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A pharmacy-led sore throat test and treat (STTT) service: antigen testing and antibiotic supply rates during the period of heightened public awareness of Group A *Streptococcus* infections

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Background: Community pharmacies in Wales delivered an NHS-funded sore throat test and treat (STTT) service during the period of increased invasive Group A *Streptococcus* (iGAS) incidents in winter 2022–23. Service users were screened using FeverPAIN/CENTOR scores, offered GAS rapid antigen detection tests (RADT) if appropriate, and antibiotics if indicated.

Objectives: To evaluate the service's response to a substantial rise in sore throat presentations during a period of heightened public anxiety.

Methods: Cross-sectional study with anonymized individual-level data from electronic pharmacy records of all eligible STTT service users, between January 2022 and March 2023.

Results: Antibiotics were supplied to 24% (95% CI: 23–24) of people who used the STTT service and 31% (95% CI: 31–32) of those who met the threshold for an RADT. Of 27 441 STTT consultations, 9308 (33.9%) occurred during December 2022. In the week commencing 2 December 2022, following the announcements of increased iGAS incidents, we observed a statistically significant increase of 1700 consultations (95% CI: 924–2476) and a statistically significant decrease in supply rate of 13.9 antibiotics per 100 RADT (95% CI: −18.40 to −9.40). Antibiotic supply rates increased thereafter to those observed before the announcements of iGAS incidents. Referral rates to other primary care or emergency settings remained below 10% throughout the study period.

Conclusions: Our findings suggest that, despite a dramatic increase in sore throat consultation rates in response to media reports, the pre-specified pathway followed by pharmacists ensured appropriate use of antibiotics, and absorbed a substantial workload that would otherwise end up in other healthcare settings.

Introduction

Group A *Streptococcus* (GAS or Strep A; *Streptococcus pyogenes*) is a common bacterium that can colonize healthy individuals.[1] GAS causes a diverse range of skin, soft tissue and respiratory tract infections, including sore throat (pharyngitis). GAS is isolated in 7%–30% of patients with symptoms of an acute sore throat,[1] and can cause suppurative complications such as peritonsillar abscess (quinsy), otitis media, sinusitis and sepsis.[2] Most sore throats are mild, self-limiting and do not require antibiotic treatment but concerns about potential suppurative complications have contributed to acute sore throat being a leading cause of antibiotic prescription.[3] In addition to suppurative complications,

a more serious rare complication of concern is invasive GAS (iGAS) infection, which has high rates of morbidity and mortality.[4]

During the winter of 2022–23, the UK experienced increased incidence of iGAS infection. A total of 2415 confirmed iGAS cases were reported through laboratory surveillance in England, with 319 deaths across all age groups for the period between 12 September 2022 and 10 March 2023, an increase of 13% on the same period in the previous year.[5] The initial increase in number of cases was accompanied by substantial media coverage with widespread reporting.

In December 2022, media reports of fatal GAS infections intensified, increasing public anxiety, with a subsequent increase in the number of people presenting to primary care for assessment of sore throat symptoms.[6] During this time, the pre-existing and previously described NHS-funded community pharmacist-led sore throat test and treat (STTT) service was in place in Wales.[7] The STTT service offers walk-in access, structured clinical assessment, which incorporated clinical prediction of the likelihood of GAS using FeverPAIN/Centor scores, and a rapid antigen detection test (RADT) for GAS where appropriate. If GAS infection is detected, antibiotics can be supplied by a pharmacist in line with a patient group direction (PGD) that adheres to NICE guidance.[8]

Wales' STTT service has been extensively evaluated.[7,9–13] Data from a 16 month evaluation, representing the largest international study of a pharmacy-led STTT service internationally, found the service promoted appropriate use of RADT and antibiotics and could improve triage and use of healthcare resources.[13]

STTT consultations are recorded in a structured online data collection form on the national *Choose Pharmacy* IT application, providing excellent opportunities for rapid, near real-time evaluation. *Choose Pharmacy* data include standardized demographic information derived from matching patients to their existing health records in the Welsh Demographic Service, and clinical information in the form of free-text and pre-defined responses recorded by pharmacists during consultations. The increased incidents of iGAS infections provided an opportunity to rapidly evaluate the service's response to a substantial rise in the incidence of sore throat presentations and assess its utility in responding to heightened public awareness and concern resulting from the increased incidence and reporting of iGAS infection. In this study, we investigated trends in STTT consultations, GAS RADT rates and antibiotic supply rates amongst people presenting with sore throat to the Wales STTT service, before and during the period of increased GAS incidence.

