Patient and Parent-Reported Signs and Symptoms for Group A Streptococcal Pharyngitis

Christina Lindgren, MD,[a] Mark I. Neuman, MD, MPH,[a,b] Michael C. Monuteaux, ScD,[a,b] Kenneth D. Mandl, MD, MPH,[a,b,c] Andrew M. Fine, MD, MPH[a,b]

abstract

BACKGROUND AND OBJECTIVES: Identifying symptomatic patients who are at low risk for group A streptococcal (GAS) pharyngitis could reduce unnecessary visits and antibiotic use. The accuracy with which patients and parents report signs and symptoms of GAS has not been studied. Our objectives were to measure agreement between patient or parent and physician-reported signs and symptoms of GAS and to evaluate the performance of a modified Centor score, based on patient or parent and physician reports, for identifying patients at low risk for GAS pharyngitis.

METHODS: Children 3 to 21 years old presenting to a single tertiary care emergency department between October 2013 and January 2015 were included if they complained of a sore throat and were tested for GAS. Patients or parents and physicians completed surveys assessing signs and symptoms to determine a modified age-adjusted Centor score for GAS. We evaluated the overall agreement and κ between patient or parent and physician-reported signs and symptoms and compared the performance of the scores based on assessments by patients or parents and physicians and the risk of GAS.

RESULTS: Of 320 patients enrolled, 107 (33%) tested GAS positive. Agreement was higher for symptoms (fever [agreement = 82%, κ = 0.64] and cough [72%, 0.45]) than for signs (exudate [80%, 0.41] and tender cervical nodes [73%, 0.18]). Agreement was highest when no signs and symptoms contained in the Centor score were present (94%, κ = 0.61). The proportion of patients testing GAS positive rose as the modified Centor score increased.

CONCLUSIONS: For identifying GAS pharyngitis, patients or parents and physicians showed moderate to substantial agreement for 3 of 4 key pharyngitis signs and symptoms.

[a]Division of Emergency Medicine and [c]Computational Health Informatics Program, Boston Children's Hospital, Boston, Massachusetts; and Departments of [b]Pediatrics and Emergency Medicine, Harvard Medical School, Boston, Massachusetts

Dr Lindgren conceptualized and designed the study, acquired the data, analyzed and interpreted the data, drafted the manuscript, critically revised the manuscript, performed statistical analysis, and obtained funding; Dr Neuman helped conceptualize and design the study, interpreted the data, critically revised the manuscript, and performed statistical analysis; Dr Monuteaux helped conceptualize and design the study, analyzed and interpreted the data, critically revised the manuscript, and performed statistical analysis; Dr Mandl helped analyze and interpret the data and critically revised the manuscript; Dr Fine conceptualized and designed the study, acquired the data, analyzed and interpreted the data, critically revised the manuscript, performed statistical analysis, and supervised the study; and all authors approved the final manuscript as submitted.

DOI: 10.1542/peds.2016-0317

Accepted for publication Apr 12, 2016

WHAT'S KNOWN ON THIS SUBJECT: Despite validated clinical prediction rules to help clinicians identify children at low risk for group A streptococcal pharyngitis, antibiotic prescribing remains high. There are no studies evaluating whether patients or their parents can accurately identify clinical predictors of streptococcal pharyngitis.

WHAT THIS STUDY ADDS: Patients or parents can report clinical symptoms of pharyngitis with moderate accuracy. These assessments could be used to identify patients at low risk for group A streptococcal pharyngitis in the prehospital setting.

To cite: Lindgren C, Neuman MI, Monuteaux MC, et al. Patient and Parent-Reported Signs and Symptoms for Group A Streptococcal Pharyngitis. *Pediatrics*. 2016;138(1):e20160317

More than 12 million patients are evaluated by a clinician for pharyngitis in the United States annually.[1] Although most cases of pharyngitis are viral, group A streptococcal (GAS) pharyngitis annually affects hundreds of millions of people worldwide.[2] Clinicians cannot reliably differentiate GAS from viral pharyngitis; clinical prediction scores have been derived and validated to help clinicians identify pharyngitis patients at low risk for GAS in an effort to decrease testing and unnecessary antibiotic use.[3–6] If low-risk patients were identified at home, before a clinic visit, they could potentially safely delay or avoid a visit to a clinician.

