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Original article

Added value of point-of-care testing for Group A *Streptococcus* in community pharmacy sore throat pathways: analysis of the Wales Sore Throat Test and Treat service

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ABSTRACT

Objective: To evaluate the diagnostic performance of FeverPAIN against point-of-care test (POCT) results for Group A *Streptococcus* (GAS) among children and adults presenting with sore throat in community pharmacies.

Methods: Cross-sectional analysis of patients aged 6 years and over with sore throat presenting to community pharmacies across Wales delivering the Sore Throat Test and Treat service from November 2018 to September 2024. Patients scoring FeverPAIN ≥2 or Centor ≥3 who underwent POCT were eligible for analysis. We described GAS positivity by age group and assessed the diagnostic performance of FeverPAIN at the National Institute for Health and Care Excellence (NICE) antibiotic threshold (≥4), reporting sensitivity, specificity, positive predictive value, negative predictive value, and area under receiver operating characteristic curve (AUROC) with 95% CIs. We estimated potential missed treatment and unnecessary antibiotic use if antibiotics were supplied based on FeverPAIN alone.

Results: Among 73 617 eligible patients, 37.0% (n = 27 220) tested positive for GAS by POCT. Positivity was highest among children aged 6 to 10 years (47.0%: 5339/11 371). FeverPAIN was used in 92.5% (n = 68 099) of assessments. At the NICE-recommended threshold for antibiotic treatment (FeverPAIN ≥4), sensitivity was 55.0% (95% CI: 54.4–55.6%) and specificity 77.0% (95% CI: 76.6–77.4%). Positive predictive value was 57.6% (95% CI: 57.0–58.2%) and negative predictive value 75.1% (95% CI: 74.7–75.5%). Overall AUROC was 0.70 (95% CI: 0.70–0.71), with the lowest AUROC of 0.69 (95% CI: 0.68–0.70) observed among children aged 6 to 10 years. Using FeverPAIN alone would miss 44% of patients testing positive for GAS and result in unnecessary antibiotics for 23% of patients testing negative.

Conclusions: FeverPAIN demonstrated limited diagnostic performance for identifying GAS when used alone, with greater discordance among children. Incorporating POCTs within community pharmacy sore

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throat pathways may support more targeted antibiotic prescribing. These findings support reconsideration of the role of POCT within community pharmacy sore throat pathways. **Quisha Bustamante, Clin Microbiol Infect 2026;▪:1**

Introduction

Acute sore throat is a common reason for primary care consultations in the UK, accounting for an estimated 80 consultations per 1000 patients annually [1,2]. Although most sore throat presentations are self-limiting and viral in origin, antibiotics are prescribed in approximately 60% of consultations, contributing to unnecessary antimicrobial use [3]. Group A *Streptococcus* (GAS) is the principal bacterial cause of sore throat, but clinical features overlap with viral infections, making accurate diagnosis challenging. GAS is responsible for a wide range of clinical syndromes, including scarlet fever and invasive infections such as necrotizing fasciitis and bacteraemia [4]. Genomic studies demonstrate substantial overlap between GAS isolates causing sore throat, scarlet fever and invasive disease, suggesting shared circulating lineages across these clinical syndromes [5,6].

In England, the National Institute for Health and Care Excellence (NICE) recommends the clinical prediction rules FeverPAIN and Centor to estimate the likelihood of GAS infection and guide antibiotic prescribing for sore throat [7]. FeverPAIN was developed in 2013 in a UK primary care population and is used predominantly in the UK. The score allocates one point each to fever, tonsillar purulence, symptom duration under 3 days, severely inflamed tonsils and absence of cough (maximum score of five) [8]. Centor, developed in 1981 in a U.S. emergency department setting, scores tonsillar exudate, lymphadenopathy, fever and absence of cough (maximum score four). The McIsaac modification subsequently incorporated age as an additional criterion [9]. NICE recommends immediate or delayed antibiotics for patients scoring FeverPAIN $\geq$4 or Centor $\geq$3. However, a UK study found that fewer than 25% of patients meeting these thresholds had microbiologically confirmed streptococcal infection, whereas some lower-scoring patients also tested positive, raising concerns regarding both undertreatment and overprescribing [10].

In 2018, Wales introduced the Sore Throat Test and Treat (STTT) service, in which community pharmacists use FeverPAIN and Centor criteria to determine eligibility for point-of-care testing (POCT) for GAS within the sore throat pathway [11]. Northern Ireland has adopted a similar approach within its Pharmacy First service [12]. In contrast, England's Pharmacy First service, launched in 2024, does not include POCTs in its sore throat pathway. This reflects conclusions from a 2019 NICE review which found that rapid tests for GAS in primary care were unlikely to provide additional benefit or cost-effectiveness over clinical scoring alone [13]. The economic modelling incorporated only common suppurative complications and did not consider invasive GAS disease or broader public health effects, such as transmission and antimicrobial resistance.

The NICE review also highlighted a lack of diagnostic accuracy studies in pharmacy settings. Since then, studies have begun to address this evidence gap through evaluation of POCT use within community pharmacy settings. A 2024 evaluation of the Wales STTT service demonstrated lower antibiotic supply rates compared with general practitioner (GP) consultations for sore throat (21% vs. 39%, respectively) [14]. In addition, a recent report of England's Pharmacy First service reported that sore throat accounted for the largest number of consultations across the scheme in 2024/2025, with antimicrobial supply occurring in 65% of cases [15]. This is substantially higher than recent antibiotic supply rates reported in the Wales STTT service (29.9%) and Northern Ireland's Pharmacy First service (25%) [12,16]. Given these differences in practice and the expanding role of community pharmacy sore throat pathways, this study evaluates the diagnostic performance of FeverPAIN compared with POCT results for GAS among children and adults presenting with sore throat to the Wales STTT service.