Methods

Ethics

Data used in this study were collected as part of routine clinical care. Data provided to the researchers were fully anonymized. Individuals could not be identified. The study was registered with the research ethics committee of Cardiff School of Pharmacy and Pharmaceutical Sciences (reg. no. 2021-15), and with the Research and Development department of Velindre NHS Trust. There were no identifiers that could link information to an individual in any of the datasets; as such, this study required no ethical approval.

Study design

This was a cross-sectional study involving secondary analyses of data obtained from routine data sources, between January 2022 (coinciding with the gradual reintroduction of the STTT service after COVID-19 lockdown period) and March 2023. Anonymized individual-level data were obtained from electronic pharmacy records of all STTT service users aged 6 years and older for the study period.

Data collection and preparation

The structure of data input from pharmacists on *Choose Pharmacy* prevented incomplete or duplicate records. Microsoft Excel® v2306 was used to prepare the master dataset, comprising monthly extracts of STTT consultations. Data were transferred to IBM SPSS® v23 to obtain descriptive statistics and Stata Statistical Software release 16 to undertake more detailed statistical analyses.[14]

Outcomes and data analysis

Key outcomes of interest were: (i) number and trend of STTT consultations; (ii) number and proportion of RADT (per 100 STTT consultations) completed following the STTT algorithm; (iii) number and proportion of positive RADTs (per 100 RADTs); (iv) number and proportion of antibiotics supplied (per 100 STTT consultations and per 100 RADTs); and (v) number and proportion of pharmacy referrals to GPs and emergency services (per 100 STTT consultations).

Descriptive statistics were used to describe key characteristics of the STTT service. Categorical variables were summarized with total numbers, frequencies and proportions with 95% CIs for single proportions calculated as described by Newcombe in 1998.[15]

The first official government publication of an article on iGAS was 2 December,[5] and this article triggered mainstream media focusing on this. To explore changes over time and the effect of media reports of iGAS incidents from this 'period marker' of 2 December 2022, an interrupted time-series approach was used. Weekly number of STTT consultations and antibiotic supply rates (per 100 RADTs) were divided into pre-outbreak (week beginning 28 January 2022, when the STTT service was gradually reintroduced, to week ending 1 December 2022) and the outbreak period (2 December 2022 to week ending 30 March 2023). We use the term 'outbreak' simply to denote a period of heightened media reporting, rather than an official public health outbreak. The changes in levels (baseline value of the outcome at time zero) and trends (the rate of change) of the pre-outbreak segment and outbreak segment were analysed using ordinary least squares regression with Newey–West standard errors to handle autocorrelation, using the *itsa* command in Stata. A Cumby–Huizinga test was used to test for autocorrelation.[16,17]

Results

Impact on STTT consultations

A total of 27441 STTT consultations were recorded in the study period of January 2022 to March 2023, with 9308 consultations (33.9%) during December 2022 (Table 1, Figure 1). In the first week following the announcements of iGAS incidents (week commencing 2 December), a statistically significant and immediate increase occurred of 1700 consultations (95% CI: 924–2476), $P < 0.001$) (Figure S1, available as Supplementary data at *JAC* Online).

