2025 Clinical Practice Guideline Update by the Infectious Diseases Society of America on diagnosis and management of Group-A Streptococcal Pharyngitis (GAS): Risk assessment using clinical scoring systems in children and adults

Supplemental Material

CONTENTS

CLINICAL PRACTICE GUIDELINE DEVELOPMENT

Guideline Panel Composition

The chair of the guideline panel was selected by the leadership of IDSA. Thirteen additional panelists comprised the full panel. The panel included infectious diseases specialists representing IDSA, as well as representatives from the PIDS, AAFP, ASM, AAP and SIDP. Members represented the disciplines of infectious diseases, pediatrics, public health, microbiology, family medicine, internal medicine and pharmacy. Panelists were diverse in gender, geographic distribution, and years of clinical experience. Guideline methodologists oversaw all methodological aspects of the guideline development, including the identification and summarization of scientific evidence for each clinical question. IDSA staff oversaw all administrative and logistic issues related to the guideline panel.

Disclosure and Management of Potential Conflicts of Interests

All members of the expert panel complied with the IDSA policy on conflict of interest (COI), which requires disclosure of any financial, intellectual, or other interest that might be construed as constituting an actual, potential, or apparent conflict. Evaluation of such relationships as potential conflicts of interest was determined by a review process which included assessment by the Standards and Practice Guideline Subcommittee (SPGS) Chair, and if necessary, the Executive Committee of the Board. This assessment of disclosed relationships for possible COI was based on the relative weight of the financial relationship (i.e., monetary amount) and the relevance of the relationship (i.e., the degree to which an independent observer might reasonably interpret an association as related to the topic or recommendation of consideration). The reader of these guidelines should be mindful of this when the list of disclosures is reviewed. See the Notes section at the end of this guideline for the disclosures reported to IDSA.

Practice Recommendations

Clinical Practice Guidelines are statements that include recommendations intended to optimize patient care by assisting practitioners and patients in making shared decisions about appropriate health care for specific clinical circumstances. These are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options [IOM 2011]. The “IDSA Handbook on Clinical Practice Guideline Development” provides more detailed information on the processes followed throughout the development of this guideline [IDSA Handbook].

Review and Approval Process

Feedback was obtained from three external individual peer expert reviewers as well as endorsing organizations. The IDSA Standards and Practice Guidelines Subcommittee (SPGS) and Board of Directors reviewed and approved the guideline prior to publication.

Process for Updating

IDSA guidelines are regularly reviewed for currency. The need for updates to the guideline is determined by a scan of current literature and the likelihood that any new data would impact the recommendations. Any changes to the guideline will be submitted for review and approval to the appropriate Committees and Board of IDSA.

SYSTEMATIC REVIEW PROCESS

Clinical Questions

Each clinical question was formatted according to the PICO style: Patient/Population (P), Intervention (I), Comparator/Control (C), Outcome (O). For each PICO question, outcomes of interest were identified a priori and rated as critical, important, or not important, according to their relative importance for decision-making.

Literature Search

A medical librarian designed the literature searches and MeSH terms for PubMed, Scopus and Cochrane. Searches were limited to studies published in English. The initial formal literature search was performed in April 2023 and then updated in April 2024 and March 2025. To supplement the electronic searches, reference lists of related articles and guidelines were reviewed for relevance.

PUBMED

1. “streptococcal infections” [Mesh]
2. “streptococcus” [Mesh]
3. streptococcus[tiab]
4. streptococci[tiab]
5. streptococcal[tiab]
6. 1 OR 2 OR 3 OR 4 OR 5
7. “pharyngitis” [Mesh]
8. pharyngitis[tiab]
9. 7 OR 8
10. 6 AND 9
11. “streptococcus pyogenes” [Mesh]
12. “streptococcal pharyngitis”[tiab]

13. “group A beta-hemolytic streptococc*”[tiab]
14. GABHS[tiab]
15. “sore throat”[tiab]
16. “streptococcal polysaccharide group A" [Supplementary Concept]
17. “group A strep*”[tiab]
18. 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17
19. 10 OR 18
20. "clinical screen*"[tiab]
21. “screening tool*"[tiab]
22. "scoring card*"[tiab]
23. "score card*"[tiab]
24. scorecard[tiab]
25. "scoring system*"[tiab]
26. "clinical scor*"[tiab]
27. "clinical prediction"[tiab]
28. "clinical features"[tiab]
29. "predictive model*"[tiab]
30. "prediction model*"[tiab]
31. "clinical decision"[tiab]
32. "clinical finding*"[tiab]
33. "clinical assessment"[tiab]
34. "clinical judgment"[tiab]
35. "clinical inquir*"[tiab]
36. "clinical data"[tiab]
37. "clinical algorithm*"[tiab]
38. physical examination [Mesh]
39. “physical exam*”[tiab]
40. medical history taking [Mesh]
41. “medical history”[tiab]
42. “clinical examination”[tiab]
43. “usual care”[tiab]
44. “clinical diagnosis”[tiab]
45. 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36 OR 37 OR 38 OR 39 OR 40 OR 41 OR 42 OR 43 OR 44
46. 19 AND 45