The 2012 Infectious Disease Society of America (IDSA) guidelines support the use of clinical and epidemiologic factors to predict a patient's likelihood of GAS and do not recommend antibiotic use without confirmation by either a rapid GAS test or positive culture.[7] The modified Centor score is a validated tool that can help providers identify which patients are at low risk for GAS based on clinical signs, reported historical symptoms, and age (Table 1).[5,6,8–10] Despite the existence of scoring systems for pharyngitis, high rates of testing and antibiotic prescribing persist. The low uptake of clinical scores into practice offers an opportunity to engage patients directly with their care.[11] Patients may have more time and motivation to consider decision support tools when faced with the prospect of extended wait times and cost. The accuracy of patient-reported or parent-reported signs and symptoms for predicting GAS has not been measured, but it could help with the triage of patients at home. Early parental identification of low-risk patients could prevent unneeded physician visits, testing, and antibiotic exposure.

The objective of this study is to determine whether patients or their parents can accurately report the physical signs and historical symptoms of pharyngitis that make up the modified Centor score to help determine whether the child is at low risk of GAS.

TABLE 1 Modified Centor Score to Help Evaluate the Risk of Group A *Streptococcus* Among Patients With Pharyngitis

Clinical Feature	Number of Points
History of fever	1
Absence of cough	1
Swollen, tender anterior cervical lymph nodes	1
Tonsillar exudate	1
Age ≤14 y old	1

Patients are assigned 1 point for the presence of each feature, with scores ranging from 0 to 4 points. Those with all 5 features are assigned the maximum score of 4.[6]

METHODS

Study Design and Population

We conducted a cohort study that included children 3 to 21 years of age presenting to a single urban, tertiary emergency department (ED) between October 1, 2013 and January 31, 2015 if they had a complaint of sore throat and were tested for GAS pharyngitis. Patients were excluded if they had inability to communicate symptoms, a triage level <3 on a 5-point scale as measured by the emergency severity index, comorbid medical conditions (significant cardiac, renal, or pulmonary disease, global developmental delay, immunocompromised state), an evaluation for sore throat by a health care provider in the previous 48 hours, received antibiotic therapy within the 7 days before presentation, or ongoing symptoms for >7 days. Trained research coordinators prospectively enrolled patients presenting between 12 PM and 10 PM, 7 days per week. The research coordinators obtained written informed consent for all patients and also obtained assent for patients 7 to 17 years of age who could comprehend the instructions. In addition, all attending physicians were aware of the study, and in concordance with our institutional review board protocol, completion of the survey served as consent for their participation in the study.

Upon enrollment, patients or their parents completed a tablet-based electronic survey about the patient's historical symptoms and physical examination findings (signs), including all elements of the modified Centor score (Table 1). We collected and managed data using the Research Electronic Data Capture electronic data capture tools hosted by the study institution. Patients >13 years old could opt to complete the survey independently. English and Spanish surveys were available.

Historical questions assessed for the presence of fever (defined as temperature >100.4°F or >38°C) and cough. The physical examination portion of the patient/parent survey assessed for the presence of 2 signs: swollen tender anterior cervical lymphadenopathy and tonsillar exudates. High-fidelity color images[12] were provided to help patients identify and evaluate these physical signs. Patients were provided a light source and a mirror to assist them with visualization of the posterior oropharynx. The patient/parent survey also included questions about daily access to the Internet and whether participants would be interested in using a Web-based triage score in the preclinical setting. The treating attending physician completed a similar survey asking the same historical symptoms and physical signs. All physicians who performed the history and physical examination and completed the survey were attending-level pediatricians working in our pediatric ED. The physician examined the patient and performed the history before patient enrollment and completion of the surveys. In an effort to minimize bias, research coordinators instructed

physicians not to discuss the physical examination findings with eligible patients or parents until after consent was obtained and both surveys were completed. Physicians and patients or their parents completed the surveys independently and were blinded to the others' responses and to the GAS test results. The modified Centor score was not calculated at the point of care. The answers generated by the survey were used to calculate the modified Centor score at the time of data analysis.