Impact on antibiotic supply

For the period January 2022 to March 2023, the overall antibiotic supply rate was 24% (95% CI: 23–24) of all STTT consultations and 31% (95% CI: 31–32) of all RADTs. The starting rate of antibiotic supply was 42.6 per 100 RADTs per week, which decreased by 0.16 per RADT over the time period prior to the iGAS incidents

Table 1. Monthly number and percentage of consultations, RADT use, positive RADT and antibiotic supply, between 1 January 2022 and 31 March 2023

Month	STTT consultations (*n*)	RADT (*n*)	Consultations provided with a RADT, % (95% CI)	Positive RADT(*n*)	RADTs that were positive, % (95% CI)	Antibiotics supplied (*n*)	Consultations supplied an antibiotic, % (95% CI)	RADT supplied an antibiotic, % (95% CI)
Jan 22	96	69	72 (62–80)	15	22 (14–33)	28	29 (21–39)	40 (30–52)
Feb 22	206	116	56 (50–63)	33	28 (21–37)	53	26 (20–32)	46 (37–55)
Mar 22	380	265	70 (65–74)	81	31 (25–36)	101	27 (22–31)	38 (33–44)
Apr 22	370	272	74 (69–78)	114	42 (36–48)	121	33 (28–38)	46 (39–50)
May 22	506	373	74 (70–77)	140	38 (33–43)	135	27 (23–31)	36 (32–41)
Jun 22	636	470	74 (70–77)	191	41 (36–45)	187	29 (26–33)	40 (36–44)
Jul 22	776	616	79 (76–82)	256	42 (38–46)	251	32 (29–36)	41 (37–45)
Aug 22	859	701	82 (79–84)	288	41 (38–41)	282	33 (30–36)	40 (37–44)
Sep 22	890	719	81 (78–83)	250	35 (32–38)	245	28 (25–31)	34 (31–38)
Oct 22	1268	1010	80 (77–82)	389	39 (36–42)	375	30 (27–32)	37 (34–40)
Nov 22	1805	1425	79 (77–81)	581	41 (38–43)	565	31 (29–34)	40 (37–42)
Dec 22	9308	6568	71 (70–72)	1619	25 (24–26)	1449	16 (15–16)	22 (21–23)
Jan 23	3524	2764	78 (77–80)	857	31 (29–33)	824	23 (22–25)	30 (28–32)
Feb 23	3271	2569	79 (77–79)	963	38 (36–40)	911	28 (26–29)	36 (34–37)
Mar 23	3546	2826	80 (78–81)	1056	37 (36–39)	992	28 (27–30)	35 (33–37)
Total	27441	20763	76 (75–76)	6833	33 (32–34)	6519	24 (23–24)	31 (31–32)

announcements (28 January to the week ending 1 December 2022), but this was not statistically significant after adjusting for seasonality (95% CI: −0.38 to 0.06, $P=0.16$) (Figure 2). In the first week following the first media reports of iGAS cases (week beginning 2 Dec), a statistically significant immediate decrease in supply rate of 13.9 antibiotics per 100 RADT was observed (95% CI: −18.40 to −9.40, $P<0.001$), followed by a statistically significant increase in the weekly rate of antibiotic supply per 100 RADT (relative to the before the announcements of iGAS incidents) of 1.29 antibiotics per consultations (95% CI: 0.47–2.10, $P=0.002$) (Figure 2). A similar trend was observed for antibiotic supply based on all STTT consultations (Figure S2).

Impact on referrals to other healthcare

Referral rates to other primary care or emergency settings remained below 10% of all consultations throughout the study period [mean (SD): 6.9% (1.7%)], with a referral rate of 8.7% for December 2022 (Figure 1).

Discussion

This is the first study to examine the impact of the increased incidence and heightened public awareness of iGAS in the UK in late 2022 on sore throat presentations in primary care and in particular on an NHS community pharmacy-led sore throat treatment service. We investigated trends in GAS positivity rate using RADTs with high specificity and selectivity for GAS, and antibiotic supply rates amongst people presenting with sore throat to Wales' STTT service, before, during and following the GAS outbreak. We found a substantial increase in patients presenting to pharmacies with sore throat symptoms, with a temporal relationship to increased media coverage.