SCOPUS

1. TITLE-ABS ("streptococcal infections")
2. TITLE-ABS (streptococcus)
3. TITLE-ABS (streptococci)
4. TITLE-ABS (streptococcal)

5. #1 OR #2 OR #3 OR #4
6. TITLE-ABS (pharyngitis)
7. #5 AND #6
8. TITLE-ABS ("streptococcus pyogenes")
9. TITLE-ABS ("streptococcal pharyngitis")
10. TITLE-ABS ("group A beta-hemolytic streptococc*")
11. TITLE-ABS (gabhs)
12. TITLE-ABS ("sore throat")
13. TITLE-ABS ("streptococcal polysaccharide group A")
14. TITLE-ABS ("group A strep*")
15. #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14
16. TITLE-ABS ("clinical screen*")
17. TITLE-ABS ("screening tool*")
18. TITLE-ABS ("scoring card*")
19. TITLE-ABS ("score card*")
20. TITLE-ABS (scorecard)
21. TITLE-ABS ("scoring system*")
22. TITLE-ABS ("clinical scor*")
23. TITLE-ABS ("clinical data")
24. TITLE-ABS ("clinical assessment")
25. TITLE-ABS ("clinical prediction")
26. TITLE-ABS ("predictive model*")
27. TITLE-ABS ("prediction model*")
28. TITLE-ABS ("clinical decision")
29. TITLE-ABS ("clinical finding*")
30. TITLE-ABS ("clinical judgment")
31. TITLE-ABS ("clinical inquir*")
32. TITLE-ABS ("clinical algorithm*")
33. TITLE-ABS (“physical exam*”)
34. TITLE-ABS (“medical history”)
35. TITLE-ABS (“clinical examination”)
36. TITLE-ABS (“usual care”)
37. TITLE-ABS (“clinical diagnosis”)
38. #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37
39. #15 AND #38

COCHRANE

1. MeSH descriptor: [Streptococcal Infections] explode all trees
2. MeSH descriptor: [Streptococcus] explode all trees
3. streptococcus OR streptococci OR streptococcal

4. #1 OR #2 OR #3
5. MeSH descriptor: [Pharyngitis] explode all trees
6. pharyngitis
7. #5 OR #6
8. #4 AND #7
9. MeSH descriptor: [Streptococcus pyogenes] explode all trees
10. “streptococcal pharyngitis”
11. “group A beta-hemolytic streptococc*”
12. GABHS OR "sore throat”
13. "group A strep*”
14. #9 OR #10 OR #11 OR #12 OR #13
15. #8 OR #14
16. "clinical screen*"
17. "screening tool*"
18. "scoring card*"
19. "score card"
20. scorecard
21. "scoring system*"
22. "clinical scor*"
23. "clinical prediction"
24. "clinical features"
25. "predictive model"
26. "prediction model"
27. "clinical decision"
28. "clinical finding"
29. "clinical assessment"
30. "clinical judgement"
31. "clinical inquir*"
32. "clinical data"
33. "clinical algorithm"
34. MeSH descriptor: [Physical Examination] explode all trees
35. MeSH descriptor: [Medical History Taking] explode all trees
36. “physical exam*"
37. “medical history”
38. “clinical examination”
39. “usual care”
40. "clinical diagnosis”
41. #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40
42. #15 AND #41

Study Selection

Guideline methodologist screened titles and excluded articles that were clearly irrelevant to the overall topic of Group-A Streptococcal Pharyngitis. Titles and abstracts of articles included from the previous step were screened in duplicates by the panel, and all potentially relevant citations were reviewed in full text; Covidence was used to facilitate screening [Covidence]. Predefined inclusion and exclusion criteria tailored to meet the specific population, intervention, and comparator of each question were applied during the screening process. The steps of the literature selection process were supervised and reviewed by a guideline methodologist for the final selection of the relevant articles. Details of this selection process are reported via PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagrams.