Microbiologic Testing

All enrolled patients had a swab of the tonsils and posterior pharynx performed by a clinician. Per institutional protocol, a 2-tiered testing strategy was used, with all samples undergoing a rapid antigen detection test for GAS, performed at the point of care within minutes. The sensitivity of a rapid antigen test is 70% to 90%; therefore, a culture is sent if the rapid test is negative, in concordance with IDSA and American Academy of Pediatrics guidelines.[13–15] Those testing positive by rapid test or culture are considered positive and typically treated for 10 days with oral antibiotics.[13]

Outcomes

The primary outcomes of this study were to measure the agreement between patient or parent and physician-reported symptoms and signs of GAS based on survey responses and to evaluate the performance of the modified Centor score in identifying patients at low risk of GAS pharyngitis based on patient or parent versus physician reports of symptoms and signs. The modified Centor score was dichotomized to identify a low-risk group (0 and 1) and non–low-risk group (score of ≥2), in accordance with the Centers for Disease Control and Prevention and IDSA approaches. Patients and parents completed surveys about Internet access and the appeal of using a Web-based sore throat triage system at home if it were available.

Statistical Analysis

To evaluate agreement between the patients or parents and clinicians, we calculated the percentage absolute agreement and the Cohen unweighted κ statistic to assess for agreement beyond chance alone. We calculated 95% confidence intervals (CIs) for the point estimates by using normal approximation methods. Levels of agreement were classified based on the κ statistic agreement as slight (0.00–0.20), fair (0.21–0.40), moderate (0.41–0.60), substantial (0.61–0.80), and almost perfect (0.81–1.00).[16–18] We used the JMP Statistical Discovery software (Cary, NC) for all data analysis. The Boston Children's Hospital institutional review board approved the study.

RESULTS

During the study period, 1069 patients age 3 to 21 years were screened by research coordinators for possible study inclusion. Potentially eligible patients were not included in the study for the reasons shown in Fig 1. Of the 320 patients enrolled, 107 (33%) tested positive for GAS pharyngitis, 192 (60%) were female, and the mean age was 10.3 years (median 8.9, interquartile range 5.7–14.8). Patients testing positive were more likely to have the following signs and symptoms according to patient or parent report: history of fever and absence of cough.

Table 2 contains demographic and clinical characteristics of enrolled patients stratified by GAS testing results. Patients who tested positive for GAS were more likely to be <14 years old and have the following signs and symptoms according to clinician report: history of fever, presence of swollen anterior cervical lymph nodes, and tonsillar exudates. Patients testing positive were more likely to have the following signs and symptoms according to patient or parent report: history of fever and absence of cough. Table 3 contains the distribution of the modified Centor scores generated by patients or parents and clinician reporting of signs and symptoms. Physicians classified 25% and patients and parents self-classified 33% of patients as low risk (modified Centor score 0–1).

Table 4 displays the proportion of patients with each clinical sign and symptom according to clinician and patient or parent report, and the overall percentage agreement and κ between the subjects and clinicians for each sign or symptom. Patients and parents were less likely to report absence of cough (35%; 95% CI, 30%–40%) than clinicians (51%; 95% CI, 47–57). Patients and parents were also less likely than clinicians to report swollen, tender anterior cervical nodes (13%; 95% CI, 10–17) than clinicians (27%; 95% CI, 22–31) but more likely to report tonsillar exudates (25%; 95% CI, 20–29) than clinicians (19%; 95% CI, 15–23). Agreement between patients or parents and clinicians was higher for historical symptoms than for clinical signs. Specifically, there was substantial agreement for history of fever (κ 0.64; 95% CI, 0.55–0.73) and moderate agreement for absence of cough (κ 0.45; 95% CI, 0.36–0.54). There was lower agreement for clinical signs than for historical symptoms: tender cervical lymphadenopathy (κ 0.18; 95% CI, 0.06–0.29) and tonsillar exudate (κ 0.41; 95% CI, 0.29–0.53). Among clinical scores, the highest agreement (94%) between patients or parents and clinicians occurred for patients with a modified Centor score of 0 (κ 0.61; 95% CI, 0.45–0.77). When we combined the 2 lowest scores (0–1), the agreement was 81% with a κ of 0.55 (95% CI, 0.45–0.64), indicating substantial agreement.