Methods

Study design

Cross-sectional study of consultations for the Wales STTT service.

Participants and service overview

Patients aged $\geq$6 years presenting with sore throat to community pharmacies across Wales between November 2018 and September 2024 were included. During this period, the service expanded to 577 community pharmacies.

Patients underwent assessment using FeverPAIN or Centor criteria. Patients scoring FeverPAIN $\geq$2 or Centor $\geq$3 were eligible for pharmacist-administered POCT. Patients with features of severe illness were referred to their GP or emergency care.

Pharmacists delivering the service completed a bespoke training programme provided by Health Education and Improvement Wales, with ongoing competence maintained through mandatory re-accreditation. Patients with positive POCT results were supplied antibiotics within the pharmacy pathway, with phenoxymethylpenicillin used as first-line therapy.

The OSOM® Strep A Test (Sekisui Diagnostics) was used, with reported sensitivity ranging from 85% to 98% and specificity from 90% to 99% compared with throat culture across different settings and populations [13,17]. The protocol and data collection methods have been described previously [11].

Data sources

Consultation data were collected electronically on the Choose Pharmacy IT application. Demographic data (age, sex and postcode) were obtained through linkage with the Welsh Demographic Service. Relative deprivation scores were calculated by linking patient postcodes to the Welsh Index of Multiple Deprivation database [18].

Exclusion criteria

Primary analyses excluded patients not assessed with FeverPAIN or Centor criteria, those ineligible for POCT (FeverPAIN <2 or Centor <3) and eligible patients who did not undergo testing.

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Primary outcomes

Key outcomes were GAS positivity by POCT and the diagnostic performance of FeverPAIN relative to POCT results, assessed using sensitivity, specificity, positive predictive value, negative predictive value and area under receiver operating characteristic curve.

Primary analysis

Analyses were performed using STATA 18.0. Patient characteristics, consultation attendance and GAS positivity were summarized overall and by age group (6–10, 11–15, 16–40 and ≥41 years) among eligible patients who underwent POCT.

Diagnostic performance analyses were conducted among patients assessed using FeverPAIN. FeverPAIN scores at the NICE antibiotic threshold (≥4) were compared with POCT results, with 95% CIs. Centor could not be formally evaluated at its NICE threshold (≥3) because the same threshold was used operationally to determine POCT eligibility, leaving no comparator group below the threshold. GAS positivity across FeverPAIN scores was described overall and by age group.

Sensitivity analysis

Sensitivity analyses compared ineligible patients who underwent POCT with ineligible patients who were not tested. POCT results were imputed for eligible untested patients and diagnostic performance re-estimated under two scenarios: (a) assuming the same GAS positivity as tested patients and (b) assuming all were POCT negative. Additional sensitivity analyses included all patients who underwent POCT irrespective of eligibility criteria.

Ethics

Data were collected as part of routine clinical care and fully anonymized. Data processing was undertaken under a Data Protection Impact Assessment with Digital Health and Care Wales. Ethical approval was granted by the Cardiff School of Pharmacy and Pharmaceutical Sciences Research Ethics Committee (reference number: 2324-17).

Results

Population and service usage

A total of 109 812 STTT consultations for acute sore throat were recorded between November 2018 and September 2024. After excluding patients without FeverPAIN or Centor assessment (7.2%: $n = 7903$), those ineligible for POCT (21.2%: $n = 21\,579$) and eligible but untested patients (8.4%: $n = 6713$), 73 617 consultations were included in the analysis (Fig. 1).

Mean monthly consultations increased from 442 in 2019 to 644 in 2020, fell sharply in 2021, and then increased again in 2022 (mean 984 per month), peaking at 6054 consultations in December 2022 during the national GAS surge (Fig. 2(a)) [19]. Attendance remained high thereafter as service provision expanded, with monthly means of 2067 consultations in 2023 and 3064 in 2024.

Children under 16 years comprised 28.3% ($n = 20\,804$) of consultations and 66.7% ($n = 49\,137$) of patients were female. Attendance was higher among patients from more deprived areas, with 21.3% of consultations from the most deprived quintile compared with 15.5% from the least deprived quintile (Table 1). Self-referral was common (66.3%: $n = 48\,785$). Younger children presented earlier, with 64.5% ($n = 7333/11\,371$) of 6–10-year-olds attending within 2 days of symptom onset compared with 44.1% ($n = 5854/13\,268$) of patients aged ≥41 years. Most patients reported they would otherwise have consulted a GP (92.4%: $n = 67\,997$), whereas onward referral to a GP was infrequent (4.0%: $n = 2949$). FeverPAIN was used in 92.5% ($n = 68\,099$) of assessments.

