

BMJ Open Quality Impact of a pilot NHS-funded sore throat test and treat service in community pharmacies on provision and quality of patient care

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ABSTRACT

Objective A National Health Service (NHS)-funded sore throat test and treat (STTT) service was introduced in selected pharmacies in two local health boards in Wales, as an extension to the national pharmacy common ailment scheme. The aim of this study was to evaluate the impact of STTT on provision and quality of patient care, namely antibiotic use, patient safety and general practitioner (GP) consultation rates.

Methods Secondary analyses of STTT consultation data to describe service outcomes, and routine data to explore changes in antibiotic prescribing and the prevalence of complications. Data were also collected from one GP practice to explore the feasibility of measuring changes in sore throat consultation rates in general practice.

Results Less than 20% of 1725 consultations resulted in antibiotic supply. The availability of STTT was associated with greater reductions in prescriptions for phenoxymethylpenicillin than in areas where STTT was not available (−3.8% and −3.4%, difference 0.4%). When pharmacy supplies were included, the reductions in the supply of the antibiotic were similar. No increase in the monthly number of incidents of quinsy was detected, and patients were appropriately referred to other healthcare professionals during pharmacy consultations. GP consultation rates since introduction of STTT were found to be lower than the equivalent monthly average since 2014.

Conclusions Data from the first 5 months of the STTT service suggest that it may have a role in safely rebalancing uncomplicated sore throat management from general practice to community pharmacies while continuing to promote antibiotic stewardship.

commonly, group A beta-haemolytic streptococcus (GABHS), and antibiotic prescribing where GABHS is suspected is partly driven by a desire to prevent suppurative complications such as peritonsillar abscess (quinsy).^{4,5} Distinguishing between viral and bacterial infections is difficult because the signs and symptoms are similar regardless of cause, and this can lead to unnecessary antibiotic prescribing which contributes to the global public health issue of antimicrobial resistance (AMR).⁶ Throat swabs can help guide prescribing but delays in bacteriology results limit their use in general practice meaning they are not recommended for routine use.⁷ Rapid antigen detection testing (RADT) has a specificity of greater than 95% and sensitivity of 70%–90% for GABHS. Given its high specificity and limited sensitivity, a positive RADT can be useful in establishing the presence of GABHS,⁸ although in its most recent diagnostic guideline on rapid antigen tests for GABHS infection in people with sore throat, the National Institute for Health and Care Excellence (NICE) concluded that the use of RADT by general practitioners (GPs) was unlikely to be a cost-effective use of National Health Service (NHS) resources when added to clinical assessment by GPs.⁹

In Wales, patients with sore throat are encouraged to seek advice from community pharmacies through the national pharmacy common ailment service (CAS). Only symptomatic treatments (eg, analgesics) are available from pharmacies providing CAS and no antibiotics can be supplied, meaning that many patients still prefer to see a GP.¹⁰ In November 2018, the CAS service was extended in selected pharmacies to incorporate RADT in sore throat consultations with antibiotic supply if prespecified clinical criteria were met,¹¹ as defined in the sore throat test and treat (STTT) service. The STTT service had

INTRODUCTION

Sore throat is a condition that frequently presents to primary care. An average-sized UK general practice with a list size of 7000, has an estimated 5481 consultations with 3562 antibiotic prescriptions for sore throat over 10 years.¹ Around 60%–78% of sore throat consultations result in an antibiotic prescription.² However, most sore throats are caused by a virus and around 80% of people recover without any treatment within 8 days.³ Some sore throats may be caused by bacteria, most



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several aims; (1) To provide a more accessible, efficient and high-quality clinical pathway for patients with a sore throat. (2) To better use pharmacist skills and free up GP time for more complex and urgent medical issues. (3) To more accurately screen for GABHS and potentially reduce unnecessary antibiotic prescribing.

A previous study found that it is feasible to deliver a community-pharmacy-based screening and treatment service using RADT,¹² but no conclusive evidence could be provided on effectiveness or cost-effectiveness.^{13 14} Additionally, the previous study looked only at provision of a private, commercial service in which patients were required to pay for investigation and treatment. It is not known whether the results of that study would be reproduced in the NHS. The wider available evidence on RADT for sore throats is inconclusive. While randomised trials have suggested no additional benefit over clinical scores alone^{11 15} and the recent NICE guideline did not recommend RADT use,⁹ it is recognised there is a lack of robust evidence regarding the role of RADT in community pharmacies and its value in this setting is still unknown. NICE has recommended further research to measure the wider effects of RADT on public health and antimicrobial stewardship in healthcare settings other than general practice.

The implementation of STTT provided a unique opportunity to evaluate such a service, in the NHS and in a real-world setting. While trials are a vital part of evaluating new diagnostic pathways, it is important to understand the role of the STTT service in a health system where patients make their own choices as to how and when to access treatment, which precluded a prospective randomised trial. This study aimed to evaluate whether a pharmacy-led STTT service had an impact on antibiotic use, patient safety, and GP consultation rates.