Fig 2 displays the proportion of patients testing positive according to the modified Centor score. The proportion of patients testing positive for GAS in the low-risk group (score 0–1) was similar when we compared scores generated by patient or parent reports versus clinician reports of signs and symptoms. For patients classified by clinicians as the lowest-risk group (modified Centor score = 0), 4% of patients tested positive, compared with 7% of those classified as the lowest risk by patients and parents. Twenty-two percent of patients with a modified Centor score of 1 tested positive. Among the 105 (33%) patients identified by patient or parent reports with the lowest modified Centor scores (0–1), 86 (82%) were negative for GAS.

Of 320 enrolled, 296 (93%) reported daily access to the Internet, and of those, 99% expressed the desire to use a Web-based triage app if it were available in the prehospital setting.

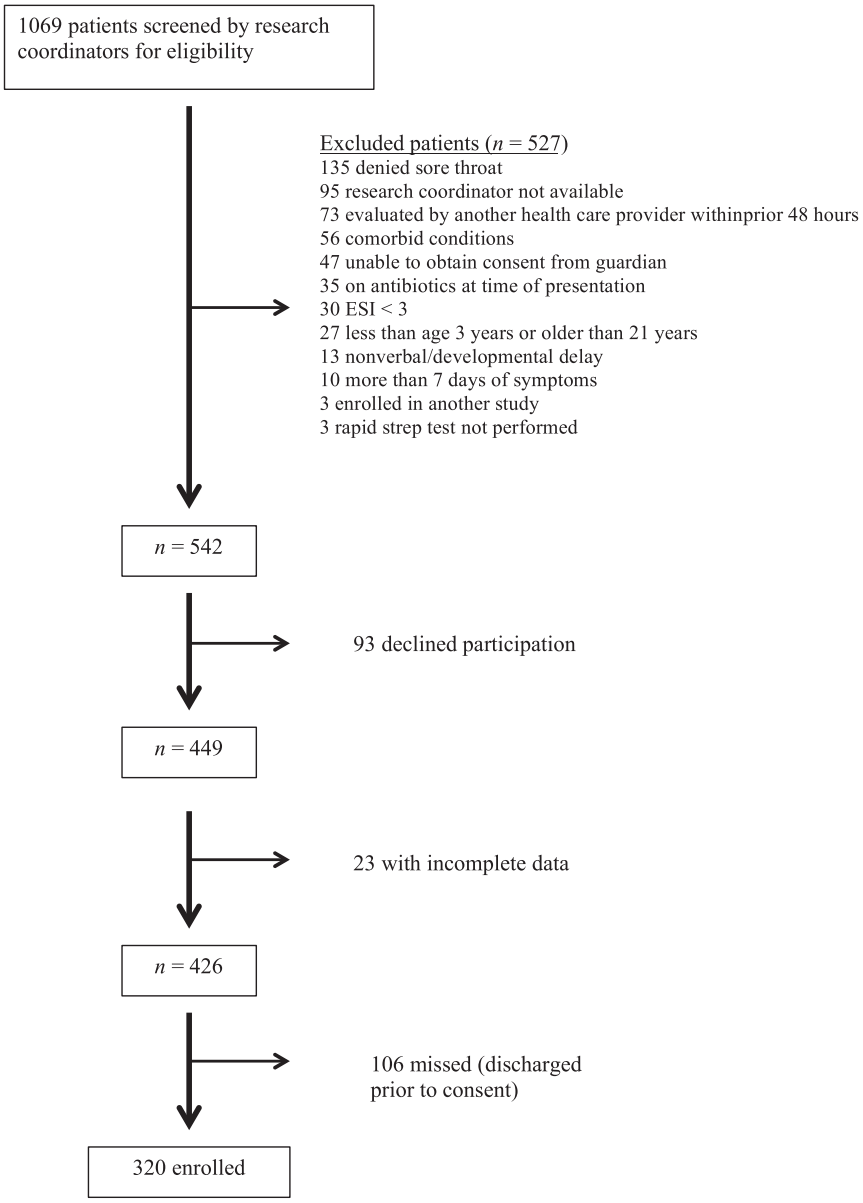

FIGURE 1
Patient flow diagram.