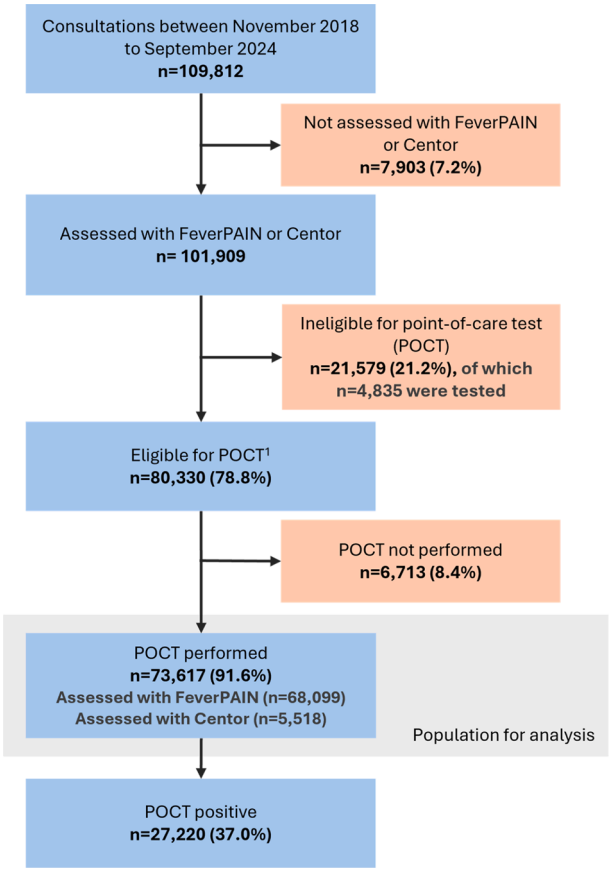

Fig. 1. Overview of the Wales Sore Throat Test and Treat (STTT) service, November 2018 to September 2024. [1]Patients were eligible for POCT if they scored FeverPAIN ≥2 or Centor ≥3. POCT, point-of-care test.

GAS positivity

Among 73 617 eligible patients who underwent POCT, GAS positivity was 37.0% ($n = 27\,220$) (Fig. 2(b)). Positivity was highest among children aged 6–10 years (47.0%: $n = 5339/11\,371$) and lowest among patients aged ≥41 years (29.5%: $n = 3918/13\,268$). Antibiotics were supplied to 35.6% of patients ($n = 26\,209/73\,617$), with the highest supply rates observed in children aged 6–10 years (45.2%: $n = 5137/11\,371$).

During the 2022/2023 GAS surge, positivity decreased from 42.7% ($n = 574/1344$) in November 2022 to 26.1% ($n = 1580/6054$, $p < 0.001$) in December 2022, before rising again in early 2023.

Diagnostic performance of FeverPAIN

A total of 68 099 (92.5%) patients were assessed using FeverPAIN and included in the diagnostic performance analysis; 36.2% ($n = 24\,662$) were POCT positive. Using POCT as the reference standard and the NICE antibiotic threshold FeverPAIN ≥4, sensitivity of FeverPAIN was 55.0% (95% CI: 54.4–55.6%) and specificity 77.0% (95% CI: 76.6–77.4%) (Table 2). The positive predictive value

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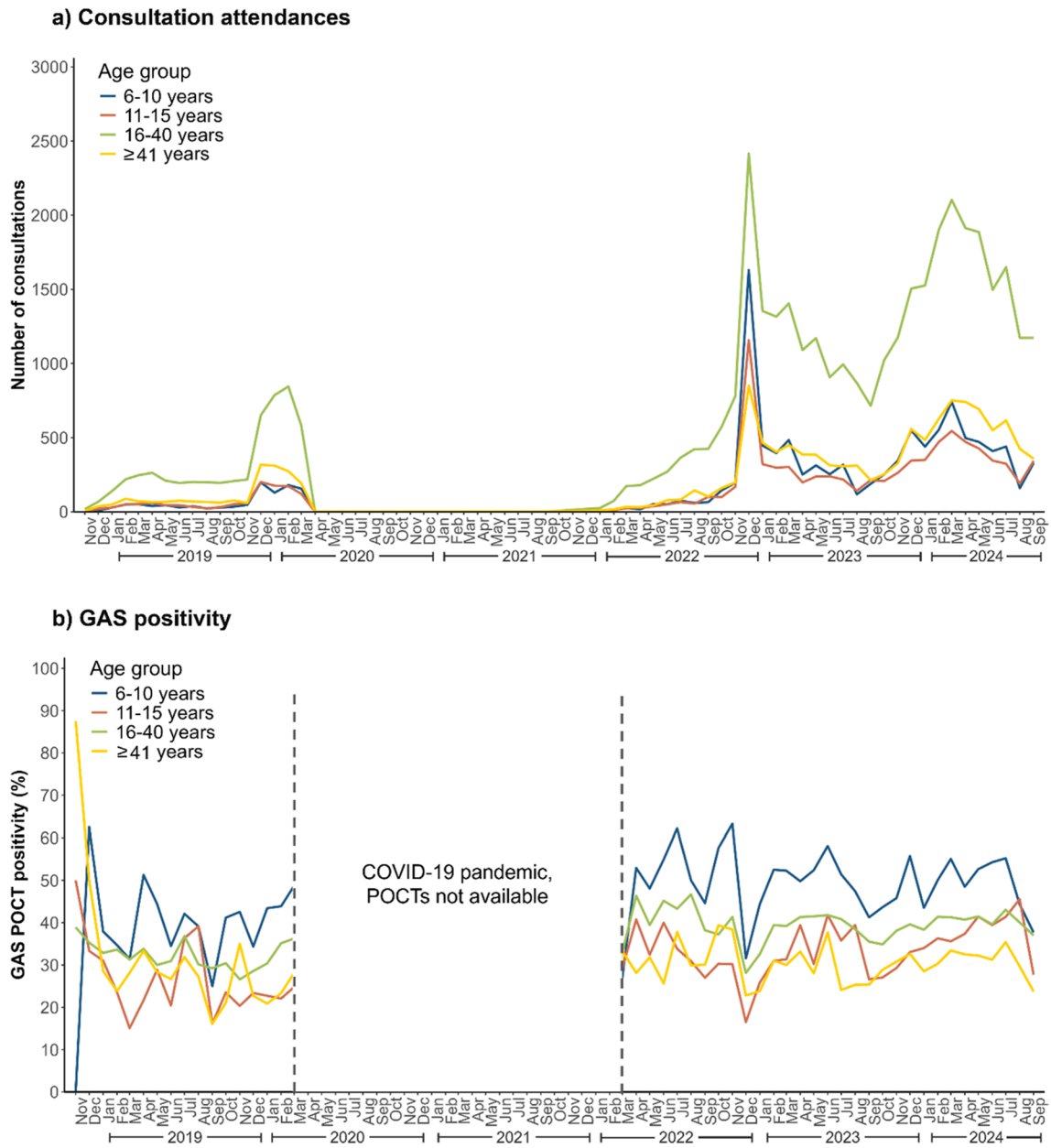

