

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Diagnostics Assessment Programme

Rapid Tests for Group A Streptococcal infections in people with a sore throat

Final scope

November 2018

1 Introduction

The medical technologies topic oversight group identified the topic 'Rapid tests for Group A Streptococcal infections' as potentially suitable for evaluation by the Diagnostics Assessment Programme on the basis of a briefing which was published as a [NICE medtech innovation briefing](#).

The revised scope was informed by discussions at the scoping workshop on 24 October 2018 and the assessment subgroup meeting held on 7 November 2018. A glossary of terms and a list of abbreviations are provided in appendices A and B.

2 Description of the technologies

This section describes the properties of the diagnostic technology based on information provided to NICE by companies and experts. NICE has not carried out an independent evaluation of this description.

2.1 Purpose of the medical technology

The rapid tests for the Group A Streptococcus (Strep A) bacteria are intended to be used in addition to clinical scoring systems, such as FeverPAIN and Centor, to increase diagnostic confidence of a suspected Strep A infection. They aim to help guide antimicrobial prescribing decisions in people presenting with an acute sore throat and to contribute to improving antimicrobial stewardship. The tests may be suitable for use in all settings where patients may present with an acute sore throat; this includes both primary and secondary care, and community pharmacies.

2.2 Product properties

21 rapid tests for Strep A are available. The tests use either immunoassay detection methods (rapid antigen detection tests) or molecular methods (polymerase chain reaction [PCR] or isothermal nucleic acid amplification). The tests listed below were mostly identified from the NICE medtech innovation briefing on [point-of-care diagnostic testing in primary care for Strep A infection in sore throat](#). Additional tests that may be relevant were identified from literature searches and from stakeholder feedback.

2.2.1 Rapid antigen detection tests

Seventeen rapid antigen detection tests were identified, and their product properties are summarised below. Of these, 16 tests use lateral flow techniques (also known as immunochromatographic or immunofluorescent assays), and 1 test is a turbidimetric immunoassay.

The lateral flow (immunochromatographic and immunofluorescence) tests require a throat swab which is typically placed into a specimen extraction tube and mixed with reagents to extract the sample from the swab. The swab is discarded and then either a test strip is immersed in the extracted solution, or drops of the extracted solution are added to the sample well of a test cassette. The sample then migrates along the test strip or cassette, with any Strep A antigens present in the sample binding to immobilised Strep A antibodies in the test strip or cassette. When Strep A is present at levels above the detection limit of the test, a line appears in the test line region of the strip or cassette. A control line shows technical success of the test. Results should be discarded when the control line indicates that the test has failed (that is, no line appears in the control line region). Depending on the technology, the results are read by either visual inspection or by using a test reader device.

The turbidimetric immunoassay has similar sample collection and extraction steps to the lateral flow tests, but the extracted solution is placed into a cuvette which is prefilled with reagents. This contains rabbit anti-Strep A antibodies which bind to Strep A antigens present in the sample. The Quikread go instrument measures the absorbance of each cuvette and converts the absorbance value into a positive or negative result.

Several of the companies recommend that negative rapid antigen detection test results are confirmed by microbiological culture of a throat swab.

Table 1 Rapid antigen detection tests – product properties

Product	Test format	Method	LOD	Time to result^a (minutes)	Results	Confirmation of negative result?
Clearview exact Strep A cassette (Abbott)	Cassette	Lateral flow (immunochromatographic)	5x10 ⁴ organisms/test	5	Qualitative	Yes
Clearview exact Strep A dipstick (Abbott)	Test strip	Lateral flow (immunochromatographic)	5x10 ⁴ organisms/test	5	Qualitative	Yes
BD Veritor plus system group A Strep (Beckton Dickinson)	Cassette	Lateral flow (immunochromatographic) ^b	Strain 12384: 1x10 ⁵ CFU/ml Strain 19615: 5x10 ⁴ CFU/ml Strain 25663: 2x10 ⁵ CFU/ml	5	Qualitative	Yes
Strep A rapid test (Biopanda reagents)	Cassette	Lateral flow (immunochromatographic)	1E+05organism s/swab	5	Qualitative	Yes
Strep A rapid test (Biopanda reagents)	Test strip	Lateral flow (immunochromatographic)	1E+05organism s/swab	5	Qualitative	Yes
NADAL Strep A (nal von minden GmbH)	Test strip	Lateral flow (immunochromatographic)	1.5x10 ⁵ organisms/swab	5	Qualitative	No