Between November and December 2022, we found consultations where patients' symptoms made them eligible for a RADT decreased by 8.3%, and the percentage of positive RADTs decreased by 12.5%, suggesting individuals with apparently uncomplicated viral acute sore throats may have been more likely to attend a community pharmacy in the period for advice, testing and treatment. The timing of the increase in presentations, decrease in symptom severity and reduced RADT positivity rate could suggest increased media coverage raised anxiety levels amongst patients generally and fuelled increased primary care demand. Community pharmacists continued to refer fewer than 10% of patients to other primary care services, or out-of-hours and emergency care. The unchanged referral rate compared with the period outside of the outbreak is suggesting that either more severely ill patients with viral infections presented themselves in the pharmacy, due to the increased awareness of the STTT service amongst the public, or an increased anxiety of pharmacists and a slightly lower threshold for referring.

Our findings highlight the practical value of rapid RADTs to determine underlying aetiology during an infectious disease outbreak with high numbers of patients present with symptoms that could be difficult to distinguish from self-limiting viral illness. Rapid diagnostics were identified as a key element in guiding rational use of antibiotics in a 2016 UK government-commissioned review on tackling drug-resistant infections globally.[18] Rapid tests at the point of care were also mentioned in the 2019 UK five-year action plan for antimicrobial resistance as an area that would benefit from further research.[19] Multiple stakeholders, including healthcare professionals, government agencies, media and the public have shown increasing interest in the use of diagnostics, particularly point-of care tests, to rapidly diagnose GAS infections, in both community and secondary care settings.[20] This stratified approach with consideration for