Fig. 2. (a) Monthly STTT consultation attendances and (b) GAS positivity, November 2018 to September 2024. GAS positivity from November to December 2018 should be interpreted with caution because of the small number of POCTs provided during the beginning of the STTT service. POCTs were unavailable from March 2020 to January 2022 because of suspension of the service during the COVID-19 pandemic. The service was gradually reintroduced from January 2022, with measurable POCT provision resuming from March 2022. GAS, Group A *Streptococcus*; POCT, point-of-care test; STTT, Sore Throat Test and Treat.

was 57.6% (95% CI: 57.0–58.2%) and negative predictive value was 75.1% (95% CI: 74.7–75.5%). Among patients scoring FeverPAIN ≥4, 57.6% were POCT positive and 42.4% were POCT negative; among those scoring below this threshold, 75.1% were POCT negative and 24.9% were POCT positive. The summary area under receiver operating characteristic curve was 0.70 (95% CI: 0.70–0.71), with the lowest observed among children aged 6–10 years (0.69, 95% CI: 0.68–0.70) (Fig. 3).

Association between FeverPAIN score and GAS positivity

GAS positivity increased with FeverPAIN score, from 16.8% at score 2 to 70.7% at score 5 (Fig. 4). Positivity was consistently highest in children aged 6–10 years.

Clinical implications of using FeverPAIN alone

On the basis of an observed GAS positivity of 36.2%, approximately 36 of every 100 patients presenting to the pharmacy service would be expected to test positive for GAS by POCT, whereas 64 would test negative. If antibiotic supply were based solely on NICE guidance (FeverPAIN ≥4), an estimated 16 of the 36 patients testing positive for GAS (44%) would not receive antibiotics, whereas approximately 15 of the 64 patients testing negative (23%) would receive antibiotics despite no evidence of GAS infection (Fig. 5). By age group, missed antibiotic treatment was greatest among children aged 6–10 years, where 21 of 46 patients testing positive for GAS (46%) would not receive antibiotics (Fig. S1). Potential overtreatment was highest among patients aged

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Table 1
Characteristics of patients presenting to the Wales Sore Throat Test and Treat (STTT) service, November 2018 to September 2024.

	All ages (n = 73 617)	6–10 y (n = 11 371)	11–15 y (n = 9433)	16–40 y (n = 39 545)	≥41 y (n = 13 268)
Sex					
Female	49 137 (66.7)	6481 (57.0)	5440 (57.7)	27 803 (70.3)	9413 (70.9)
Male	24 478 (33.3)	4889 (43.0)	3993 (42.3)	11 741 (29.7)	3855 (29.1)
Welsh Index of Multiple Deprivation (IMD)					
1 (most deprived)	15 659 (21.3)	2800 (24.6)	2232 (23.7)	8265 (20.9)	2362 (17.8)
2	16 797 (22.8)	2748 (24.2)	2237 (23.7)	8980 (22.7)	2832 (21.3)
3	14 626 (19.9)	2184 (19.2)	1825 (19.3)	7889 (19.9)	2728 (20.6)
4	13 087 (17.8)	1918 (16.9)	1695 (18.0)	6946 (17.6)	2528 (19.1)
5 (least deprived)	11 383 (15.5)	1557 (13.7)	1296 (13.7)	6026 (15.2)	2504 (18.9)
Missing	2065 (2.8)	164 (1.4)	148 (1.6)	1439 (3.6)	314 (2.4)
Referral source					
Self-referral	48 785 (66.3)	7967 (70.1)	6376 (67.6)	25 452 (64.4)	8990 (67.8)
GP	21 665 (29.4)	2993 (26.3)	2735 (29.0)	12 200 (30.9)	3737 (28.2)
Other[a]	3167 (4.3)	411 (3.6)	322 (3.4)	1893 (4.8)	541 (4.1)
Symptom duration					
Less than 1 d	7127 (9.7)	1637 (14.4)	1025 (10.9)	3497 (8.8)	968 (7.3)
1–2 d	31 586 (42.9)	5695 (50.1)	4375 (46.4)	16 630 (42.1)	4886 (36.8)
3–4 d	24 493 (33.3)	3157 (27.8)	3039 (32.2)	13 584 (34.4)	4713 (35.5)
5–6 d	4078 (5.5)	358 (3.1)	422 (4.5)	2370 (6.0)	928 (7.0)
7 d or more	6333 (8.6)	524 (4.6)	572 (6.1)	3464 (8.8)	1773 (13.4)
Alternative patient action if service was not available					
Contact GP	67 997 (92.4)	10 519 (92.5)	8779 (93.1)	36 473 (92.2)	12 226 (92.1)
Contact other services[a]	3615 (4.9)	636 (5.6)	433 (4.6)	1986 (5.0)	560 (4.2)
Buy medication from pharmacy	1132 (1.5)	111 (1.0)	137 (1.5)	592 (1.5)	292 (2.2)
Do nothing	866 (1.2)	104 (0.9)	83 (0.9)	493 (1.2)	186 (1.4)
Missing	7	<5	<5	<5	<5
Referrals to other services					
No referral made	69 452 (94.3)	10 766 (94.7)	9008 (95.5)	37 206 (94.1)	12 472 (94.0)
GP	2949 (4.0)	435 (3.8)	327 (3.5)	1616 (4.1)	571 (4.3)
Other services[b]	1216 (1.7)	170 (1.5)	98 (1.0)	723 (1.8)	225 (1.7)
Clinical prediction scores					
FeverPAIN used	68 099 (92.5)	10 481 (92.2)	8814 (93.4)	36 613 (92.6)	12 191 (91.9)
2	20 620 (30.3)	2770 (26.4)	2828 (32.1)	10 084 (27.5)	4938 (40.5)
3	23 925 (35.1)	3745 (35.7)	3,108 (35.3)	12 697 (34.7)	4375 (35.9)
4	16 959 (24.9)	2846 (27.2)	2106 (23.9)	9790 (26.7)	2217 (18.2)
5	6595 (9.7)	1120 (10.7)	772 (8.8)	4042 (11.0)	661 (5.4)
Centor used	5518 (7.5)	890 (7.8)	619 (6.6)	2932 (7.4)	1077 (8.1)
3	4260 (77.2)	610 (68.5)	485 (78.4)	2297 (78.3)	868 (80.6)
4	1258 (22.8)	280 (31.5)	134 (21.6)	635 (21.7)	209 (19.4)
POCT result					
Negative result	46 397 (63.0)	6032 (53.0)	6514 (69.1)	24 501 (62.0)	9350 (70.5)
Positive result	27 220 (37.0)	5339 (47.0)	2919 (30.9)	15 044 (38.0)	3918 (29.5)
Antibiotics supplied	26 209 (35.6)	5137 (45.2)	2824 (29.9)	14 495 (36.7)	3753 (28.3)