Product	Test format	Method	LOD	Time to result ^a (minutes)	Results	Confirmation of negative result?
NADAL Strep A (nal von minden GmbH)	Cassette	Lateral flow (immunochromatographic)	1.5x10 ⁵ organisms/swab	5	Qualitative	No
NADAL Strep A plus (nal von minden GmbH)	Cassette	Lateral flow (immunochromatographic)	1.5x10 ⁵ organisms/swab	5	Qualitative	No
NADAL Strep A plus (nal von minden GmbH)	Test strip	Lateral flow (immunochromatographic)	1.5x10 ⁵ organisms/swab	5	Qualitative	No
NADAL Strep A scan test (nal von minden GmbH)	Cassette	Lateral flow ^b (immunochromatographic)	1.5x10 ⁵ organisms/swab	5	Qualitative	No
OSOM Strep A test (Sekisui diagnostics)	Test strip	Lateral flow (immunochromatographic)	Not known	5	Qualitative	Yes
QuikRead Go Strep A test kit (Orion Diagnostica)	N/A	Turbidimetric immunoassay ^c	7x10 ⁴ CFU/swab	<7	Qualitative	Not known
Alere TestPack Plus Strep A (Abbott)	Cassette	Lateral flow (immunochromatographic)	Not known	5	Qualitative	Yes (if symptoms persist)

Product	Test format	Method	LOD	Time to result ^a (minutes)	Results	Confirmation of negative result?
Bionexia Strep A plus (Biomerieux)	Cassette	Lateral flow (immunochromatographic)	1x10 ⁴ organisms/swab	5	Qualitative	Not known
Bionexia Strep A dipstick (Biomerieux)	Test strip	Lateral flow (immunochromatographic)	Not known	5	Qualitative	Not known
Biosynex Strep A (Biosynex)	Cassette	Lateral flow (immunochromatographic)	1x10 ⁵ bacteria/swab	5	Qualitative	Not known
Sofia Strep A FIA (Quidel)	Cassette	Lateral flow (immunofluorescence) ^d	Strain Bruno [CIP 104226]: 1.86x10 ⁴ CFU/test Strain CDC-SS- 1402: 9.24x10 ³ CFU/test Strain CDC-SS- 1460: 2.34x10 ⁴ CFU/test	5 to 6	Qualitative	Yes
Abbreviations: CFU/ml colony forming units per millilitre; LOD limit of detection.						
^a read time (does not include sample preparation time) ^b requires BD Veritor Plus analyser ^c requires QuikRead go instrument ^d requires Sofia analyser						

2.2.2 Molecular tests

Four molecular tests were identified which use nucleic acid amplification techniques, either polymerase chain reaction (PCR) or isothermal nucleic acid amplification, of a specific segment of the Strep A genome. In each test, any Strep A DNA present in the sample is labelled during the reaction, producing fluorescent light, which is monitored by a reader. If fluorescence reaches a specific threshold, the test is considered positive. If the threshold is not reached during the set time (usually up to 15 minutes), the test is negative.

Table 2 Molecular tests – product properties

Product	Method	Analyser	LOD	Time to result (minutes) ^a	Result	Confirmation of negative result?
Alere i Strep A (Abbott)	Isothermal nucleic acid amplification	Alere i instrument	Strain: ATCC12344 4.2 CFU/ml ATCC19615 41.8 CFU/ml	<8	Qualitative	Yes
Alere i Strep A 2 (Abbott)	Isothermal nucleic acid amplification	Alere i instrument	Not known	<6	Qualitative	No
Cobas Strep A assay (Roche Diagnostics)	Polymerase chain reaction	Cobas Liat analyser	Strain: ATCC BAA-946 5 CFU/ml ATCC BAA-1066 10 CFU/ml ATCC 12370 10 CFU/ml ATCC 700294 20 CFU/ml	<15	Qualitative	No
Xpert Xpress Strep A (Cepheid)	Polymerase chain reaction	GeneXpert system	Not known	≥18	Not known	Not known
Abbreviations: CFU/ml colony forming units per millilitre; LOD limit of detection.						
^a does not include sample preparation time						

3 Target conditions

3.1 Sore throat

Sore throat is usually a self-limiting condition which does not require any treatment. It is characterised by inflammation of the pharynx (pharyngitis) or inflammation of the tonsils (tonsillitis). Symptoms of a sore throat include pain in the throat, fever and a headache. Symptoms could also include: nausea, vomiting, abdominal pain, muscle pain, scarlet fever and rashes. A sore throat is most often caused by a viral infection, but some can be caused by a bacterial infection. The most common cause of bacterial pharyngitis is Group A Streptococcus (Strep A) (Public Health England 2015). Expert advice suggests that bacterial sore throat can also be caused by Group C Streptococcus, Group G Streptococcus, *Streptococcus milleri* and *Fusobacterium necrophorum*. Strep A is thought to account for around 80% of bacterial throat infections, and Group C and G Strep for around 20%.