PATIENTS AND METHODS

STTT pilot service

The STTT service was available in 56 community pharmacies in two local health boards (LHBs) in Wales, in established CAS sites whereby CAS had been embedded in primary care pathway for more than 6 months. Initially 23 pharmacies in an LHB in central South Wales commenced the service in November 2018. The service was extended to another 33 pharmacies in an LHB in North Wales by December 2018. Pharmacy sites were commissioned within the LHBs based on a balance of population needs and expressions of interest from pharmacy sites that had already been offering CAS for a minimum of 6 months.

The STTT service specification (a document describing the conditions under which commissioned community pharmacies were required to provide the service including any training requirements, and clinical inclusion and exclusion criteria) was developed collaboratively by the LHBs who determined all children under 6 years would be excluded and referred to their GP (online supplementary figure 1). Patients aged 6 years and over presenting with acute sore throat at a participating pharmacy were

assessed using either FeverPAIN or CENTOR clinical scoring, validated methods to support identification of bacterial infection.¹⁶ The choice of scoring method was left to the pharmacist's discretion. Pharmacists received detailed training on throat examination, use of scoring tools and sampling using a throat swab. Patients with FeverPAIN >1 or CENTOR >2 were offered RADT in the pharmacy, allowing pharmacists to quickly ascertain presence of GABHS. Clinical scoring allows targeted testing of those most likely to have a GABHS infection rather than asymptomatic GABHS carriers. Patients with a positive test were offered antibiotics supplied by the pharmacist under a Patient Group Direction.¹¹ Leaflets promoting self-care and providing information about the effectiveness of antibiotic use for sore throats were developed by the Welsh Medicines Information Service, approved by the all Wales Medicines Strategy Group and used in the service.¹⁷ Pharmacists were asked to make a follow-up telephone consultation for all patients accessing the STTT service within 10–14 days of each consultation. This was used to assess treatment success and subsequent health service utilisation (eg, appointments with a GP).

Study design

This study involved secondary analyses of data obtained from routine data sources. Data were analysed using Microsoft Excel, IBM SPSS V.23 to obtain descriptive statistics and Stata Statistical Software release V.16 to undertake more detailed statistical comparisons.

Data collection

Service outcomes

Data from all STTT consultations were collected between November 2018 (service introduction) and end of March 2019, to describe service outcomes. Data were obtained through the Choose Pharmacy system, an IT application supporting delivery of services through community pharmacies in Wales. Data included standardised demographic information derived from matching patients to existing health records in the Welsh Demographic Service, and clinical information in the form of free-text and predefined responses recorded by pharmacists during consultations and follow-up telephone calls.

Patient safety

There is currently no routine data linkage of pharmacy data to other primary or secondary care data that would enable us to track patients who have visited pharmacies for STTT. To explore possible impact on patient safety, hospital admissions for quinsy were monitored, as a surrogate for possible complication of untreated GABHS infections. Patient Episode Database for Wales data for coded hospital inpatient stays of quinsy were obtained from the NHS Wales Informatics Service (NWIS) for the period March 2014 to March 2019.¹⁸ Data for a period of 4 full years prior to the service's introduction were obtained to account for seasonal variation that may have impacted on

quinsy hospital admissions, and would allow us to calculate averages and 95% CIs.

In addition, free-text comments providing clinical information recorded by pharmacists during consultations were analysed using content and deductive thematic analysis for patients who were referred to another healthcare professional, to explore appropriateness of referrals. Data were also analysed for patients who were followed up, to explore possible patient deterioration after an STTT consultation. The number of patients who had further contact with healthcare professionals was calculated and pharmacist comments in relation to patient-reported reasons for seeking further advice were analysed thematically.

GP consultations

Data were also obtained from one GP practice to explore the feasibility of measuring changes in sore throat consultation rates in general practice pre and post STTT service implementation. Audit+ was used as a data source to extract Read-coded GP sore throat related consultations for full 4 years prior to STTT, between March 2014 to March 2019.¹⁹ The GP practice selected (list size=10 220) was located adjacent to four community pharmacies in which the STTT service was available (online supplementary table 1).

Antibiotic prescribing

Comparison of antibiotic prescribing was completed using an ecological study design which analysed data at the population rather than individual level to identify any association in total antibiotic supply between intervention (STTT) and non-intervention (non-STTT) areas.²⁰ This design has been used previously to explore the impact of licensing changes on antibiotic (chloramphenicol) supply rates. This approach relied on a linear regression model to predict the number of antibiotic prescriptions at the end of the study period. We determined that in order to make the regression model robust it would be necessary to obtain data for 25 months prior to the intervention. This was in line with previous studies.²¹ Data were provided by the NHS Wales Shared Services Partnership (NWSSP). Monthly antibiotic prescribing data for the period October 2016 to March 2019 were provided for each primary care cluster, that is, a group of GP practices serving populations of between 50 000 and 100 000 people, within the two LHBs in which the STTT service was available. Clusters were designated as STTT and non-STTT depending on whether or not community pharmacies within their respective areas were providing the STTT service (online supplementary table 2). A retrospective analysis of prescription and pharmacy supply data for phenoxymethylpenicillin in areas in which STTT was available was undertaken. Phenoxymethylpenicillin prescriptions, the recommended antibiotic treatment for sore throat,²² were chosen for analysis. Phenoxymethylpenicillin is not indicated for treatment of any other acute bacterial infection in Wales and as such was assumed

to be a good measure of antibiotic prescribing for sore throat. Prescriptions for second line antibiotics (clarithromycin and erythromycin) were excluded because they were only indicated for patients with a known penicillin allergy and had multiple possible indications. Prescribing data for non-STTT clusters were used as a control.