Values are n (%) unless stated otherwise.
Sex excludes patients reported as intersex (n < 5).
GP, general practitioner; POCT, point-of-care test.
[a] Includes NHS Direct/NHS 111, accident and emergency department, GP out of hours, optometrist, other healthcare professionals.
[b] Includes accident and emergency department, GP out of hours, dentist, optometrist, other healthcare professionals.

16–40 years, where 16 of 63 patients testing negative (25%) would receive antibiotics.

Sensitivity analysis

A total of 4835 patients ineligible for POCT underwent testing; reasons for testing were unavailable. Among these, 12.3% (n = 593) were positive for GAS (Table S1).

Imputing POCT results for 6462 eligible untested patients assessed with FeverPAIN increased the analytic sample from 68 099 to 74 561, with no material change in diagnostic performance (Tables S2a and S2b). Analyses including all patients who underwent POCT, irrespective of eligibility criteria (n = 4835), produced comparable results (Table S3).

Discussion

Analysis of data from the Wales STTT service demonstrates that clinical prediction rules alone cannot reliably distinguish GAS infection within community pharmacy sore throat pathways. Among patients meeting the NICE threshold for antibiotic treatment (FeverPAIN ≥4), 42% tested negative by POCT, whereas 25% of patients below the threshold tested positive for GAS, indicating potential overtreatment and missed treatment if FeverPAIN were used in isolation.

POCT positivity increased with higher FeverPAIN scores, broadly aligning with NICE estimates derived from throat culture-based studies, in which scores of 4–5 are associated with a 62% to 65% probability of streptococcal isolation and scores of 0–1 with probabilities below 20% [5]. In this cohort, positivity increased from 16.8% at a score of 2 to 70.7% at a score of 5. However, overlap between adjacent scores was greater than suggested by guideline estimates, indicating that although FeverPAIN may be calibrated at a population level, it lacks precision for individual treatment decisions without confirmatory testing. These findings support the role of POCT as an adjunct to structured clinical assessment within sore throat pathways.

Younger children demonstrated the highest GAS positivity across all FeverPAIN scores and the greatest discordance between clinical scores and POCT results, whereas adults were more likely

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Table 2
Diagnostic performance of FeverPAIN score thresholds compared with POCT results (n = 68 099).