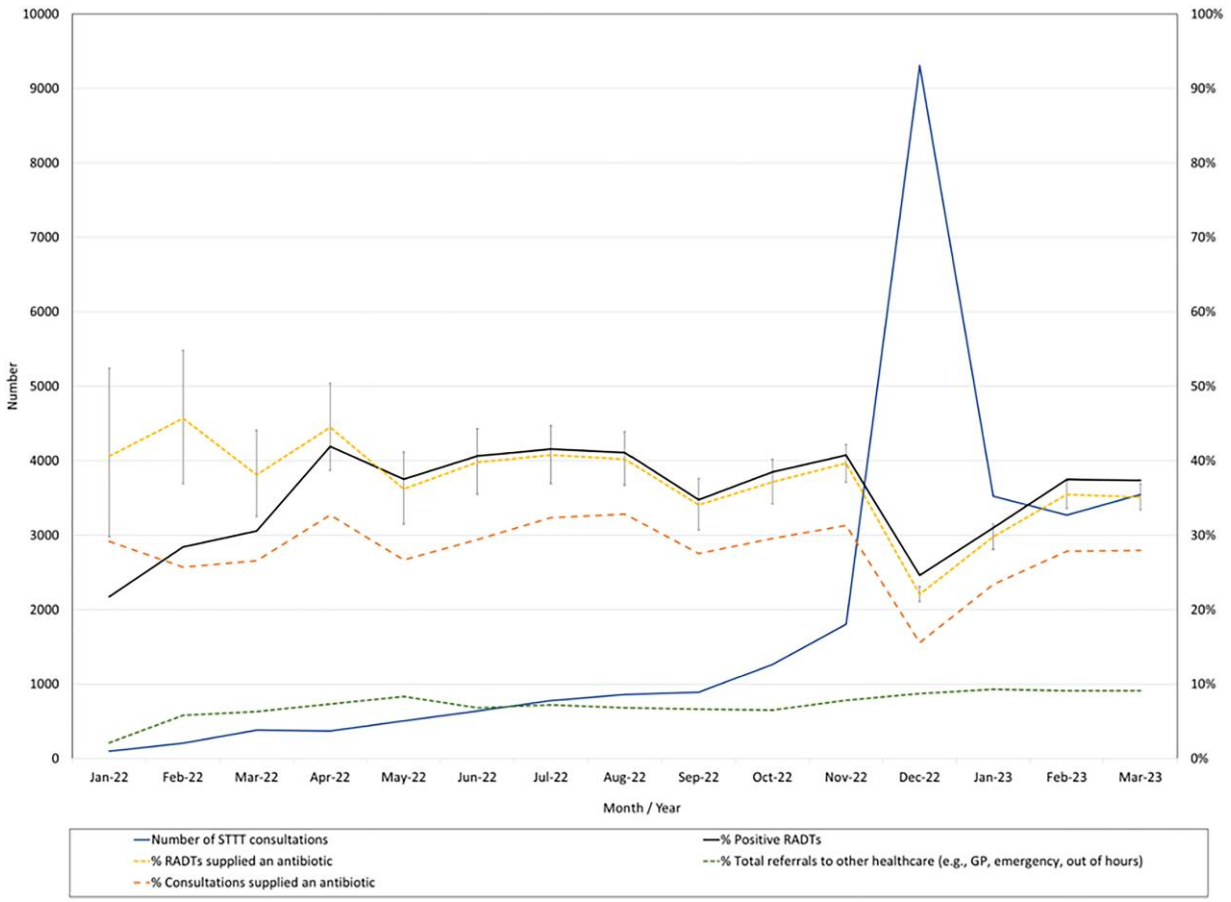

Figure 1. Number of STTT consultations and related percentages of positive RADT, antibiotic supply and onward referrals to other healthcare settings per month, between January 2022 and March 2023. This figure appears in colour in the online version of *JAC* and in black and white in the print version of *JAC*.

antibiotics only after a positive RADT confirms the presence of GAS is also supported by recent evidence provided by Gunnarsson *et al.*,[21] who explored nine different strategies for managing patients with apparently uncomplicated acute sore throat to identify a restrictive antibiotic use for clinical practice. In the UK, while stratification based on clinical scoring finds support from NICE recommendations, further research has been recommended concerning the role of an additional GAS RADT in settings such as community pharmacy.[22]

The role of pharmacists in triaging and treating patients with symptoms of sore throat has been recently recognized in an international consensus.[23] Our previous research contributed further to the body of evidence suggesting that, outside of periods of outbreak of infectious diseases, a community pharmacy-led sore throat service, with screening of service users using clinical scoring tools supported by RADT, has a role in promoting access to primary care without adversely affecting antibiotic stewardship.[7,9,10,12,13] Data from this study showed that even with a rapid increase in case numbers, pharmacists followed a structured protocol, which meant antibiotic supply was rational, suggesting that community pharmacies could potentially play a critical role in serving as an RADT site for patients experiencing sore throat in similar situations in the future. This has potential benefits such as timely diagnosis, targeted antimicrobial utilization or promoting symptomatic (non-antibiotic) treatment, including advice on use of over-the-counter analgesics and patient education on the limited role of antibiotics on viral infections. It would also reduce burden on primary care and hospitals by lowering unnecessary visits from patients who have non-severe symptoms.

Strengths and limitations

This is the first analysis of *Choose Pharmacy* data related to STTT service provision during the period of increased demand for health services resulting from the increased public awareness and anxiety that accompanied health authority and media announcements about increased cases of iGAS. The findings may be generalizable to the impact of similar reporting of other infectious diseases. The large dataset includes consultations provided by pharmacies across all parts of Wales, increasing the generalizability of our results. It is also reasonable to believe that a similar STTT service in another high-income country would behave similarly.

The existence of the national *Choose Pharmacy* database, enabling rapid access to structured data on all consultations, was critical to the timely evaluation of the service's response during