DISCUSSION

The modified Centor score serves as a validated clinical prediction rule to help clinicians determine an individual patient's risk for GAS pharyngitis. Clinical prediction rules constitute a strategy that attempts to provide evidence-based approaches to decision making in the face of clinical uncertainty.[19,20] Despite being validated instruments, prediction rules often exert limited effect on clinical practice because of time constraints and other factors.[21–24] Application of prediction rules in the preclinical setting offers a unique opportunity for implementation that can be patient centered.

Use of a prediction rule in the preclinical setting was attempted previously through the use of a Web-based triage tool during the H1N1 influenza epidemic.[25] This study was limited by the wide spectrum of disease associated with influenza infection because the course tends to be less predictable, with higher morbidity and mortality. Unlike influenza, pharyngitis is usually nonurgent and can typically wait for evaluation without concern for rapid clinical deterioration. Treatment of GAS pharyngitis is important to prevent rheumatic fever, reduce suppurative complications (ie, peritonsillar abscess), increase symptom resolution, reduce the spread of disease, and decrease transmission. However, if patients knew that they were at low risk for GAS pharyngitis before evaluation by a clinician, some might choose to defer immediate care, which could decrease overall health care utilization, testing, and unnecessary antibiotic prescribing. In addition, when compared with clinicians, patients may have more personal incentive and time to apply a clinical score in a preclinical setting.

We are unaware of previous studies of acute illnesses in the pediatric

literature that measure interrater agreement between clinicians and patients for predictors applied to a decision tool. Previous studies of interrater agreement have focused on physician–physician or physician–nurse dyads.[26–28] We demonstrated that the overall percentage agreement was high for all modified Centor score predictors between the clinician and patient or parent. When we evaluated the κ, however, which measures agreement beyond chance alone, the agreement for historical symptoms was moderate or high and lower for clinical examination findings. It is not surprising that patients report historical symptoms more accurately than they report clinical signs, given their lack of training in physical examination skills. Furthermore, of the clinical predictors within the modified Centor tool, tonsillar exudate and tender cervical lymphadenopathy were observed in fewer patients in the study overall, which also contributes to a lower κ.

It is somewhat surprising that agreement was not higher for the historical predictors. We consider clinician reporting of predictors to be the gold standard because the modified Centor score was previously derived and validated based on clinician reports. However, it is conceivable that parental report of symptoms is more accurate than reporting by clinicians. Clinicians may be susceptible to cognitive errors such as faulty context formulation and faulty estimation of disease prevalence.[29,30] In addition, clinicians may incorporate experience from the encounter when applying a score. For example, a patient may cough while the physician is obtaining the history, and the physician therefore assumes the patient has a cough, whereas the patient may not have reported having a cough before that single episode. One could postulate that patient or parent reporting may be better than that of clinicians for certain predictors and that application of the modified Centor score to determine patients at low risk may be more useful in a preclinical setting than at the time of seeking medical care.

For children assessed to be at low risk for GAS (score 0–1) by clinicians and patients or

TABLE 2 Clinical Characteristics of Patients Presenting to the ED With Pharyngitis (*n* = 320)

Characteristic	Overall, *N* (%) (*n* = 320)	GAS Positive, *N* (%) (*n* = 107)	GAS Negative, *N* (%) (*n* = 213)	*P*
Demographics				
Age ≤14 y	225 (70)	92 (86)	133 (62)	<.01
Female	192 (60)	59 (55)	133 (62)	.22
Signs and symptoms (physician report)				
Fever	187 (58)	77 (72)	110 (52)	<.01
Absence of cough	164 (51)	61 (57)	103 (48)	.19
Tender anterior cervical lymph nodes	85 (27)	48 (45)	37 (17)	<.01
Tonsillar exudates	59 (18)	27 (25)	32 (15)	.03
Signs and symptoms (patient or parent report)				
Fever	185 (58)	73 (68)	112 (53)	<.01
Absence of cough	111 (35)	45 (42)	66 (31)	.05
Tender anterior cervical lymph nodes	41 (13)	19 (18)	22 (10)	.06
Tonsillar exudates	79 (25)	31 (29)	48 (23)	.21