Linear regression was used to generate a cumulative supply equation for phenoxymethylpenicillin prescriptions ($r=0.999$, $p<0.005$) and predict the number of supplies (ie, prescriptions and pharmacy supplies) of phenoxymethylpenicillin in STTT clusters at month 30 of the study. The regression model was used to predict prescription numbers at month 30, and was based on NWSSP prescription data for the 25 months immediately preceding the availability of the STTT service (month 1: October 2016). Similar linear regression models were used to predict the number of prescriptions for phenoxymethylpenicillin in non-STTT clusters ($r=0.999$, $p<0.005$) and for oral broad-spectrum penicillins (as an indicator of the general trend in antibiotic prescribing within STTT clusters) in STTT clusters ($r=0.999$, $p<0.005$). The effect of STTT on antibiotic supplies was estimated using a difference in difference design comparing phenoxymethylpenicillin supplies in STTT and non-STTT clusters, and phenoxymethylpenicillin and broad-spectrum antibiotic prescriptions within STTT clusters.

Ethical considerations

The study was registered with the Research and Development department of both LHBs. There were no identifiers that could link information to an individual in any of the data sets; as such, this study required no ethical approval. The process for obtaining and using Audit+ GP data was approved by the NWIS Data Quality System Governance Board.

Patient involvement

Two members of the Lay Faculty of Cardiff School of Pharmacy and Pharmaceutical Sciences provided patient insight throughout the conceptualisation of the evaluation of the service. Patients were not involved in the design or conduct of this arm of the study.

RESULTS

During the study period 1725 STTT consultations were undertaken in the 56 participating community pharmacies. Table 1 summarises the characteristics of service users, patient alternative action had the service not been available, referral sources to STTT and use of clinical scoring tools during consultations.

Of the 1725 patients screened using FeverPAIN or CENTOR, 1239 patients were found to meet the threshold criteria for RADT (72%). Of the 1239 patients having the RADT test, a total of 350 (28.2%) tested positive for GABHS and 340 (27.4%) were supplied antibiotics. Ten patients did not receive antibiotics, four were referred to their GPs due to feeling systemically unwell or because of a recent recurrent infection and six patients

Table 1 Descriptive overview of the sore throat test and treat (STTT) service consultations

		Patients (n=1725)	Patients followed up at 10–14 days (n=537)	Patients not followed- up (n=1188)
Patient demographics				
Age at consultation (years)	Median	29.2	28.8	29.4
	IQR	16–39	15–38	16–39
	Range (SD)	6–89 (17.4)	6–79 (17.1)	6–89 (17.5)
Gender (% of total population)	Male	582 (33.7%)	185 (34.5%)	397 (33.4%)
	Female	1143 (66.3%)	352 (65.4%)	791 (66.6%)
Factors related to engagement with STTT				
Referred to the pharmacy by: (% of total population)	General practitioner	991 (57.4%)	300 (55.9%)	691 (58.2%)
	Self-referral	667 (38.7%)	218 (40.6%)	449 (37.8%)
	Other (OOH/other HCP/ NHS 111/ NHS Direct)	48 (2.8%)	15 (2.8%)	33 (2.8%)
	Missing values	19 (1.1%)	4 (0.7%)	15 (1.3%)
What would the patient have done if the service had not been available (% of total population)	Visited GP	1610 (93.3%)	503 (93.7%)	1107 (93.2%)
	Other (OOH/other HCP/ NHS 111/NHS Direct/accident and emergency)	56 (3.2%)	18 (3.4%)	38 (3.2%)
	Done nothing	25 (1.4%)	7 (1.3%)	18 (1.5%)
	Bought medication from the pharmacy	27 (1.6%)	8 (1.5%)	19 (1.6%)
	Missing values	7 (0.4%)	1 (0.2%)	6 (0.5%)
Presenting features				
Clinical scoring tool (consultations)	CENTOR	133 (7.7%)	56 (10.4%)	77 (6.5%)
	FeverPAIN	1592 (92.3%)	481 (89.6%)	1111 (93.5%)

GP, general practitioner; HCP, healthcare professional; NHS, National Health Service; OOH, out of hours.

declined antibiotics in favour of self-care. In total, antibiotics were supplied in 19.7% of STTT consultations (340/1,725) (figure 1). The number and percentage of antibiotic supplies by age group are presented in online supplementary figure 2.

In 59 (3.4%) consultations patients had an RADT test despite not meeting the required clinical criteria. Free-text notes made by pharmacists provided an insight into the reasons for these tests, which included: patients presenting with a referral for RADT from their GP; patients' insistence related to recurrent infections or for reassurance in cases where the pharmacist used their professional discretion when faced with a distressed patient. Four of these patients, two of whom had been encouraged to take a test by their GP because they were children with recurrent infections, were supplied an antibiotic.