3.2 Group A Streptococcus

Strep A (also known as *Streptococcus pyogenes*) is a bacterium which commonly colonises the throat or skin and can cause a range of infections. Infections caused by Strep A include tonsillitis, pharyngitis, scarlet fever, impetigo, erysipelas (an infection in the upper layer of the skin), cellulitis and pneumonia. Strep A infections of the throat are more common in children than in adults and the incidence of Strep A infections is highest in winter and spring. Whilst most cases of Strep A infection resolve without complications, in rare cases rheumatic fever (which affects the heart) or post-Streptococcal glomerulonephritis (which affects the kidneys) can develop. Strep A can also cause severe infections (invasive group A Strep) if the bacteria move from the throat into the body, leading to sepsis or Streptococcal toxic shock syndrome. Strep A is also associated with necrotizing fasciitis (a severe infection of soft tissue). Expert advice suggests that people aged over 75 are more likely to have a Strep A infection that becomes invasive and have a higher associated mortality rate.

Onward transmission of Strep A may also be a concern, particularly amongst younger children, older people, pregnant women and people who are immunocompromised. Onward transmission occurs when the infection passes from one person to another and can occur via airborne droplets when a person coughs or sneezes or through sharing food and drink. When a person who is suspected of having a Strep A infection is in close contact with these higher risk groups, antibiotics may be prescribed to reduce the risk of onward transmission. Group C and G Strep are thought to present a lower public health risk than Group A, although Group G can cause invasive disease.

Scarlet fever is an infection that can develop in people who have a Strep A infection of the throat. It is characterised by a red rash and can be accompanied by a fever. Expert advice suggests that it is most common in children aged under 15. The [third report on seasonal activity of Group A Streptococcal infections in 2017/18](#) reported that the incidence of scarlet fever in children ranged from 46 per 100,000 in children aged less than 1 year to 1488 per 100,000 in children aged 1 to 4. In adults, incidence of scarlet fever reduces with age, with infection rates of 138 per 100,000 in people aged 15 to 44 years, but only 2 per 100,000 in people aged over 75 (Public Health England 2018).

Both invasive Group A Strep and scarlet fever are notifiable diseases and must be reported to Public Health England health protection teams. Guidance on [managing close contacts of cases of invasive Group A Strep](#) and managing [scarlet fever outbreaks in school, nurseries and other childcare settings](#) are available from Public Health England.

3.3 Diagnostic and care pathway

The care pathway for assessing and treating a sore throat is outlined in [NICE's antimicrobial prescribing guidance on sore throat](#) (NG84). The guideline notes that acute sore throat (including pharyngitis and tonsillitis) is self-limiting and often triggered by a viral infection of the upper respiratory tract. Further, symptoms can last for around 1 week, but most people will get better within this time without antibiotics, regardless of cause (bacteria or virus).

The guideline (NG84) recommends that healthcare professionals advise people presenting with a sore throat that the usual course of a sore throat is around 1 week and that the symptoms, including fever, pain and dehydration, can be managed with self-care. In addition, risk scoring tools can be used to identify people who may be more likely to benefit from an antibiotic. If the person is systemically very unwell, has symptoms and signs of a more serious illness or condition, or is at high-risk of complications, an immediate antibiotic prescription should be given with advice about seeking medical help if symptoms worsen, or further appropriate investigations or management should be offered. People should be referred to hospital if they have a severe systemic infection, severe suppurative complications (e.g. quinsy [peritonsillar abscess], cellulitis, parapharyngeal abscess, retropharyngeal abscess or Lemierre syndrome). In addition people with suspected epiglottitis should be referred to secondary care to have their throat examined (Public Health England 2015). People who are at an increased risk of complications include people who have a history of rheumatic fever, the very young or very old and people who are at risk of immunosuppression.

Children aged under 5 who present with a sore throat and a fever should be assessed as outlined in the NICE guideline on [fever in under 5s](#). Expert advice suggests that the assessment of children aged under 5 is very different to the assessment of older children and adults. They may be more likely to present with a fever as an indicator of infection and are not able to communicate their symptoms, making it difficult to identify whether they have a sore throat. It can also be difficult to obtain throat swabs from younger children and prescribing thresholds are likely to be different because of the risk of children becoming unwell very quickly. The scope of this assessment therefore focuses on people aged 5 and above.

Advice on diagnosing and managing sore throat is also provided in the NICE [clinical knowledge summary on acute sore throat](#) and in Public Health England's guidance on [managing common infections in primary care](#).