TABLE 3 Distribution of Modified Centor Scores of Patients Presenting to the ED With Pharyngitis (*n* = 320)

Characteristic	Overall, *N* (%) (*n* = 320)	GAS Positive, *N* (%) (*n* = 107)	GAS Negative, *N* (%) (*n* = 213)
Distribution by score (physician report)			
Modified Centor 0	25 (8)	1 (1)	24 (11)
Modified Centor 1	55 (17)	13 (12)	42 (20)
Modified Centor 2	102 (32)	23 (21)	79 (37)
Modified Centor 3	99 (31)	42 (39)	57 (27)
Modified Centor 4	39 (12)	28 (26)	11 (5)
Distribution by score (patient or parent report)			
Modified Centor 0	28 (9)	2 (2)	26 (12)
Modified Centor 1	78 (24)	17 (16)	61 (29)
Modified Centor 2	111 (35)	39 (36)	72 (34)
Modified Centor 3	76 (24)	33 (31)	43 (20)
Modified Centor 4	27 (8)	16 (15)	11 (5)

TABLE 4 Agreement Between Patient or Parent and Clinician (*n* = 320)

Predictor	Patient, *N* (%)	Physician, *N* (%)	% Agreement	κ (95% CI)
History of fever	185 (58)	187 (58)	82	0.64 (0.55–0.73)
Absence of cough	111 (35)	164 (51)	72	0.45 (0.36–0.54)
Tender anterior cervical lymphadenopathy	41 (13)	85 (27)	73	0.18 (0.06–0.29)
Tonsillar exudate	79 (25)	59 (19)	80	0.41 (0.29–0.53)
Modified Centor 0	28 (9)	25 (8)	94	0.61 (0.45–0.77)
Modified Centor 1	78 (24)	55 (17)	77	0.31 (0.19–0.43)
Modified Centor 2	111 (35)	102 (32)	65	0.21 (0.10–0.31)
Modified Centor 3	76 (24)	99 (31)	68	0.21 (0.10–0.32)
Modified Centor 4	27 (8)	39 (12)	90	0.37 (0.2–0.55)
Low risk score (0–1)	106 (33)	80 (25)	81	0.55 (0.45–0.65)

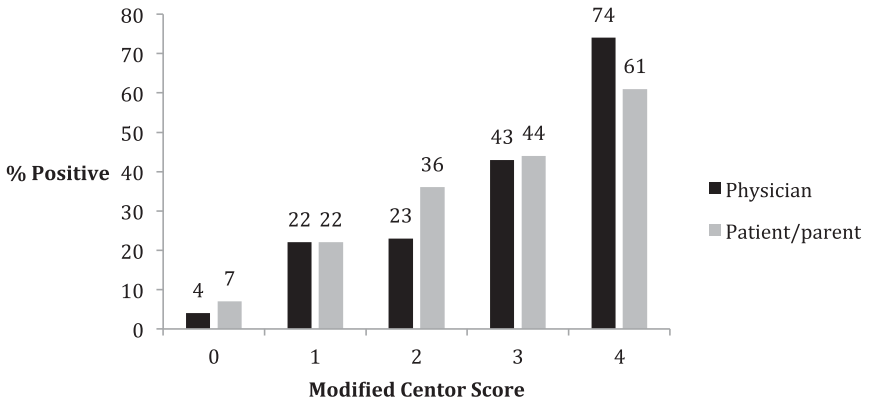

FIGURE 2
Percentage of patients with pharyngitis testing positive for GAS, by modified Centor score.

providers, the modified Centor score performance demonstrated moderate agreement. This suggests that patients or parents may be able to accurately identify children at low risk for GAS. Although some GAS-positive patients would have been incorrectly classified as low risk through application of the score, delaying treatment of GAS does not typically result in rapid disease progression. Application of the tool before evaluation by a clinician may be useful to help patients or parents determine that they are at low risk for GAS infection and therefore could avoid unnecessary testing and treatment. We recognize that 10% to 20% of patients initially may be missed through application of this score, but given that GAS generally has an indolent course, this error will be unlikely to result in major complications. Use of this score in the preclinical setting may be best interpreted in conjunction with a clinician who can provide clinical context, discuss risks and benefits with the patient or parent, and arrange timely and appropriate follow-up if symptoms are not improving. It is encouraging that >90% of the patients reported daily Internet access and also reported interest in using this type of home triage tool if it were available.