In addition to the 340 antibiotics supplied, 528 patients received 804 analgesic items (ibuprofen n=402 and paracetamol n=402). In total, 89 patients (5.2%) received both an antibiotic and analgesic and 943 patients (54.7%) were not supplied any medication.

Numbers of GP prescriptions for phenoxymethylpenicillin were lower than predicted for March 2019 in STTT

clusters (figure 2). A reduction in phenoxymethylpenicillin prescriptions was also observed in non-STTT clusters but the reduction was smaller than those in which STTT was available (−3.4% vs −3.8%, difference 0.4%). When pharmacy supplies were included, no difference was observed between the reduction in phenoxymethylpenicillin supplies in STTT and non-STTT clusters (−3.4% vs −3.4%). In STTT clusters numbers of prescriptions for oral broad-spectrum penicillins also reduced but the reduction was smaller than that for phenoxymethylpenicillin items (−2.5% vs −3.4%, difference 0.9%) (online supplementary figures 3 and 4).

Pharmacists referred 170 patients (9.9%) to other healthcare professionals; 167 referrals were made to GPs and three to dentists (table 2—most common reasons for referring). Two patients were diagnosed with epiglottitis during the clinical examination and were referred urgently to secondary care, whereby both diagnoses were confirmed and patients treated; these incidents were reported to the LHBs and information for these patients was not entered in Choose Pharmacy (L. Sayce, NWIS, personal communication).

In total 896 patients (51.9%) consented to a follow-up phone call and 537 follow-up phone calls were completed

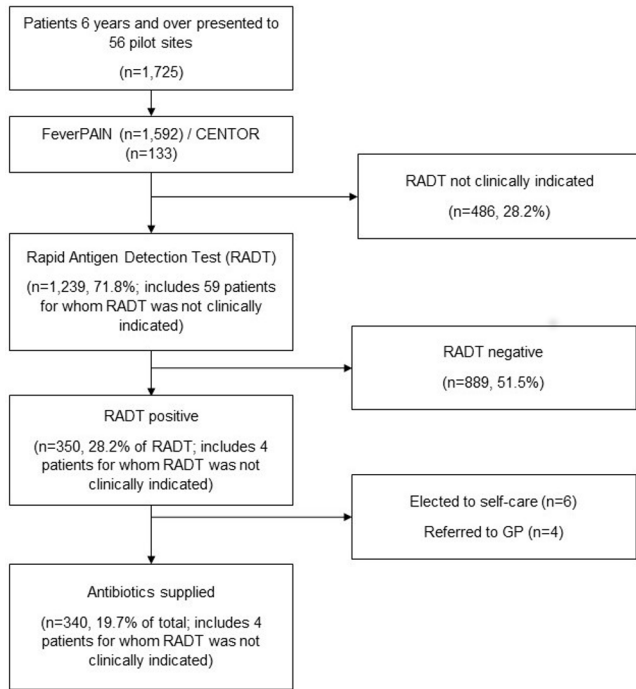


Figure 1 Overview of the pilot sore throat test and treat (STTT) service outcomes in 56 community pharmacies in Wales, between November 2018 and March 2019.

within the study period (59.9% of those who gave consent). The characteristics of patients participating in follow-up phone calls were compared and found similar to the overall study population (table 1). Of those patients for whom follow-up was completed, 492 (91.6%) reported feeling completely or mostly better after using the STTT service; 81 (15.1%) reported contacting a healthcare professional after the STTT consultation. Table 3 provides a breakdown of the information from patients'

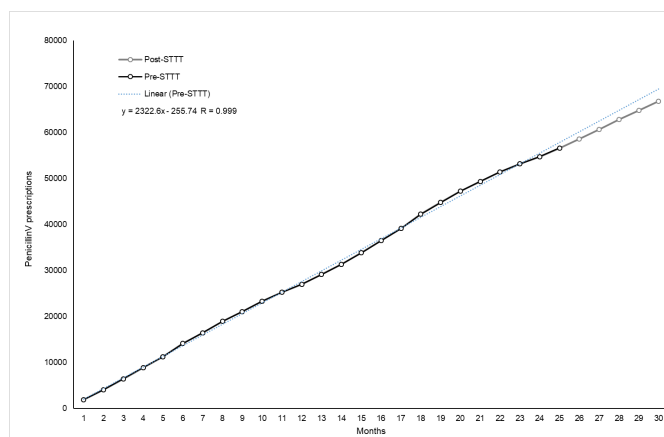


Figure 2 The linear regression used to generate a cumulative supply equation for phenoxyethylpenicillin prescriptions ($r=0.999$, $p<0.005$) in clusters with pharmacies piloting the sore throat test and treat (STTT) service, with data from October 2016 (month 1). The graph includes predicted and actual prescriptions for phenoxyethylpenicillin pre-STTT (months 1 to 25) and post-STTT (months 26 to 30) intervention.

further contact with healthcare professionals after their STTT consultation ($n=81$ out of 537 who were followed up), recorded by pharmacists during follow-up phone calls. Patients have been categorised by the patients' need for a RADT as indicated by their clinical score, RADT result (positive or negative) and whether an antibiotic was supplied during the STTT consultation.