FeverPAIN threshold	Above/Below	POCT positivity (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	AUROC (95% CI)
All ages							
≥3	47 479/20 620	36.2 (35.9–36.6)	86.0 (85.5–86.4)	39.5 (39.0–40.0)	44.7 (44.2–45.1)	83.2 (82.7–83.7)	0.63 (0.62–0.63)
≥4	23 554/44 545		55.0 (54.4–55.6)	77.0 (76.6–77.4)	57.6 (57.0–58.2)	75.1 (74.7–75.5)	0.66 (0.66–0.66)
5	6595/61 504		18.9 (18.4–19.4)	95.6 (95.4–95.7)	70.7 (69.6–71.8)	67.5 (67.1–67.9)	0.57 (0.57–0.57)
6–10 y							
≥3	7711/2770	45.8 (44.8–46.7)	85.5 (84.5–86.5)	36.5 (35.2–37.8)	53.2 (52.1–54.3)	74.9 (73.2–76.5)	0.61 (0.60–0.62)
≥4	3966/6515		54.2 (52.8–55.6)	76.0 (74.9–77.1)	65.6 (64.1–67.1)	66.3 (65.1–67.4)	0.65 (0.64–0.66)
5	1120/9361		18.3 (17.2–19.4)	95.7 (95.1–96.2)	78.2 (75.7–80.6)	58.1 (57.1–59.1)	0.57 (0.56–0.58)
11–15 y							
≥3	5986/2828	30.3 (29.4–31.3)	87.0 (85.6–88.2)	40.4 (39.1–41.6)	38.8 (37.6–40.1)	87.7 (86.4–88.9)	0.64 (0.63–0.65)
≥4	2878/5936		56.9 (55.0–58.8)	77.9 (76.8–78.9)	52.8 (51.0–54.7)	80.6 (79.6–81.6)	0.67 (0.66–0.68)
5	772/8042		20.3 (18.8–21.9)	96.3 (95.7–96.7)	70.2 (66.8–73.4)	73.5 (72.5–74.5)	0.58 (0.57–0.59)
16–40 y							
≥3	26 529/10 084	37.4 (36.9–37.9)	87.3 (86.8–87.9)	36.4 (35.8–37.0)	45.0 (44.4–45.6)	82.8 (82.1–83.5)	0.62 (0.61–0.62)
≥4	13 832/22 781		57.3 (56.5–58.1)	73.9 (73.3–74.4)	56.7 (55.9–57.5)	74.4 (73.8–74.9)	0.66 (0.65–0.66)
5	4042/32 571		20.2 (19.6–20.9)	94.5 (94.1–94.7)	68.5 (67.1–70.0)	66.5 (66.0–67.0)	0.57 (0.57–0.58)
≥41 y							
≥3	7253/4938	28.8 (28.0–29.6)	80.6 (79.3–81.9)	49.0 (48.0–50.1)	39.0 (37.9–40.1)	86.2 (85.2–87.2)	0.65 (0.64–0.66)
≥4	2878/9313		45.7 (44.0–47.3)	85.3 (84.5–86.0)	55.7 (53.8–57.5)	79.5 (78.7–80.3)	0.65 (0.65–0.66)
5	661/11 530		13.6 (12.4–14.7)	97.9 (97.5–98.2)	72.0 (68.4–75.4)	73.7 (72.9–74.5)	0.56 (0.55–0.56)

Above/Below = consultations above FeverPAIN threshold/consultations below FeverPAIN threshold.
AUROC, area under receiver operating characteristic curve; NPV, negative predictive value; POCT, point-of-care test; PPV, positive predictive value.

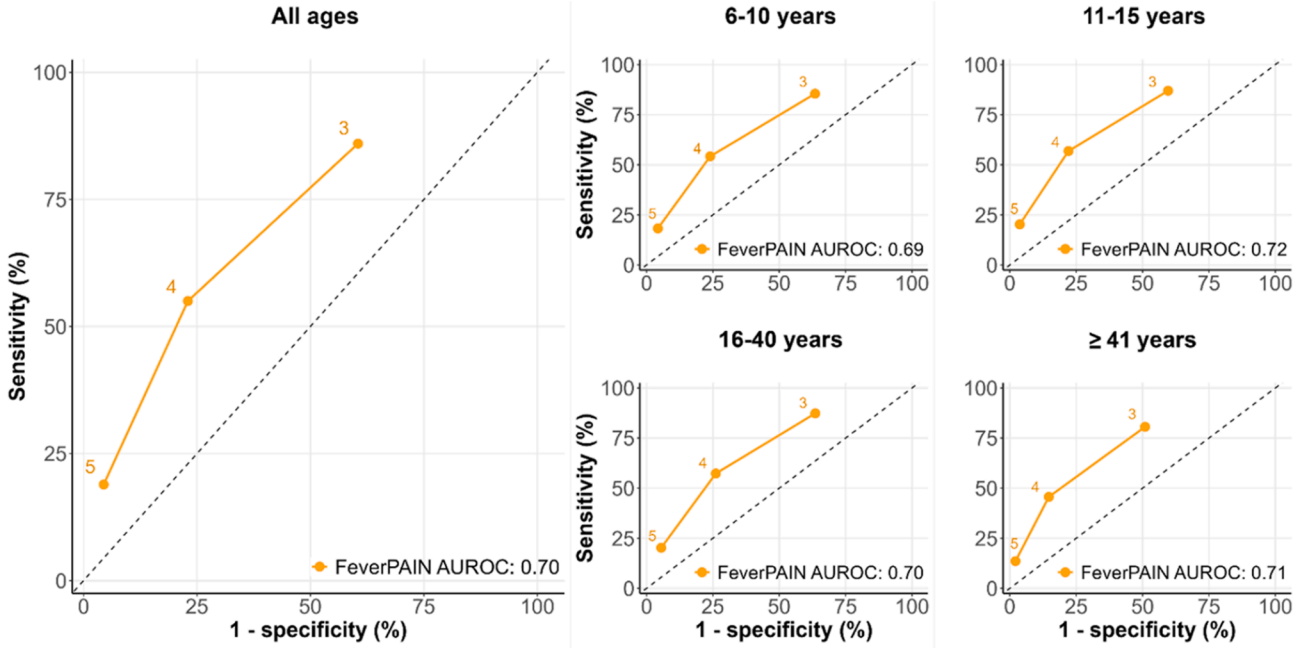

Fig. 3. Receiver operating characteristic curves for FeverPAIN thresholds by age group. AUROC, area under receiver operating characteristic curve.

to test negative despite meeting antibiotic treatment thresholds. These findings highlight limitations in applying GP-derived prediction rules within high-throughput community pharmacies, where protocol-driven assessments may provide less opportunity for clinical judgement. In this context, incorporating POCTs within pharmacy pathways may support more targeted antibiotic use across age groups.

Accurate identification of GAS may also have broader public health relevance. Previous studies suggest that strains causing sore throat, scarlet fever and invasive disease share common lineages, highlighting the potential importance of identifying and appropriately managing GAS infection within the community [5,6].