Our study has several limitations. First, we relied on patients reporting that they had a sore throat. We did not systematically screen all patients presenting to the ED for sore throat, which may have led to some ascertainment bias. Second, we did not measure the percentage of patients who completed the survey independent of their parents. Research coordinators left the room while the patient completed the survey in an effort to minimize any bias they might introduce. Although we recognize this as a limitation, we believe this reflects how this tool would be used in a preclinical setting. Third, we are unable to comment on the presence of the streptococcal carrier state that may have existed in some patients. However, because all enrolled patients had sore throat as a symptom, these patients would be clinically considered to have GAS pharyngitis and would be treated with antibiotics in the acute care setting. Fourth, this study was limited to a single ED, which may limit the generalizability of our findings to other clinical settings such as a primary care clinic. Finally, our sample size may have limited our ability to measure agreement between the clinical examination findings, given that few patients demonstrated presence of these specific findings, which contributes to a lower κ.

CONCLUSIONS

We have demonstrated that patients and physicians demonstrate moderate agreement in their application of the modified Centor score for identifying children at low risk of GAS pharyngitis. It may be safe to apply a similar tool in the preclinical setting, allowing patients and parents to self-triage by incorporating their own data into a clinical prediction score. This approach could help screen out sore throat patients at low risk for GAS and decrease resource utilization.

ABBREVIATIONS

CI: confidence interval
ED: emergency department
GAS: group A streptococcal
IDSA: Infectious Disease Society of America

Address correspondence to Andrew M. Fine, MD, MPH, Boston Children's Hospital, Division of Emergency Medicine, 300 Longwood Ave, Boston, MA 02115. E-mail: andrew.fine@childrens.harvard.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