Follow-up was unsuccessful in 359 cases. The most commonly recorded reasons for unsuccessful follow-up included patients not answering despite multiple attempts ($n=97$, 27.5%), patients not returning phone calls or voice messages ($n=49$, 13.6%), and incorrect phone number ($n=12$, 3.3% of unsuccessful follow-ups).

No increase in the monthly number of incidents of quinsy was detected (figure 3). It was feasible to extract sore throat consultation data from GP practice prescribing system using Audit+. Monthly sore throat consultation numbers were used to estimate the average consultation rate per month for the study practice before the introduction of STTT. Sore throat consultation rates decreased from 0.71 per 1000 patients in March 2018 (prior to STTT) to 0.36 per 1000 patients in March 2019 (4 months after STTT). Data suggested GP consultation rates were lower during the study period than in the same season in all previous years although this was not tested statistically (figure 4).

DISCUSSION

This study triangulated data derived from a range of national databases providing pharmacy, GP, prescribing and secondary care data, to evaluate whether a pilot of an NHS-funded pharmacy STTT service had an impact on antibiotic provision, patient safety and GP consultation rates.

Data from the first 5 months of the STTT service suggest that it may have a role in promoting antibiotic stewardship as a coordinated approach towards sore throat management. Prior to the availability of RADT, screening of patients was liable to identification of asymptomatic GABHS carriers leading to inappropriate antibiotic prescribing. The overall percentage of STTT consultations resulting in antibiotic supply at <20%, was significantly lower than rates reported from consultations with GPs, where RADT is not routinely used.² Findings suggest that RADT in addition to clinical scoring systems increases diagnostic confidence of suspected GABHS infection rather than carriage of the bacteria. The availability of STTT was associated with greater reductions in the prescribing of phenoxyethylpenicillin than in areas where STTT was not available although there was no overall difference when pharmacy supplies were included; and greater reductions in antibiotic prescribing for sore throat when compared with antibiotic prescribing for other common infections.

The antibiotic supply rate in the STTT service at 19.7 per 100 consultations is double that reported in the only other test and treat service researched in the UK,

Table 2 Common reasons for pharmacists referring patients to other healthcare professionals when undertaking clinical assessment during a sore throat test and treat (STTT) consultation. Main themes with illustrative reasons are presented

Theme	Example note(s) in Choose Pharmacy
High results from scoring tool but pharmacist unable to complete effective RADT	<p><i>"Patient has symptoms for test but could not undertake due to gagging."</i></p> <p><i>"Unable to fully assess patient due to inability to tolerate swab. tonsils have exudate bilaterally. Patient is generally unwell."</i></p> <p><i>"(name of patient) tested negative for strep A however he has considerable ear pain with a sensation of pressure. Tonsils were inflamed and had visible exudate. Due to discomfort and poor gag reflex I cannot say that I effectively swabbed his throat."</i></p> <p><i>"Tonsils not visible as jaw unable to be opened fully (?trismus). Severe inflammation of left submandibular lymph. 5/7 history with worsening symptoms."</i></p> <p><i>"Worsening throat pain...He (patient) has a Hx of symptoms for 5/7...some submandibular swelling. He has a temperature of 36.6C without antipyretics. He does not have any red flags other than trismus. Due to this I am unable to perform an examination or to obtain an uncontaminated swab. He is self-reporting an inability to swallow food or drink."</i></p>
Recurrent infections	<p><i>"...patient presented 6 week history of sore throat, intermittent symptoms for 1 week then resolving for approx. 2 days. Low FP score, no symptoms suggestive of infection, light smoker and drinker, symptoms not associated with lifestyle. No reflux."</i></p> <p><i>"Not scored high enough on FEVER PAIN to offer a point of care test but concerned that patient has had a sore throat since November and has tried various treatments."</i></p>
Symptoms indicative of other infections/conditions	<p><i>"... one tonsil a lot worse than the other and blood present - negative for strep A so referral for possible quinsy."</i></p> <p><i>"...patient who mentioned to the receptionist she was coughing up blood, before being referred to the pharmacy for common ailments. She has been suffering with cough and cold symptoms, but now has a moderately sore throat, however, has coughed up blood on two consecutive days..."</i></p> <p><i>"...potential glandular fever. Stomach pain, viral symptoms, severe sore throat."</i></p> <p><i>"Patient presenting for sore throat test but exhibiting symptoms of URTI - green, thick mucus being coughed up and rattling on chest noticed by partner during nights."</i></p> <p><i>"Suspected throat abscess. Temperature 37.4, very swollen right side of the throat."</i></p> <p><i>"...as patient has had symptoms for 3 weeks, cough with pain under rib cage probably stemming from the cough. Sore throat present for 3 weeks despite using cough and cold medicines including Paracetamol. I think possibly the patient may be suffering with acid reflux, due to the length of the time the patient has had the sore throat."</i></p>
Challenges associated with young age	<p><i>"...patient was unable to swab (due to age) and kept closing mouth when the swab was near mouth. "</i></p> <p><i>"Patient reluctant to have swab taken, unable to swab tonsil area to get sufficient sample. Patient unwell, history of fever, poor appetite."</i></p> <p><i>"...tonsil inflamed only on one side, very, very painful for patient almost on risk of choking."</i></p> <p><i>"fever point 1, swab not required, when looked into patient mouth tonsils are both very inflamed to the stage that patient struggles to breathe, some difficulty breathing in the morning."</i></p> <p><i>"Concerned about the possibility of scarlet fever - no rash present but does have the 'strawberry tongue' associated with scarlet fever."</i></p>