The following eligibility criteria were used:

Inclusion criteria:

- *Patient population* – Children or adults with pharyngitis
- *Intervention* – Use of clinical scoring system
- *Comparator* – Clinical evaluation or physical examination without using a scoring system
- *Reference standard* – Throat culture
- *Outcomes* – Diagnostic accuracy (sensitivity, specificity, Positive predictive value, negative predictive value), unnecessary testing (defined as testing yielding negative results for GAS), missed diagnosis of GAS Pharyngitis
- *Study design* – randomized and non-randomized studies that compared use of a clinical scoring system to physician judgement alone in deciding who should be tested for GAS pharyngitis, Articles published in English

Exclusion criteria:

- Studies not comparing both arms (use of clinical score vs. Clinician judgement)
- Studies focusing on the use of scoring systems to guide antibiotic prescriptions rather than testing
- Studies not comparing against reference standards of throat culture or RADT
- Raw data needed to calculate sensitivities and specificities not reported
- Articles in non-English language
- Animal studies
- Abstracts and conference proceedings, letters to the editors, editorials

Data extraction and analysis

A guideline methodologist in conjunction with panelists extracted data for each pre-determined patient-important outcome. Data were descriptively summarized and presented as forest plots using RevMan

Web [RevMan Web]. Separate analyses were conducted for children (<18 years), adults (≥18 years) as well as combined population in studies where the participants were not separated by age.

Evidence to decision

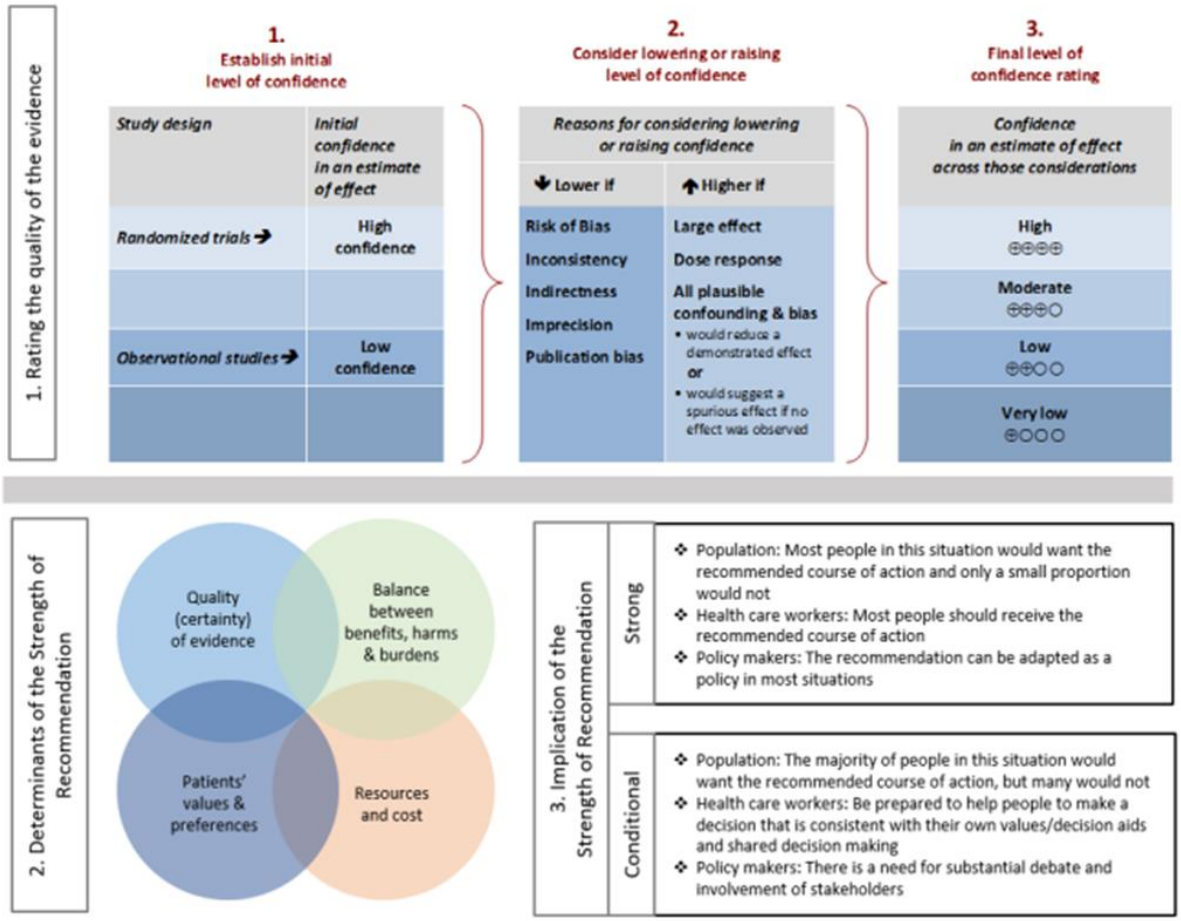
Guideline methodologist prepared the evidence summaries and assessed the risk of bias and the certainty of evidence. Risk of bias was assessed using the QUADAS-C assessment [Yang 2021] and table was created using ROBVIS web app [McGuiness 2021]. The certainty of evidence was determined first for each critical and important outcome and then for each recommendation using the GRADE approach for rating the confidence in the evidence [Guyatt 2008, GRADE Handbook]. Evidence profiles were developed using the GRADEpro Guideline Development Tool [GRADEpro GDT] and reviewed by panel members responsible for each PICO.

