation and antibiotic prescribing. Nursing staff have used the tool when triaging patients, and they have demonstrated a better understanding of the importance of screening patients before assuming a patient needs a strep test, which was evidenced by a decrease in strep tests ordered, fewer antibiotic prescriptions, and positive post-survey results from the project team. Enhanced understanding of the Centor tool proves helpful for nurses when screening and triaging patients and can also help nurses explain to patients, should they ask, why a test was or was not performed. Nance et al[20] also found during a quality improvement project that having nurses use the Centor tool was not only safe and effective, but incorporating it into nurse triage screenings allows concerning factors that may contribute to a bacterial source to be reviewed. Having the tool documented in the patient chart informs the provider about symptoms and the Centor Score before the visit and can serve as a communication tool between the patient and provider.

Clinical decision support (CDS) tools have been useful for detecting preventative care service needs, and they are also useful in diagnosis and treatment. Richardson et al[21] noted that CDS tools

must be brief and easy to use. Screening appropriately decreases unnecessary tests, which leads to potentially shorter wait times for patients and providers. Ultimately better patient–provider relationships will improve patient satisfaction and outcomes; thus, shared decision-making would certainly affect health care in a positive manner.

A larger scale expansion of this project to future offices would include additional costs for clinician and nurse training time. Further costs to consider are those associated with each test and the lab staff that collect, analyze, and document test results. One must consider the time it takes lab staff to collect, run, and analyze data. Screening only those patients who meet screening recommendations would save on time and expenses related to supplies; thus, introduction of the Centor tool into practice would help eliminate unnecessary tests and reduce overall cost. Furthermore, an additional element to consider is the cost to the patient if prescribed an antibiotic, especially for those without prescription coverage, and for increased visits due to medication side effects and complications from multidrug-resistant organisms.

Limitations

The major limitation to this project was that it was started during a pandemic and that pre-implementation education was completed primarily via synchronous online meetings. Clinical decision-making tools can be used effectively despite the type of encounter; however, this may have been more cumbersome for staff members who were using this tool for the first time. An additional limitation was the small number of participants as this project only looked at 3 clinics, and the clinicians rotated through each of these clinics. Overall outcomes may have resulted in larger significance had more clinics, clinicians, and support staff been involved.

Conclusion

The Centor tool has remained in the EMR for clinician and staff use at the 3 clinics; however, its use would be beneficial for any office that treats patients with sore throat complaints and is applicable across the lifespan. Clinicians are the gatekeepers of antibiotic stewardship standards. This responsibility requires thoughtful and careful consideration when deciding best practice and treatment options for acute pharyngitis. This project showed that use of the Centor tool improved coordination of care as well as improvement in quality outcomes using evidence-based practice standards. The result was a reduction in strep testing and inappropriate antibiotic prescribing practices. Having the Centor tool housed in the EMR helps to ensure ongoing utilization while aiding in medical decision-making and treatment planning. This intervention is an effective approach to assist in appropriate testing and antibiotic stewardship practices.

CRediT authorship contribution statement

Crystal S. Earp: Writing – original draft, Methodology, Conceptualization, Supervision.

Declaration of Competing Interest

In compliance with standard ethical guidelines, the author reports no relationships with business or industry that may pose a conflict of interest.