RADT, rapid antigen detection testing; URTI, upper respiratory tract infection.

a private service offered to patients 12 years and older.¹² The current study found both the percentage of patients with a clinical score above the threshold for RADT, and the percentage of patients provided antibiotics following RADT, were higher than in the private service. This suggests that patients in the current study, largely referred by the GP after presentation at the surgery or following triage over the phone, and by implication patients presenting to NHS services, were more likely to have a bacterial infection than those accessing a private service. This finding could be explained by different demographics of patients in the studies, for example, in this study the STTT service was available to children aged 6 years or over (rather than

12 years or over), and children aged between 6 years and 12 years received 15% of the overall antibiotic supply; or by differences arising from use of FeverPAIN rather than CENTOR scoring. It is also possible the difference could be attributed to differences in health-seeking behaviours among users of pharmacies including a tendency for pharmacy services to be accessed by the 'worried well', described previously.²³

No safety concerns were evident in the operation of the STTT service. There was no observed increase in episodes of quinsy in secondary care, and patients were appropriately referred to other healthcare professionals during pharmacy consultations. A total of 4.5% of patients in

Table 3 Patients' further contact with healthcare professionals after their sore throat test and treat (STTT) consultation, by rapid antigen detection testing (RADT) outcome and antibiotic supply

STTT consultation	Follow-up phone call					Antibiotic provided after STTT (n)	Total patients
	Healthcare professional contacted (number of patients) (reasons for contact where noted)						
	GP	Hospital	Dentist	Nurse	OOH		
RADT needed— result negative and no antibiotic supplied	23 (Gastro-oesophageal disease (GORD), anxiety, glandular fever, suspected hand foot and mouth, further blood tests to identify issue)	2 (Repetitive strain of vocal cords)	1 (Referral to dental hospital)	1	3	12	30
RADT Needed— result positive and antibiotic supplied	29 (allergy to antibiotic supplied, glandular fever, ulcer in throat, referral to ENT)	2 (Quinsy, drained tonsils)	0	0	5 (Course of antibiotics extended; one patient not seen)	13	36
RADT not needed and no antibiotic supplied	14 (Referral to ENT, mild chest infection, GORD; GPs not seen three patients and referred back to pharmacist)	0	1 (Dental abscess)	0	0	3	15
Total	66	4	2	1	8	28	81

ENT, Ear, Nose and Throat; GP, general practitioner; OOH, out of hours.

a representative sample during follow-up phone calls had a negative RADT during STTT but were prescribed antibiotics later. This may be explained by the reported sensitivity of the test;²⁴ that it only detected presence of GABHS, meaning that bacterial infections caused by other microorganisms were not picked up and treated by STTT; or infections arising after presenting at the pharmacy. However, these explanations assume it was appropriate to prescribe antibiotics in each case, something not possible to verify.

The benefits of the STTT rely on a collaborative approach between community pharmacies and GP surgeries and appropriate substitution of GP services by pharmacists. Results suggest a high degree of collaboration with 57.4% of all consultations taking place following referral by the patient's GP (n=991). A summary of each consultation was sent to each patient's GP with the aim of integrating the service and encouraging GPs to refer appropriate patients in future; whether GP referrals to the STTT service changed over time and in response to

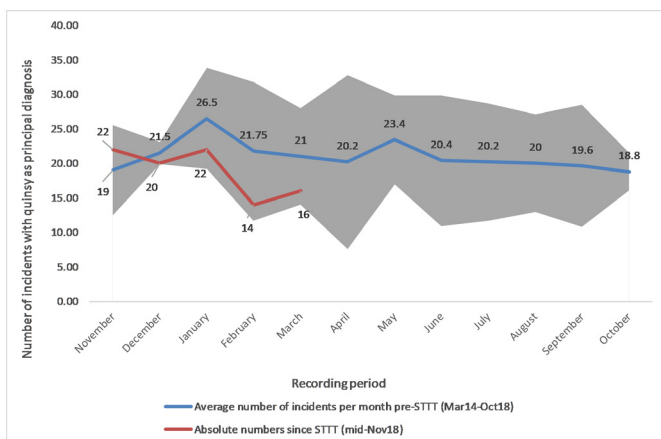


Figure 3 Incidents of quinsy in the two local health boards whereby sore throat test and treat (STTT) was introduced in middle November 2018, by time, with a 95% confidence band for the average number per month between March 2014 and October 2018.