The Evidence to Decision framework [GRADEpro] was used to translate the evidence summaries into practice recommendations. All recommendations are labeled as either “strong” or “conditional” according to the GRADE approach [IDSA CPG Handbook]. "The panel recommends” indicates strong recommendations and “The panel suggests” indicates conditional recommendations. Supplementary Figure 1 provides the suggested interpretation of strong and conditional recommendations for patients, clinicians, and healthcare policymakers.

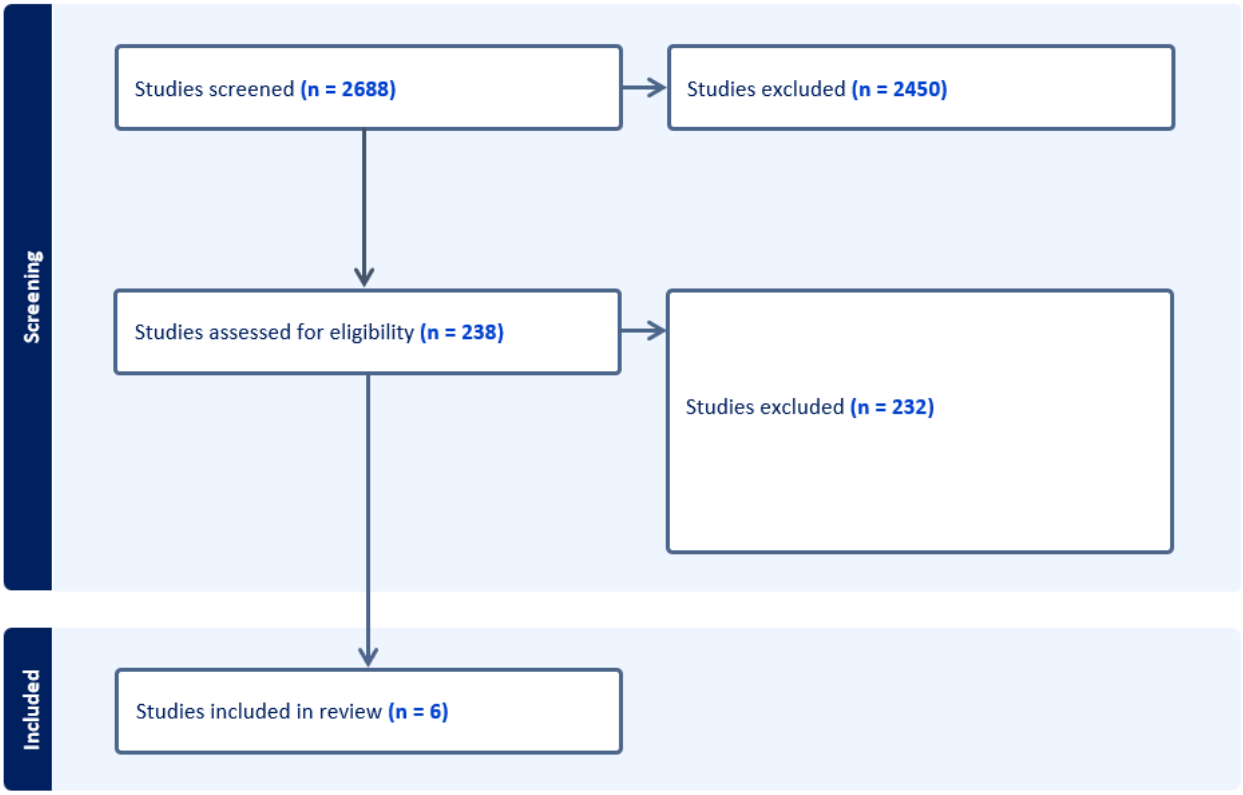
All members of the panel participated in the preparation of the draft guideline and approved the recommendations.