Despite known seasonal variation and increased national GAS activity during winter 2022/2023, GAS positivity within the STTT POCT cohort remained relatively stable over time. This likely reflects the higher baseline prevalence of GAS infection among patients selected for POCT. The marked increase in consultations during December 2022, accompanied by a decrease in proportional GAS positivity, may reflect increased healthcare-seeking

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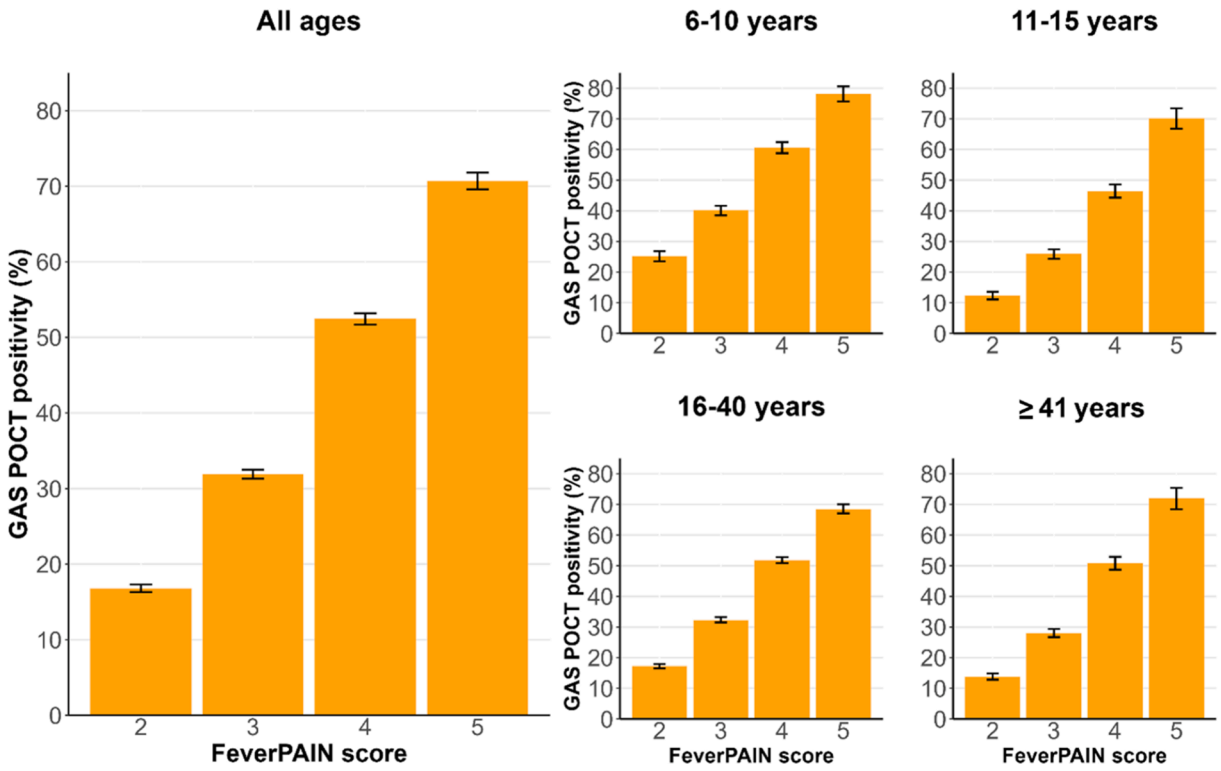

Fig. 4. GAS positivity rate and 95% CIs for FeverPAIN scores by age group. GAS, Group A *Streptococcus*.

behaviour during periods of heightened public awareness. These findings suggest potential operational value of POCT-integrated community pharmacy services during periods of increased healthcare demand.

Previous evaluations of the STTT service have highlighted limitations of relying solely on clinical prediction rules. Matuluko *et al.* [16] reported that over one-third of patients meeting NICE thresholds for antibiotics were POCT negative, whereas more than a quarter of those below the threshold were POCT positive, illustrating the risk of misclassification if clinical prediction rules were used in isolation. Our findings align with and extend these observations by quantifying diagnostic performance and its implications for antibiotic prescribing across age groups.

Reported antibiotic supply rates for sore throat consultations vary across UK community pharmacy models (Wales: 29.9%, Northern Ireland: 25%, England: 65.5%) [12,15,16]. Although comparisons should be interpreted cautiously given differences in pathway design and patient populations, this variation may reflect the availability of POCTs within pharmacy sore throat pathways. This is further supported by the temporary suspension of POCTs in Wales during the COVID-19 pandemic (March 2020 to January 2022), when pharmacist prescribing increased from 27% to 63%, despite exceptionally low national GAS circulation compared with prepandemic levels [20,21]. In addition, as STTT service use was higher among patients from more deprived areas, community pharmacy-based pathways may help improve access to assessment and diagnostic testing in populations that experience a greater burden of antimicrobial resistance [15].

The principal strength of this study is the large sample size derived from a real-world national dataset spanning 577 community pharmacies across Wales, supporting the external validity of the findings. The use of routinely collected clinical data enhances the applicability to clinical practice. Age-stratified analyses enabled assessment of diagnostic performance across age groups, including children, in whom GAS infection is common. Minimal missing data and consistent sensitivity analyses strengthen the robustness of our findings.

Limitations include the absence of a microbiological reference standard, such as throat culture, which limits certainty regarding true infection status. POCTs were used as a proxy for microbiological confirmation within routine practice. Although not a reference standard, validated GAS POCT assays have established diagnostic performance and provide timely information to support antibiotic decision-making in community pharmacies [13,17].