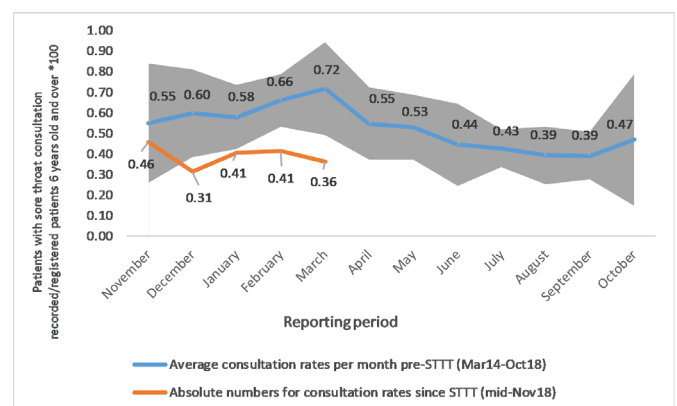


Figure 4 Rates for recorded sore throat consultations for patients age 6 years and over, in one general practitioner (GP) surgery within the vicinity of four sore throat test and treat (STTT) pilot sites, with a 95% confidence band for the average rate per month between March 2014 and October 2018.



feedback is worthy of further research. We found it was feasible to collect sore throat consultation data from GP practices and use this to assess the impact of the STTT service on GP consultation rates. Data suggest the service may have potential to relieve pressure on GPs. The vast majority of patients using the STTT service reported they would have visited their GP or other health service had STTT not been available. This finding is supported by follow-up data where only 12.3% of patients (66/537) reported contacting their GP after using the pharmacy service; many of the reasons for contacting their GP subsequently were unrelated to sore throat. A further 2.7% of patients (15/537) subsequently contacted a hospital, out of hours, dentist or a nurse; one patient who was later diagnosed with quinsy had commenced antibiotic therapy supplied by a pharmacy.

STTT is an NHS service, hence there were no ethical issues in relation to financial conflicts for pharmacists that could be associated with the private service in England.^{12 13} The service is part of CAS, so other treatments were offered if the pharmacist determined that they were more appropriate. Patient education regarding the appropriateness of antibiotic treatment for viral infections and of the self-limiting nature of many bacterial ones was an integral part of the service. The role of self-care in management of common ailments in general was promoted, with self-care leaflets provided as part of service.¹⁷ A small number of patients chose to self-care instead of taking antibiotics despite having tested positive for RADT; of these none reported a subsequent need for antibiotic treatment. Results suggest that the STTT service is using the skills of pharmacists more effectively and that pharmacists make appropriate clinical decisions, providing self-care, referring to other healthcare professionals where needed. This finding is consistent with the recommendations of Jones *et al*,²⁵ that pharmacists can play a role in antimicrobial stewardship by being part of a coordinated approach to promote appropriate use of antibiotics and therefore contribute to tackling AMR, and Buss *et al* who reviewed the literature on point-of-care tests conducted in community pharmacies and concluded that pharmacies are well suited to deliver a wide range of such tests.²⁶

Because the service has not yet been available for a full calendar year, it was not possible to consider the effect of seasonal variations in the incidence of bacterial sore throats or the impact of a potential mild winter on GP consultation rates. The study demonstrates that routine data sources can effectively be analysed to evaluate STTT. Further studies will use the methodologies described in this paper to monitor the impact of seasonal variations on the service. The descriptive analysis of the pharmacy service included all consultation data; however, the analysis of prescribing rates included all data on prescriptions for phenoxymethylpenicillin only and included prescriptions for children under 6 years (no stratifying by age was available). This assumes the majority of prescriptions for sore throat would be for phenoxymethylpenicillin with

other treatments reserved for patients with penicillin allergy. These other treatments, such as clarithromycin, would also be expected to have significant use in non-sore throat indications, making an assessment of impact on prescribing rates less meaningful. The study took a pragmatic approach to identifying non-STTT (control) clusters; by using those within the same LHB areas we hoped to take account of differences in prescribing formularies or approaches to antimicrobial stewardship which may occur between NHS organisations. Despite this we found underlying differences in factors such as the socio-economic deprivation, rurality and size of GP practices between STTT and non-STTT clusters. Caution is therefore required in applying these findings more generally and future studies should be designed to take account of these potential confounding variables. While the selection of non-STTT clusters may have taken account of some of these, it is plausible the baseline reduction for phenoxymethylpenicillin in non-STTT clusters and prescribing for other infections could be attributed to other stewardship initiatives such as national targets, prescribing indicators and local initiatives.

Coding limitations in GP consultation data were assumed to be consistent throughout the study period within the individual GP practice. Not enough data are available yet to run an interrupted time series that looks at the trend of quinsy rates and sore throat consultation rates before and after implementation of STTT. Pharmacies were not chosen in a way to allow for STTT and non-STTT clusters to be comparable, so it was not possible to adjust for baseline starting point and examine between-group differences (difference in differences approach).

Future work evaluating the STTT service will include exploring patient, pharmacist, GP and GP practice staff's views and experiences of the service, an economic evaluation, and changes in pattern of use as the service becomes normalised.