TABLES AND FIGURES

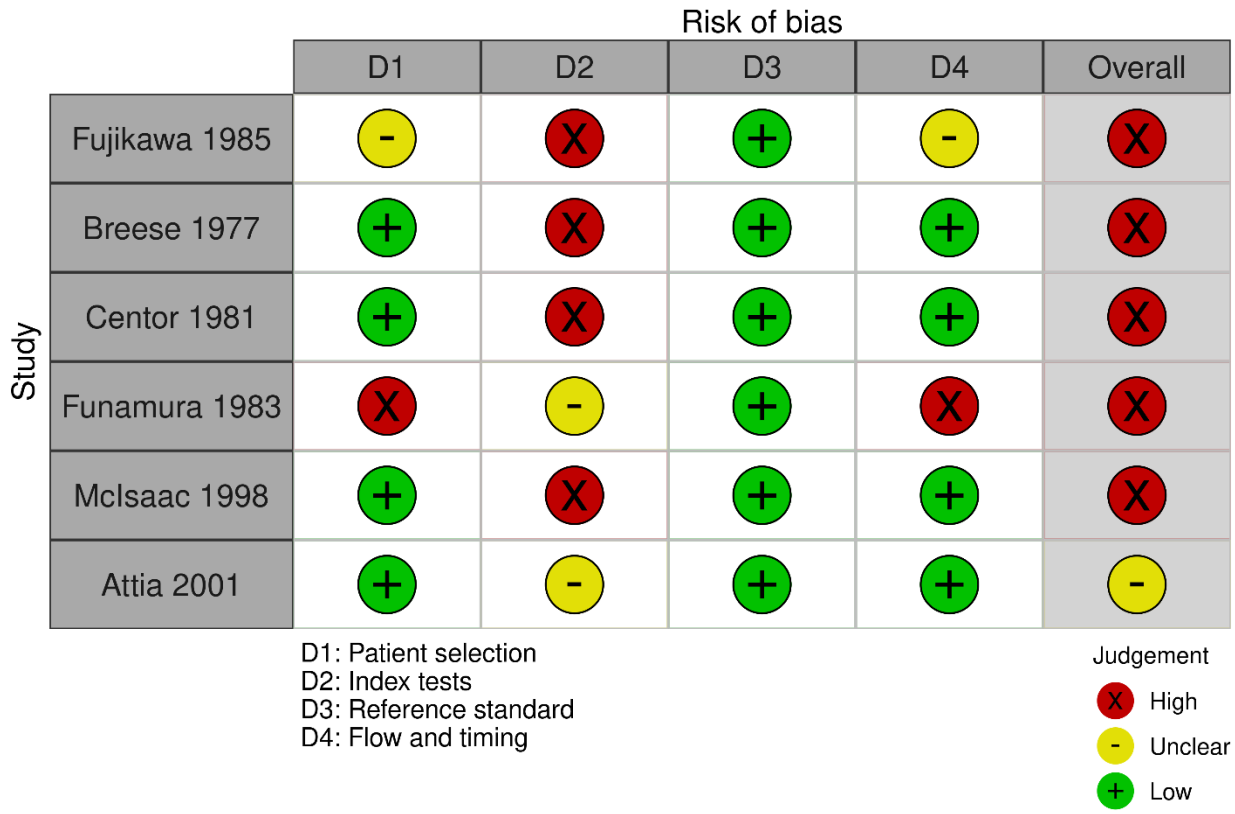
Supplementary Figure 1. Approach and implications to rating the quality of evidence and strength of recommendations using GRADE methodology (unrestricted use of figure granted by the U.S. GRADE Network)



Supplementary Figure 2: PRISMA Flow diagram



Supplementary Figure 3: Risk of Bias assessment of included studies



Supplementary Table 1. Characteristics of included studies

Author, year of publication	Location, years of data collection	Study design	Number of patients, diagnosis, and mean age (range) / Prevalence	Population included	Index test	Comparator	Reference standard	Scoring system
Breese 1977	*USA* *1973 and intermittently throughout 1974 and early 1975*	*Prospective cohort study*	*670 patients* *Mean age: not mentioned* *Prevalence: 54%*	*Not mentioned*	*Nine-factor scoring system*	*Physician's predictions*	*Throat cultures*	*9-factor scoring system* *1. Month in which patient is seen* *2. Age* *3. WBC count* *4. Fever* *5. Sore Throat* *6. Cough* *7. Headache* *8. Abnormal pharynx* *9. Abnormal cervical lymph nodes*
Funamura 1983	*USA* *April 1980 – April 1981*	*Retrospective review*	*892 patients* *Mean age: not mentioned*	*Patients under the age of 16 years who had a throat culture taken for suspected streptococcal pharyngitis*	*Nine-factor scoring system (Breese)*	*Clinical impression*	*Throat cultures*	*9-factor scoring system* *1. Month in which patient is seen* *2. Age* *3. WBC count* *4. Fever*

