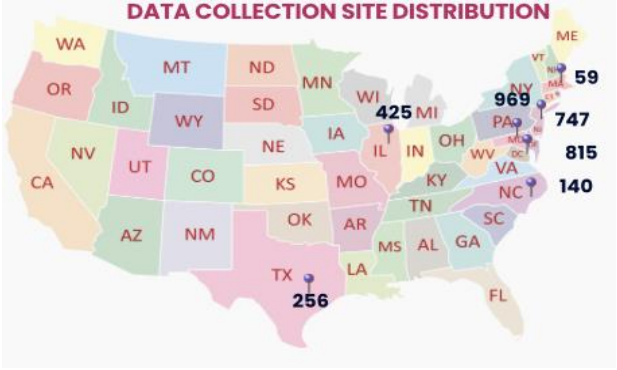
Multistate data acquisition helping to guide machine learning for image identification of Streptococcus in children aged 3-17

Patrick Dolan MD FAAP FCUCM: PM Pediatric Care, Aleese McKinnon: PM Pediatric Care, Raj Shekhar: Children's National Hospital Pediatrics

Background

- Pharyngitis is a leading cause of pediatric urgent care utilization in the United states accounting for approximately 15 million visits annually.
- Group A Streptococcus (GAS) is responsible for an estimated 20% of cases, resulting in substantial over testing and inappropriate antibiotic prescribing.
- In response, antimicrobial stewardship initiatives have emphasized reducing unnecessary diagnostic testing and antibiotic use
- Clinical prediction rules, including the modified Centor (McIsaac) score, are recommended by current guidelines to guide testing decisions; their diagnostic accuracy remains suboptimal in pediatric populations.
- PM Pediatric Care is the nation's largest provider of dedicated pediatric urgent cares with ~90 locations across 14 states.



Objectives

- The subjective nature of clinician's assessment of the oropharyngeal region introduces variability and potential for diagnostic error. Clinical features alone are insufficient to reliably distinguish between Group A Streptococcus (GAS) and viral pharyngitis, highlighting the need for improved diagnostic approaches.
- This study is a multicenter prospective investigation aimed at developing novel artificial intelligence-based software for diagnosing GAS pharyngitis using machine learning techniques.
- To address existing limitations, we constructed a dataset comprising nearly 5,000 pediatric patients across eight U.S. States, including more than 75,000 oropharyngeal images linked to clinical and laboratory data
- Using this dataset, we developed a supervised machine learning model to predict the likelihood of GAS infection and to identify patients who would benefit from confirmatory testing

METHODS

- IRB review was obtained for all sites engaged in the project. Participating locations included Washington DC, Massachusetts, Illinois, Texas, North Carolina, New Jersey and Pennsylvania.
- Patients were eligible for inclusion if they were between the ages of 3 and under 18 years, were being evaluated for Group A Streptococcal (GAS) pharyngitis with a GAS test and had no exposure to antibiotics within the preceding 48 hours.
- Each patient and their guardian were informed about the project and verbal consent was obtained prior to participation.
- For each clinical encounter, standardized symptoms data and oropharyngeal images were collected. This information was then de-identified and securely transmitted for analysis using machine learning methods.
- All images were reviewed for quality by pediatric specialists involved in the study, and interrater agreement was assessed. Following quality review and classification of case outcomes, the data were used to train the AI software

Centor Score

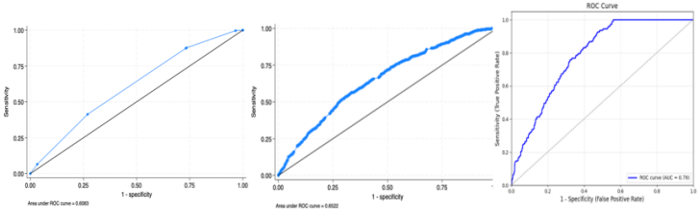
AUC: 0.60

Clinical Factors

AUC: 0.65

StrepApp

AUC: 0.79



AUC: Area under the curve

RESULTS

The resulting model achieved a discriminatory performance of 0.91, substantially outperforming existing clinical scoring systems

	Specificity	NPV	accuracy
DL Model	96.6%	93.6%	89.3%

True Negative

True Positive

DISCUSSION

- StrepApp is an AI-driven clinical decision support system designed to establish an objective, data-driven baseline for the diagnosis of pediatric streptococcal pharyngitis. The platform integrates multimodal inputs—including patient-reported symptoms, clinical exam findings, and potentially imaging data (e.g., oropharyngeal photographs)—to generate a probabilistic risk score for Group A Streptococcus (GAS) infection.
- Using supervised machine learning models trained on labeled clinical datasets (e.g., RADT and throat culture-confirmed cases), StrepApp demonstrates improved diagnostic performance relative to conventional clinical scoring systems such as the Centor Criteria and McIsaac Score. Preliminary validation suggests higher sensitivity and specificity, with improved area under the receiver operating characteristic curve (AUROC), enabling more accurate risk stratification.
- By reducing reliance on subjective clinical judgment and improving pretest probability estimation, the system has the potential to decrease unnecessary rapid antigen detection tests (RADTs) and throat cultures, optimize antibiotic stewardship, and reduce both direct and indirect healthcare costs
- From a health systems perspective, StrepApp aligns with multiple quality domains defined by the Institute of Medicine, including efficiency (reduced over testing), effectiveness (improved diagnostic accuracy), and patient-centered care (streamlined clinical workflows and reduced burden of care).

Next Steps

Image machine learning for other disease processes. IE Conjunctivitis, Anemia, Bilirubin

REFERENCES

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