This study could not distinguish between active infection and asymptomatic carriage. Reported GAS carriage prevalence varies across age groups and settings, with paediatric carriage estimates ranging from 10.5% in a meta-analysis to 2.8% in more recent London data, whereas rates in healthy UK adults are reported at <1% [22–24]. However, participants in this study were symptomatic and met FeverPAIN or Centor criteria for POCT eligibility. Within routine clinical practice, detection of GAS in symptomatic patients would generally be considered clinically relevant. Notably, POCT availability in this analysis was associated with lower, rather than higher, antibiotic prescribing, which does not support the treatment of incidental carriage. Alternative pathogens were not systematically tested for and clinical outcomes, including complications, onward referral and healthcare utilization, were not assessed.

Measures of FeverPAIN performance in this study should be interpreted within uncomplicated ambulatory sore throat presentations managed in community pharmacy. Within this population, discordance between FeverPAIN score and POCT result remained evident. In addition, Centor could not be analysed at its NICE-recommended threshold because of a methodological limitation of the community pharmacy pathway, where the same threshold was used to determine POCT eligibility.

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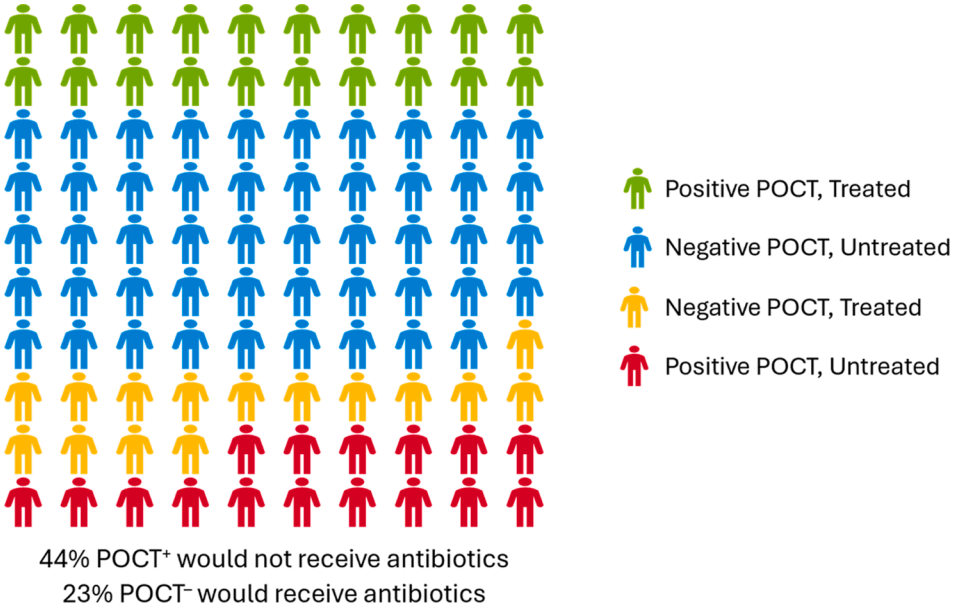

Fig. 5. Proportion of treated and untreated patients if FeverPAIN ≥4 alone was used to guide antibiotic prescribing in 100 patients presenting with sore throat to the STTT service using a GAS positivity of 36%. GAS, Group A *Streptococcus*; STTT, Sore Throat Test and Treat.

Future research should include economic evaluation of POCT integration into community pharmacy sore throat pathways, including the consequences of misclassification such as unnecessary antibiotic exposure and missed or delayed treatment. Evaluations should adopt a health-system perspective and assess outcomes including repeat consultations, escalation of care and antibiotic-related adverse events. Given the greater discordance observed in children, further evaluation in paediatric populations and assessment of public health impacts, including antimicrobial resistance, antibiotic consumption and GAS transmission dynamics are warranted.

In conclusion, within community pharmacy sore throat pathways, FeverPAIN demonstrated limited diagnostic performance for identifying GAS when used as a standalone tool, with greater discordance observed in younger children. Integration of POCTs within community pharmacy services may improve identification of GAS infection and support more targeted antibiotic prescribing. These findings support reconsideration of the role of POCTs in acute sore throat management in community pharmacy settings.

CRediT authorship contribution statement

Quisha Bustamante: Formal analysis, Visualization, Writing – original draft, Writing – review and editing. Hannah Thornton: Conceptualization, Methodology, Writing – original draft, Writing – review and editing. George Lawson: Writing – review and editing. Rebecca L. Guy: Writing – review and editing. Haroon Ahmed: Writing – review and editing. Christopher Jones: Writing – review and editing. Colin S Brown: Supervision, Writing – review and editing. Rebecca Cannings-John: Formal analysis, Writing – review and editing. Andrew Evans: Writing – review and editing. Efi Mantzourani: Writing – review and editing, Supervision. Victoria Hall: Conceptualization, Writing – review and editing, Supervision. Theresa Lamagni: Conceptualization, Writing – review and editing, Supervision. Mariyam Mirfendereresky: Conceptualization, Methodology, Writing – review & editing, Supervision.

Data availability

Anonymized data can be shared upon reasonable request and in accordance with organizational data-sharing governance arrangements.

Declaration of AI and AI-assisted technologies in the writing process

During the preparation of this work, Microsoft 365 Copilot was used to assist with structural refinement and language editing. All scientific interpretation, analysis and references were developed and verified by the author team.

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Declaration of competing interest

Colin S Brown is part-funded by the NIHR Health Protection Research Unit in Healthcare Associated Infections and Antimicrobial Resistance at the University of Oxford. All other authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cmi.2026.06.017.

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