			Prevalence: *24% at PACC and 49% in PHC*					5. *Sore Throat* 6. *Cough* 7. *Headache* 8. *Abnormal pharynx* 9. *Abnormal cervical lymph nodes*
Fujikawa 1985	*Tokyo* *Jan 1982-Dec 1983*	*Prospective cohort study*	*271 patients* *Mean age: not mentioned* *Prevalence: 67%*	*Children with signs and symptoms of acute upper respiratory tract infection, including fever (over 37.5 C), sore throat and others, and were suspected of being infected by some bacteria*	*Tentative diagnosis at first visit*	*Diagnosis by new score system*	*Throat cultures*	*10 factors* 1. *Fever over 37.5 C* 2. *Sore Throat* 3. *Nausea or vomiting* 4. *Anorexia* 5. *Absence of cough and/or rhinorrhea* 6. *Pharynx; dark red or petechiae* 7. *Cervical lymph node* 8. *Tonsils; exudate (white spotty)* 9. *Rash (scarlet fever-like, erythema or urticaria)* 10. *Strawberry tongue or marked papillae*
McIsaac 1998	*Canada* *December 1995 – February 1997*	*Prospective cohort study*	*521 patients (94 were children)* *Mean age: not mentioned* *Prevalence: 13.8% in total population and 36.2% in children aged 3-14 years*	*Patients 3 years of age and above who presented with a new infection of the upper respiratory tract*	*Clinical score-based management*	*Usual physician care*	*Throat swabs*	- *Temperature > 38 C* - *No cough* - *Tender anterior cervical adenopathy* - *Tonsillar swelling or exudate* - *Age (3-14 yr, 15-44 yr or ≥45 yr)*
Attia 2001	*USA* *April, 1999 – March 2000*	*Prospective cohort study*	*545 patients* *(64 patients* *Mean ± SD: 6.8 ±3.8 years* *Prevalence: 37%*	*Children with signs and symptoms of acute pharyngitis*	*Predictive scoring model*	*Subjective assessment by clinicians, RADT*	*Throat cultures*	*0-5 scale* - *No Coryza* - *Tonsillar swelling* - *Cervical lymphadenopathy* - *Scarlatiniform rash*
Centor 1981	*USA* *Feb 15, 1980 – April 15, 1980*	*Prospective cohort study*	*286 adults* *Mean age: not mentioned* *Prevalence: 17%*	*Adults aged >15 years presenting with complaints of sore throat*	*Probability of positive culture with 3 models:* - *Individual signs and symptoms; and resident's guess* - *4 variables with positive throat culture* - *3 variables including resident's guess with positive throat culture*	*Throat culture*	*Probability of GAS*	*Centor score* *Predictive model included four variables:* - *tonsillar exudates (exudtons)* - *swollen tender anterior cervical nodes (swolacn)* - *lack of a cough - (cough)* - *fever history (fevhist)*

Supplementary Table 2: GRADE Evidence Profile: Comparing use of clinical scoring system vs. No clinical scoring system to determine who should be tested for GAS Pharyngitis in children

Clinical scoring system		No clinical scoring system	
Sensitivity	0.83 to 0.97	Sensitivity	0.71 to 0.87
Specificity	0.60 to 0.72	Specificity	0.60 to 0.92

Prevalences	25%		

Outcome	№ of studies (№ of patients)	Study design	Factors that may decrease certainty of evidence					Effect per 1,000 patients tested		Test accuracy CoE
								pre-test probability of25%		
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Clinical scoring system	No clinical scoring system	
True positives (patients with Group A Streptococcal Pharyngitis)	3 studies 1309 patients	cohort & case-control type studies	serious[a]	not serious	serious[b]	serious[c]	none	208 to 243	178 to 218	⨁◯◯◯ Very low
								30 more to 25 more TP in Clinical scoring system		
False negatives (patients incorrectly classified as not having Group A Streptococcal Pharyngitis)								7 to 42	32 to 72	
								30 fewer to 25 fewer FN in Clinical scoring system		
True negatives (patients without Group A Streptococcal Pharyngitis)	3 studies 1309 patients	cohort & case-control type studies	serious[a]	not serious	serious[b]	serious[c]	none	450 to 540	450 to 690	⨁◯◯◯ Very low
								0 fewer to 150 fewer TN in Clinical scoring system		
False positives (patients incorrectly classified as having Group A								210 to 300	60 to 300	
								0 fewer to 150 more FP in		