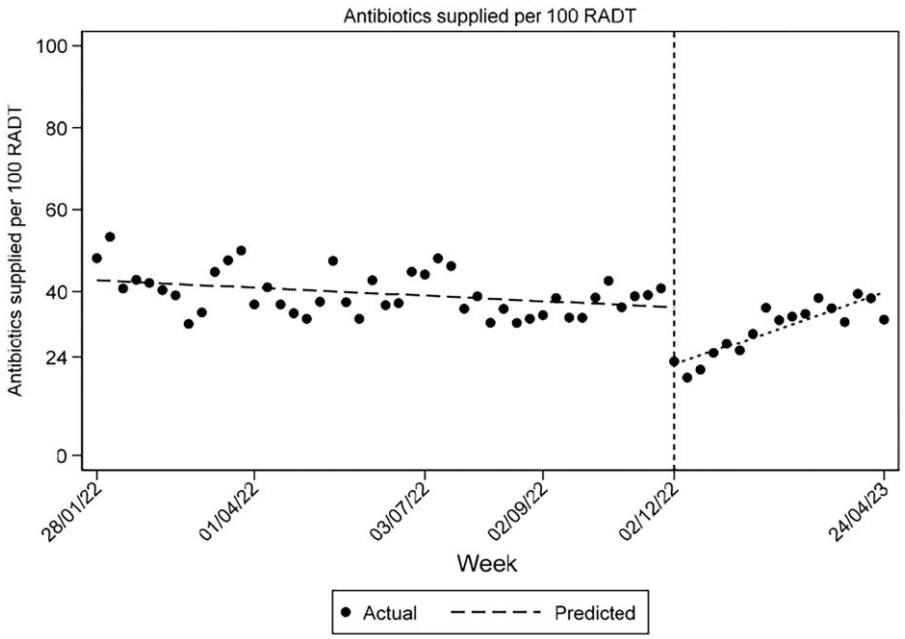

Figure 2. Weekly antibiotic supply data per 100 RADT to examine the effect of the iGAS incidents announcements from 2 December 2022. Dashed vertical line indicates the start of the announcement of iGAS incidents; dashed lines before and after indicate the predicted antibiotic supply rate (per 100 RADT) from the regression models pre- and post-outbreak, respectively.

this period. *Choose Pharmacy* is recorded prospectively and is mostly structured, so all the parameters required for this study were recorded, with no missing values.

Choose Pharmacy is currently not capturing socioeconomic characteristics of service users, and any explanatory information on deviation from the pre-defined pathway relies on pharmacist free-text input. There is currently no individual level data linkage of pharmacy data to other primary or secondary care data that would enable us to track adverse outcomes, although this is likely to be possible in future analyses. No formal data were available to estimate how pharmacists coped with the dramatically increased demand. No qualitative data are available to explain the discrepancy for the first 3 months between % positive RADT and % RADT supplied antibiotics, although this can be attributed to the service just being re-launched after COVID-19, in a period of general uncertainty.

Conclusions

Rapid access to structured individual-level patient data from the national pharmacy database enabled a timely evaluation of the community pharmacy STTT service during a period of increased demand for health services after media reports about an increase in iGAS infections during the winter of 2022. Our findings suggest that, despite a dramatic increase in sore throat consultation rates, the pre-specified pathway followed by pharmacists ensured appropriate use of RADT and helped limit unnecessary antibiotic use.

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Transparency declarations

None to declare.

Supplementary data

Figures S1 and S2 are available as Supplementary data at *JAC* Online.

References

1 Gunnarsson RK, Holm SE, Söderström M. The prevalence of beta-haemolytic streptococci in throat specimens from healthy children and adults: implications for the clinical value of throat cultures. *Scand J Prim Health Care* 1997; **15**: 149–55. https://doi.org/10.3109/02813439709018506

2 Spinks A, Glasziou PP, Del Mar CB. Antibiotics for treatment of sore throat in children and adults. *Cochrane Database Syst Rev* 2021; issue **12**: CD000023. https://doi.org/10.1002/14651858.CD000023.pub5

3 Cohen JF, Pauchard J-Y, Hjelm N *et al*. Efficacy and safety of rapid tests to guide antibiotic prescriptions for sore throat. *Cochrane Database Syst Rev* 2020; issue **6**: CD012431. https://doi.org/10.1002/14651858.CD012431.pub2

4 Nelson GE, Pondo T, Toews KA *et al*. Epidemiology of invasive group A streptococcal infections in the United States, 2005–2012. *Clin Infect Dis* 2016; **63**: 478–8. https://doi.org/10.1093/cid/ciw248

5 HM Government. UK Health Security Agency update on scarlet fever and invasive group A strep. 2023. https://www.gov.uk/government/news/ukhsa-update-on-scarlet-fever-and-invasive-group-a-strep-1.

6 Boston N. Strep A drives surge in GP demand on top of record appointments. 2022. https://www.gponline.com/strep-drives-surge-gp-demand-top-record-appointments/article/1807413.