Funding

References

1. Ashurst JV, Edgarley-Gibb L. Streptococcal pharyngitis. *Stat Pearls.* 2022. https://www.ncbi.nlm.nih.gov/books/NBK525997/
2. Young EH, Panchal RM, Yap AG, Reveles KR. National trends in oral antibiotic prescribing in United States physician offices from 2009 to 2016. *Pharmacotherapy.* 2020;40:1012-1021. https://doi.org/10.1002/phar.2456
3. Miller JM, Binnicker MJ, Campbell S, et al. A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases: 2018 update by the Infectious Disease Society of America and the American Society for Microbiology. *Clin Infect Dis.* 2018;67(6):e1-e94. https://doi.org/10.1093/cid/ciy381
4. Nadeau N, Kimia A, Fine AM. Impact of viral symptoms on the performance of the modified Centor Score to predict pediatric group A streptococcal pharyngitis. *Am J Emerg Med.* 2020;38(7):1322-1326. https://doi.org/10.1016/j.ajem.2019.10.026
5. World Health Organization. Increased incidence of scarlet fever and invasive Group A Streptococcus infection—multi-country. 2022. https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON429
6. Mustafa Z, Ghaffari M. Diagnostic methods, clinical guidelines, and antibiotic treatment for group A streptococcal pharyngitis: a narrative review. *Front Cell Infect Microbiol.* 2020; Article 563627. https://doi.org/10.3389/fcim-b.2020.563627
7. Centers for Disease Control and Prevention. Core elements of antibiotic stewardship. 2020. Accessed June 29, 2021. https://www.cdc.gov/antibiotic-use/core-elements/index.html
8. Centers for Disease Control and Prevention. About antimicrobial resistance. 2022. https://www.cdc.gov/drugresistance/about.html
9. Sanchez GV, Fleming-Dutra KE, Roberts RM, Hicks LA. *Core elements of antibiotic stewardship.* Centers for Disease Control and Prevention. 2016. https://www.cdc.gov/antibiotic-use/core-elements/index.html
10. Centers for Disease Control and Prevention. Outpatient antibiotic prescriptions—United States, 2021. 2021. https://www.cdc.gov/antibiotic-use/data/report-2021.html
11. Centers for Medicaid and Medicare Services. (n.d.). Measures Inventory Tool: Appropriate testing for pharyngitis (eCQM). http://ecqi.healthit.gov/sites/default/files/ecqm/measures/CMS146v11.html
12. MedCalc. Centor Score (Modified/McIsaac) for strep pharyngitis. Undated, https://www.mdcalc.com/centor-score-modified-mcisaac-strep-pharyngitis
13. Luo R, Sickler J, Vahidnia F, Lee Y, Frogner B, Thompson M. Diagnoses and management of group a streptococcal pharyngitis in the Unites States, 2011–2015. *BMC Infect. Dis.* 2019;19(1):193. https://doi.org/10.1186/s12879-019-3835-4
14. Willis BH, Coomer D, Baragilly M. Comparison of Centor and McIsaac scores in primary care: a meta-analysis over multiple thresholds. *Br J Gen Pract.* 2020;70:e245. https://doi.org/10.3399/bjgp20X708833
15. Buensalido JA. What are the CDC/ACP acute bacterial pharyngitis testing and treatment recommendations based on the Centor Score? *Medscape Fam Med.* February 8, 2019. https://www.medscape.com/answers/225243-174825/what-are-the-cdcacp-acute-bacterial-pharyngitis-testing-and-treatment-recommendations-based-on-the-center-score
16. Fine AM, Nizet V, Mandl KD. Large-scale validation of the Centor and McIsaac scores to predict group A streptococcal pharyngitis. *Arch Int Med.* 2012;172(11):847-852. https://doi.org/10.1001/archinternmed.2012.950
17. Centers for Disease Control and Prevention. Group A streptococcal (GAS) disease. 2018. https://www.cdc.gov/groupastrep/diseases-hcp/strep-throat.html#treatment
18. Pecina JL, Nigon LM, Penza KS, et al. Use of the McIsaac score to predict group A streptococcal pharyngitis in outpatient nurse phone triage and electronic visits compared with in-person visits: retrospective observational study. *J Med Internet Res.* 2021;23(12):e25899. https://www.jmir.org/2021/12/e25899
19. Sykes EA, Wu V, Beyea MM, Simpson M, Beyea JA. Pharyngitis: approach to diagnosis and treatment. *Can Fam Phys.* 2020;66(4):251-257.
20. Nance J, Walters E, Willis Z. Standardizing strep throat documentation in a pediatric outpatient setting during COVID-19: A quality improvement pilot project. *J Nurse Pract.* 2023;19(2):104453. https://doi.org/10.1016/j.nurpra.2022.09.006
21. Richardson S, Feldstein D, McGinn T, et al. Live usability testing of two complex clinical decision support tools: observational study. *JMIR Hum Factors.* 2019;6(2):e12471. https://humanfactors.jmir.org/2019/2/e12471/

Crystal S. Earp, DNP, APRN, FNP-C is a clinical assistant professor at the University of North Carolina Wilmington School of Nursing and can be contacted at earpc@uncw.edu