Streptococcal Pharyngitis)								**Clinical scoring system**	

Explanations

a. High risk of bias in 2 out of 3 studies due to score being derived in the same population

b. Different scoring tools used

c. Wide range of CI

Supplementary Table 3: GRADE Evidence Profile: Comparing use of clinical scoring system vs. No clinical scoring system to determine who should be tested for GAS Pharyngitis in adults

Clinical scoring system		No clinical scoring system	
Sensitivity	0.70 (95% CI: 0.51 to 0.84)	Sensitivity	0.68 (95% CI: 0.51 to 0.82)
Specificity	0.98 (95% CI: 0.97 to 0.99)	Specificity	0.97 (95% CI: 0.95 to 0.99)

Prevalences	11 %		

Outcome	№ of studies (№ of patients)	Study design	Factors that may decrease certainty of evidence					Effect per 1,000 patients tested		Test accuracy CoE
								pre-test probability of11%		
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Clinical scoring system	No clinical scoring system	
True positives (patients with Group A Streptococcal Pharyngitis)	1 studies 423 patients	cohort & case-control type studies	serious[a]	not serious	not serious	serious[b]	none	77 (56 to 92)	75 (56 to 90)	⨁⨁◯◯ Low
								2 more TP in Clinical scoring system		
False negatives (patients incorrectly classified as not having Group A Streptococcal Pharyngitis)								33 (18 to 54)	35 (20 to 54)	
								2 fewer FN in Clinical scoring system		

True negatives (patients without Group A Streptococcal Pharyngitis)	1 studies 423 patients	cohort & case-control type studies	serious[a]	not serious	not serious	serious[b]	none	872 (863 to 881)	863 (845 to 881)	⊕⊕◯◯ Low
								9 more TN in Clinical scoring system		
False positives (patients incorrectly classified as having Group A Streptococcal Pharyngitis)								18 (9 to 27)	27 (9 to 45)	
								9 fewer FP in Clinical scoring system		

Explanations

a. score derived in same population

b. wide CI

Supplementary Table 4: GRADE Evidence Profile: Comparing use of clinical scoring system vs. No clinical scoring system to determine who should be tested for GAS Pharyngitis in combined population of children and adults

Clinical scoring system		No clinical scoring system	
Sensitivity	0.83 (95% CI: 0.72 to 0.91)	Sensitivity	0.69 (95% CI: 0.57 to 0.80)
Specificity	0.94 (95% CI: 0.92 to 0.96)	Specificity	0.97 (95% CI: 0.95 to 0.98)

Outcome	№ of studies (№ of patients)	Study design	Factors that may decrease certainty of evidence					Effect per 1,000 patients tested		Test accuracy CoE
								pre-test probability of 25%		
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	clinical scoring system	no clinical scoring system	

Prevalences	25%		

True positives (patients with GAS)	1 studies 503 patients	cohort & case-control type studies	serious[a]	not serious	not serious	serious[b]	none	208 (180 to 228)	173 (143 to 200)	⊕⊕◯◯ Low[a,b]
								35 more TP in clinical scoring system		
False negatives (patients incorrectly classified as not having GAS)								42 (22 to 70)	77 (50 to 107)	
								35 fewer FN in clinical scoring system		
True negatives (patients without GAS)	1 studies 503 patients	cohort & case-control type studies	serious[a]	not serious	not serious	serious[b]	none	705 (690 to 720)	728 (712 to 735)	⊕⊕◯◯ Low[a,b]
								23 fewer TN in clinical scoring system		
False positives (patients incorrectly classified as having GAS)								45 (30 to 60)	22 (15 to 38)	
								23 more FP in clinical scoring system		