7 Mantzourani E, Evans A, Cannings-John R *et al*. Impact of a pilot NHS-funded sore throat test and treat service in community pharmacies on provision and quality of patient care. *BMJ Open Qual* 2020; **9**: e000833. https://doi.org/10.1136/bmjoq-2019-000833

8 NICE. Sore Throat – Acute. 2021. https://cks.nice.org.uk/topics/sore-throat-acute/

9 Mantzourani E, Hicks R, Evans A *et al*. Community pharmacist views on the early stages of implementation of a pathfinder sore throat test and treat service in Wales: an exploratory study. *Integr Pharm Res Pract* 2019; **8**: 105–13. https://doi.org/10.2147/IPRP.S225333

10 Mantzourani E, Cannings-John R, Evans A *et al*. Understanding the impact of a new pharmacy sore throat test and treat service on patient experience: a survey study. *Res Social Adm Pharm* 2021; **17**: 969–77. https://doi.org/10.1016/j.sapharm.2020.07.034

11 Health Technology Wales. Evidence Appraisal Report. Rapid antigen detection tests for group A streptococcal infections to treat people with a sore throat in the community pharmacy setting. 2020. https://healthtechnology.wales/wp-content/uploads/2020/02/EAR020-Rapid-antigen-detecting-tests.pdf.

12 Mantzourani E, Cannings-John R, Evans A *et al*. To swab or not to swab? Using point-of-care tests to detect group A *Streptococcus* infections as part of a sore throat test and treat service in community pharmacy. *J Antimicrob Chemother* 2022; **77**: 803–6. https://doi.org/10.1093/jac/dkab470

13 Mantzourani E, Wasag D, Cannings-John R *et al*. Characteristics of the sore throat test and treat service in community pharmacies (STREP) in Wales: cross-sectional analysis of 11 304 consultations using anonymized electronic pharmacy records. *J Antimicrob Chemother* 2022; **78**: 84–92. https://doi.org/10.1093/jac/dkac358

14 StataCorp. Stata Statistical Software: Release 16. 2019. https://www.scirp.org/reference/referencespapers?referenceid=2757660.

15 Newcombe RG. Interval estimation for the difference between independent proportions: comparison of eleven methods. *Stat Med* 1998; **17**: 873–90. https://doi.org/10.1002/(SICI)1097-0258(19980430)17:8<873::AID-SIM779>3.0.CO;2-I

16 Linden A. Conducting interrupted time-series analysis for single- and multiple-group comparisons. *Stata J* 2015; **15**: 480–500. https://doi.org/10.1177/1536867X1501500208

17 Kontopatelis E, Doran T, Springate DA *et al*. Regression based quasi-experimental approach when randomisation is not an option: interrupted time series analysis. *BMJ* 2015; **350**: h2750. https://doi.org/10.1136/bmj.h2750

18 O'Neil J. Tackling drug-resistant infections globally: final report and recommendations. The Review on Antimicrobial Resistance. 2016. https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf.

19 HM Government. Tackling Antimicrobial resistance 2019-2024. The UK's five-year national action plan. 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1070263/UK_AMR_5_year_national_action_plan.pdf.

20 NHS England. Point of care testing in community pharmacies: Guidance for commissioners and community pharmacies delivering NHS services. 2022. https://www.england.nhs.uk/wp-content/uploads/2022/01/B0722-Point-of-Care-Testing-in-Community-Pharmacies-Guide_January-2022.pdf.

21 Gunnarsson R, Orda U, Elliott B *et al*. What is the optimal strategy for managing primary care patients with an uncomplicated acute sore throat? Comparing the consequences of nine different strategies using a compilation of previous studies. *BMJ Open* 2022; **12**: e059069. https://doi.org/10.1136/bmjopen-2021-059069

22 NICE. Rapid tests for group A streptococcal infections in people with a sore throat. Diagnostics guidance [DG38]. 2019. https://www.nice.org.uk/guidance/dg38.

23 Gunnarsson R, Ebell M, Centor R *et al*. Best management of patients with an acute sore throat—a critical analysis of current evidence and a consensus of experts from different countries and traditions. *Infect Dis (Lond)* 2023; **55**: 384–95. https://doi.org/10.1080/23744235.2023.2191714