REFERENCES

1. Klepser DG, Bisanz SE, Klepser ME. Cost-effectiveness of pharmacist-provided treatment of adult pharyngitis. *Am J Manag Care*. 2012;18(4):e145–e154
2. Carapetis JR, Steer AC, Mulholland EK, Weber M. The global burden of group A streptococcal diseases. *Lancet Infect Dis*. 2005;5(11):685–694
3. Centor RM, Witherspoon JM, Dalton HP, Brody CE, Link K. The diagnosis of strep throat in adults in the emergency room. *Med Decis Making*. 1981;1(3):239–246
4. Fine AM, Nizet V, Mandl KD. Improved diagnostic accuracy of group A streptococcal pharyngitis with use of real-time biosurveillance. *Ann Intern Med*. 2011;155(6):345–352
5. Fine AM, Nizet V, Mandl KD. Large-scale validation of the Centor and McIsaac scores to predict group A streptococcal pharyngitis. *Arch Intern Med*. 2012;172(11):847–852
6. McIsaac WJ, Kellner JD, Aufricht P, Vanjaka A, Low DE. Empirical validation of guidelines for the management of pharyngitis in children and adults. *JAMA*. 2004;291(13):1587–1595
7. Bisno AL, Gerber MA, Gwaltney JM Jr, Kaplan EL, Schwartz RH; Infectious Diseases Society of America. Practice guidelines for the diagnosis and management of group A streptococcal pharyngitis. *Clin Infect Dis*. 2002;35(2):113–125
8. McIsaac WJ, Goel V, To T, Low DE. The validity of a sore throat score in family practice. *CMAJ*. 2000;163(7):811–815
9. McIsaac WJ, White D, Tannenbaum D, Low DE. A clinical score to reduce unnecessary antibiotic use in patients with sore throat. *CMAJ*. 1998;158(1):75–83
10. Choby BA. Diagnosis and treatment of streptococcal pharyngitis [published correction appears in *Am Fam Physician*. 2013;88(4):222]. *Am Fam Physician*. 2009;79(5):383–390
11. Fine AM, Nizet V, Mandl KD. Participatory medicine: a home score for streptococcal pharyngitis enabled by real-time biosurveillance: a cohort study. *Ann Intern Med*. 2013;159(9):577–583
12. Zitelli BJ, McIntire S, Nowalk AJ, eds. *Zitelli and Davis' Atlas of Pediatric Physical Diagnosis*. 6th ed. Philadelphia, PA: Saunders/Elsevier; 2012
13. Shulman ST, Bisno AL, Clegg HW, et al. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America [published correction appears in *Clin Infect Dis*. 2014;58(10):1496]. *Clin Infect Dis*. 2012;55(10):1279–1282
14. Wessels MR. Clinical practice. Streptococcal pharyngitis. *N Engl J Med*. 2011;364(7):648–655
15. Hersh AL, Jackson MA, Hicks LA; American Academy of Pediatrics Committee on Infectious Diseases. Principles of judicious antibiotic prescribing for upper respiratory tract infections in pediatrics. *Pediatrics*. 2013;132(6):1146–1154
16. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159–174
17. Cicchetti D, Bronen R, Spencer S, et al. Rating scales, scales of measurement, issues of reliability: resolving some critical issues for clinicians and researchers. *J Nerv Ment Dis*. 2006;194(8):557–564
18. Landis JR, Koch GG. An application of hierarchical kappa-type statistics in the assessment of majority agreement among multiple observers. *Biometrics*. 1977;33(2):363–374
19. Wasson JH, Sox HC. Clinical prediction rules. Have they come of age? *JAMA*. 1996;275(8):641–642
20. Wasson JH, Sox HC, Neff RK, Goldman L. Clinical prediction rules. Applications and methodological standards. *N Engl J Med*. 1985;313(13):793–799
21. 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
22. Lomas J, Anderson GM, Domnick-Pierre K, Vayda E, Enkin MW, Hannah WJ. Do practice guidelines guide practice? The effect of a consensus statement on the practice of physicians. *N Engl J Med*. 1989;321(19):1306–1311
23. Hayward RS, Guyatt GH, Moore KA, McKibbon KA, Carter AO. Canadian physicians' attitudes about and preferences regarding clinical practice guidelines. *CMAJ*. 1997;156(12):1715–1723
24. Greenes RA. Why clinical decision support is hard to do. *AMIA Symposium*. 2006:1169–1170
25. Kellermann AL, Isakov AP, Parker R, Handrigan MT, Foldy S. Web-based self-triage of influenza-like illness during the 2009 H1N1 influenza pandemic. *Ann Emerg Med*. 2010;56(3):288–294, e286
26. Nigrovic LE, Schonfeld D, Dayan PS, Fitz BM, Mitchell SR, Kuppermann N. Nurse and physician agreement in the assessment of minor blunt head trauma. *Pediatrics*. 2013;132(3). Available at: www.pediatrics.org/cgi/content/full/132/3/e689
27. Dayan PS, Lillis K, Bennett J, et al; Pediatric Emergency Department Northeast Team of the Pediatric Emergency Care Applied Research Network (PECARN). Interobserver agreement in the assessment of clinical findings in children with first unprovoked seizures. *Pediatrics*. 2011;127(5), Available at: www.pediatrics.org/cgi/content/full/127/5/e1266
28. Kharbanda AB, Stevenson MD, Macias CG, et al; Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics. Interrater reliability of clinical findings in children with possible appendicitis. *Pediatrics*. 2012;129(4):695–700
29. Croskerry P. Achieving quality in clinical decision making: cognitive strategies and detection of bias. *Acad Emerg Med*. 2002;9(11):1184–1204
30. Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. *Acad Med*. 2003;78(8):775–780

Patient and Parent-Reported Signs and Symptoms for Group A Streptococcal Pharyngitis

Christina Lindgren, Mark I. Neuman, Michael C. Monuteaux, Kenneth D. Mandl and Andrew M. Fine

Pediatrics 2016;138;
DOI: 10.1542/peds.2016-0317 originally published online June 8, 2016;

PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Patient and Parent-Reported Signs and Symptoms for Group A Streptococcal Pharyngitis

Christina Lindgren, Mark I. Neuman, Michael C. Monuteaux, Kenneth D. Mandl and Andrew M. Fine

Pediatrics 2016;138;
DOI: 10.1542/peds.2016-0317 originally published online June 8, 2016;