Explanations

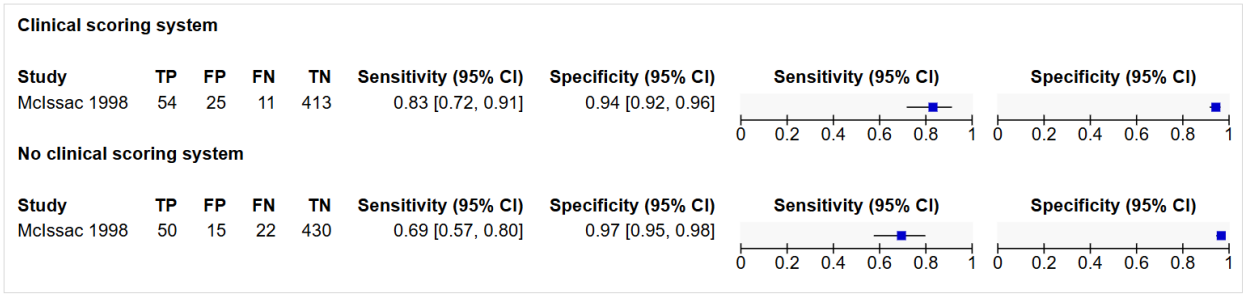
a. score derived in same population

b. wide CI

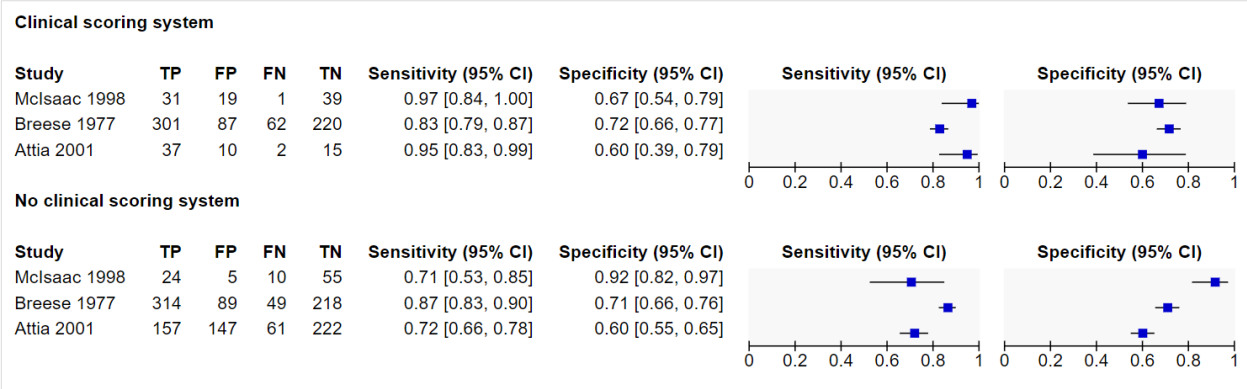
Supplementary Figure 4: Forest plots for use of clinical scoring system to determine who should be tested for GAS Pharyngitis

Outcome: Sensitivity and specificity

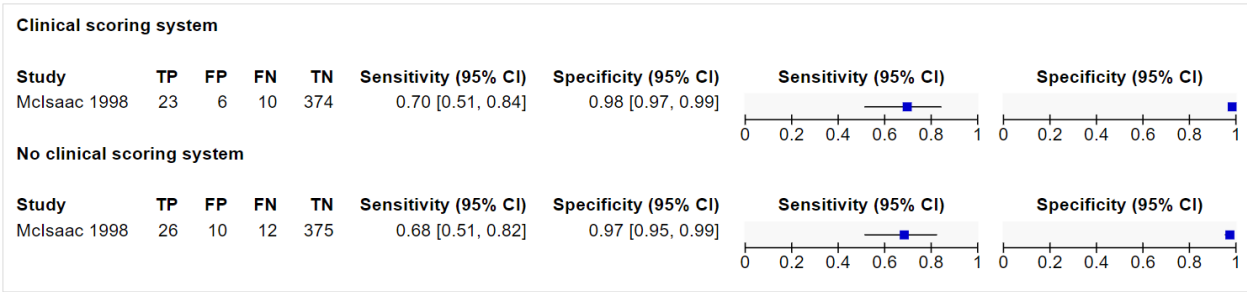
1.1 Overall population



1.2 Children



1.3 Adults



References

IOM (Institute of Medicine). Clinical Practice Guidelines We Can Trust. Washington, DC: The National Academies Press, **2011**.

Infectious Diseases Society of America. IDSA Handbook on Clinical Practice Guideline Development. Available at: https://www.idsociety.org/practice-guideline/clinical-practice-guidelines-development-training-and-resources/. Accessed May 1, 2021.

Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org.

Review Manager (RevMan). Version 8.10.0. The Cochrane Collaboration, 2024. Available at revman.cochrane.org

Yang B, Mallett S, Takwoingi Y, et al. QUADAS-C: A Tool for Assessing Risk of Bias in Comparative Diagnostic Accuracy Studies. Ann Intern Med. 2021;174(11):1592-1599. doi:10.7326/M21-2234.

McGuinness, L.A. and J.P. Higgins, *Risk-of-bias VISualization (robvis): an R package and Shiny web app for visualizing risk-of-bias assessments.* Research synthesis methods, 2021. **12**(1): p. 55-61.

GRADEpro GDT: GRADEpro Guideline Development Tool [Software]. McMaster University and Evidence Prime, 2024. Available at: https://gradepro.org/. Accessed 24 March 2025.

Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ 2008; 336(7650): 924-926.

Schünemann H, Brożek J, Guyatt GH, Oxman A. Introduction to GRADE Handbook. Available at: GRADE handbook https://gdt.gradepro.org/app/handbook/handbook.html. Accessed 2 December 2024.