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ABSTRACT

Improved diagnosis of group A streptococcal pharyngitis using real-time biosurveillance

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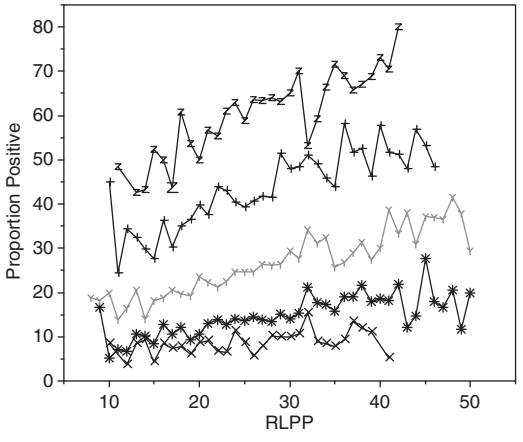
Objective
The objective of this study was to measure the value of integrating real-time contemporaneous local disease incidence (biosurveillance) data with a clinical score, to more accurately identify patients with Group A Streptococcal (GAS) pharyngitis.

Introduction
Group A Streptococcal (GAS) pharyngitis, the most common bacterial cause of acute pharyngitis, causes more than half a billion cases annually worldwide. Treatment with antibiotics provides symptomatic benefit and reduces complications, missed work days and transmission. Physical examination alone is an unreliable way to distinguish GAS from other causes of pharyngitis, so the 4-point Centor score, based on history and physical, is used to classify GAS risk. Still, patients with pharyngitis are often misclassified, leading to inappropriate antibiotic treatment of those with viral disease and to under-treatment of those with *bone fide* GAS. One key problem, even when clinical guidelines are followed, is that diagnostic accuracy for GAS pharyngitis is affected by earlier probability of disease, which in turn is related to exposure. Point-of-care clinicians rarely have access to valuable biosurveillance-derived contextualizing information when making clinical management decisions.

Methods
We analyzed data from patients tested for GAS, who presented with pharyngitis from 2006 to 2008 to MinuteClinic, a large national retail health chain. Analysis was restricted to nine markets with >7000 patient visits for pharyngitis, for a total of 138,910 patient encounters across six states. Anonymized extracted data included visit date, location, signs and symptoms included in the Centor score, and pharyngitis test results. To enable integration of contemporaneous, local GAS data with clinical data, we created a biosurveillance variable called the recent local proportion positive (RLPP), a moving window reflecting the proportion of local patients testing positive in the previous week. Patients were grouped by Centor score (0–4) and further categorized by RLPP. We calculated the percent of patients who tested positive for GAS for all combinations of Centor score and RLPP. Using standard metrics (sensitivity, specificity, AUC), we compared the accuracy of the Centor score alone and RLPP alone with the accuracy of a biosurveillance-responsive score that integrated the Centor score and the RLPP to predict which patients tested positive for GAS. We examined the public health effects of subtracting 1 point from the Centor score when the RLPP was below certain thresholds, and adding 1 point when the RLPP exceeded thresholds.

Results
There was no distinct seasonal GAS pattern. For patients with Centor scores of 1–4, represented by the top 4 lines in the figure below, the percent of patients testing positive increases as the RLPP increases ($P<0.0001$). When RLPP >0.30, managing patients with Centor scores of 1 (where the American College of Physicians recommendation is neither



test nor treat) as if their scores were 2 would identify 114,850 previously missed patients who would test positive for GAS each year in the United States while misclassifying 33,161 patients who tested negative. When RLPP <0.20, approaching patients with Centor scores of 3 (where one guideline suggests empiric treatment) as if their scores were 2 would spare unnecessary antibiotics for 78,367 patients while missing 8,195 positives. The AUC is best for the biosurveillance-responsive model incorporating RLPP with the Centor score (0.72), followed by Centor score alone (0.70), and then by RLPP alone (0.57).

Conclusions

Incorporating live epidemiological data into clinical guidelines for GAS should be considered to reduce missed cases when the contemporaneous incidence is elevated, and to spare unnecessary antibiotics when the contemporaneous incidence is low.

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