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REFERENCES

- Gulliford MC, Moore MV, Little P, *et al.* Safety of reduced antibiotic prescribing for self limiting respiratory tract infections in primary care: cohort study using electronic health records. *BMJ* 2016;354:i3410.
- Gulliford MC, Dregan A, Moore MV, *et al.* Continued high rates of antibiotic prescribing to adults with respiratory tract infection: survey of 568 UK general practices. *BMJ Open* 2014;4:e006245.
- Spinks A, Glasziou PP, Del Mar CB. Antibiotics for sore throat. *Cochrane Database Syst Rev* 2013:CD000023.
- Kumar S, Little P, Britten N. Why do general practitioners prescribe antibiotics for sore throat? Grounded theory interview study. *BMJ* 2003;326:138.
- Worrall GJ. Acute sore throat. *Can Fam Physician* 2007;53:1961–2.
- Chatterjee A, Modarai M, Naylor NR, *et al.* Quantifying drivers of antibiotic resistance in humans: a systematic review. *Lancet Infect Dis* 2018;18:e368–78.
- National Institute for Health and Care Excellence. Clinical Knowledge Summaries. *Sore throat - acute*. Available: <https://cks.nice.org.uk/sore-throat-acute>
- Waljee H, Patel C, Brahmabhatt P, *et al.* Tonsillitis. *InnovAiT* 2017;10:577–84.
- National Institute for Health and Care Excellence. NICE Diagnostics Guidance [DG38]. *Rapid tests for group A streptococcal infections in people with a sore throat*, 2019. Available: <https://www.nice.org.uk/guidance/dg38>
- McNulty C, Joshi P, Butler CC, *et al.* Have the public's expectations for antibiotics for acute uncomplicated respiratory tract infections changed since the H1N1 influenza pandemic? A qualitative interview and quantitative questionnaire study. *BMJ Open* 2012;2:e000674.
- National Institute for Health and Care Excellence. NICE Guidance Guideline [NG84]. *Sore throat (acute): antimicrobial prescribing*, 2018. Available: <https://www.nice.org.uk/guidance/ng84>
- Thornley T, Marshall G, Howard P, *et al.* A feasibility service evaluation of screening and treatment of group A streptococcal pharyngitis in community pharmacies. *J Antimicrob Chemother* 2016;71:3293–9.
- Sore throat test and treat – a £34 million question? *Drug Ther Bull* 2017;55:1.
- Goyder C, Verbakel J, Hayward G, *et al.* The sore throat test and treat service: speed should not substitute science. *Br J Gen Pract* 2017;67:110.1–110.
- Little P, Hobbs FDR, Moore M, *et al.* Clinical score and rapid antigen detection test to guide antibiotic use for sore throats: randomised controlled trial of prism (primary care streptococcal management). *BMJ* 2013;347:f5806.
- Little P, Hobbs FDR, Moore M, *et al.* Primary care streptococcal management (PriSM) study: in vitro study, diagnostic cohorts and a pragmatic adaptive randomised controlled trial with nested qualitative study and cost-effectiveness study. *Health Technol Assess* 2014;18:1–102. vii–xxv.
- All Wales Medicines Strategy Group. Common Ailments Formulary Patient Information Leaflets. *Sore Throat and Tonsillitis*. Available: <http://awmsg.org/docs/awmsg/medman/CAFPIL/Sore%20Throat%20and%20Tonsillitis.pdf>
- NHS Digital. National clinical coding standards ICD-10 5th edition (2017). International classification of diseases. Available: <https://hscic.kahootz.com/gf2.ti/f/762498/27838213.1/PDF/-/NCCSID102017.pdf>
- NHS Digital. Read codes. Available: <https://digital.nhs.uk/services/terminology-and-classifications/read-codes>
- Coggon D, Rose G, Barker DJP. Chapter 6: Ecological studies. In: *Epidemiology for the uninitiated*. London: BMJ Books, 2003.
- Walker R, Hinchliffe A. Prescribing and sale of ophthalmic chloramphenicol following reclassification to over-the-counter availability. *Int J Pharm Pract* 2010;18:269–74.
- All Wales Medicines Strategy Group. All Wales Antimicrobial Guidance Group. Primary Care Antimicrobial Guidelines. September 2015 (Updated July 2018). *Formulary Choice for Acute Sore Throat*. Available: <http://www.awmsg.org/docs/awmsg/medman/Primary%20Care%20Antimicrobial%20Guidelines.pdf>
- Miller D, Acton TM, Hedge B. The worried well: their identification and management. *J R Coll Physicians Lond* 1988;22:158–65.
- Cohen JF, Bertille N, Cohen R, *et al.* Rapid antigen detection test for group A Streptococcus in children with pharyngitis. *Cochrane Database Syst Rev* 2016;7:CD010502.
- Jones LF, Owens R, Sallis A, *et al.* Qualitative study using interviews and focus groups to explore the current and potential for antimicrobial stewardship in community pharmacy informed by the theoretical domains framework. *BMJ Open* 2018;8:e025101.
- Buss VH, Deeks LS, Shield A, *et al.* Analytical quality and effectiveness of point-of-care testing in community pharmacies: a systematic literature review. *Res Social Adm Pharm* 2019;15:483–95.