3.3.1 *Self-care*

NICE's [antimicrobial prescribing guidance on sore throat](#) (NG84) outlines self-care for people with a sore-throat. It makes the following recommendations:

- Consider paracetamol for pain or fever, or if preferred and suitable, ibuprofen.
- Advise about the adequate intake of fluids.
- Explain that some adults may wish to try medicated lozenges containing either a local anaesthetic, a non-steroidal anti-inflammatory drug (NSAID) or an antiseptic. However, they may only help to reduce pain by a small amount.

3.3.2 *Clinical scoring tools*

NICE's [antimicrobial prescribing guidance on sore throat](#) (NG84) recommends using either the FeverPAIN or Centor clinical scoring tools to identify people who are more likely to benefit from an antibiotic.

FeverPAIN

The FeverPAIN clinical scoring tool includes the following variables:

- Clinical history
 - Sore throat (none; mild; moderate; severe)
 - Cough or cold symptoms (none; mild; moderate; severe)

- Muscle aches (none; mild; moderate; severe)
- Fever in last 24 hours (yes; no)
- Onset of illness (0-3 days; 4-7 days; 7+ days)
- Clinical examination
 - Cervical glands (none; 1-2cm; >2cm)
 - Inflamed tonsils (none; mild; moderate; severe)
 - Pus on tonsils (yes; no)

The result of FeverPAIN is presented as a score ranging from 0 to 5.

Centor

The Centor clinical scoring tool includes the following variables:

- Cough (yes; no)
- Exudate or swelling on tonsils (no; yes)
- Tender/swollen anterior cervical lymph nodes (no; yes)
- Temperature >38°C (no; yes)

Expert advice suggests that the Mclsaac (modified Centor) clinical scoring tool may also be used to assess people with sore throats. The Mclsaac score adjusts the Centor score to account for the higher incidence of Strep A in children and reduced incidence in older adults. This adds age criteria (3-14 years; 15-44 years; ≥45 years), and adds one point for those aged under 15 and subtracts one point for those aged 45 and over (Fine et al. 2012).

The result of Centor/modified Centor is presented as a score ranging from 0 to 4.

3.3.3 Microbiology investigations

Guidance on microbiological testing for throat swabs is provided in Public Health England's UK Standards for Microbiology Investigations B9: [Investigation of throat related specimens](#) (2015). Standard media for throat swabs are anaerobic blood agar which is incubated for 18 to 24 hours or aerobic Staphylococcus/Streptococcus selective agar which is incubated for 18 to 48 hours. The target organisms for these media are Lancefield group A, C and G Streptococci. Additional media should be used in specific clinical

situations where target organisms other than Lancefield group A, C and G Streptococci are suspected, for example where there is a history of foreign travel to a high risk area, cultures for *Corynebacterium diphtheriae* and *Corynebacterium ulcerans* may be done. Where colonies are identified antimicrobial susceptibility testing should be done in-line with [British Society for Antimicrobial Chemotherapy](#) (BSAC) or [European Committee on Antimicrobial Susceptibility Testing](#) (EUCAST) guidelines.

Expert advice suggests that in current practice throat swabs are typically only taken for people presenting with recurrent sore throats, when there has been a poor response to a first-line antibiotic, to exclude other infections such as *Fusobacterium necrophorum* or glandular fever, or if definitive confirmation of Strep A infection is needed, for example in patients with a history of rheumatic fever.

3.3.4 Treatment with antibiotics

Antibiotic prescribing for sore throat should be guided by the results of FeverPAIN or Centor, unless the patient is systemically very unwell, has symptoms and signs of a more serious illness or condition, or is at high-risk of complications. Antibiotics for sore throat may reduce the risk of post-infection complications and reduce the risk of Strep A spreading to other people such as family members and close contacts; however, antibiotics only shorten symptoms by around 16 hours, on average (NG84). Targeting the use of antibiotics to those most likely to benefit can contribute to improved antimicrobial stewardship. Withholding antibiotics in this clinical scenario is unlikely to result in complications, and is balanced against the adverse effects associated with antibiotics such as [antibiotic associated diarrhoea](#) and nausea.

People who are unlikely to benefit from an antibiotic

People with a FeverPAIN score of 0 or 1, or a Centor score of 0, 1 and 2 are unlikely to benefit from an antibiotic and should not be offered an antibiotic prescription. They should be given advice about self-care and advised to seek medical help if their symptoms worsen rapidly or significantly, they do not start to improve after 1 week, or they become systemically unwell. Expert advice suggests that the rapid Strep A tests would not be useful in this group.

People who may be more likely to benefit from an antibiotic

People with a FeverPAIN score of 2 or 3 may be more likely to benefit from an antibiotic. In this group of people advice on self-care and when to seek further medical help could be given instead of a prescription or a back-up prescription could be considered. Where a back-up prescription is given the person should

be advised that an antibiotic is not needed immediately, but the prescription can be used if the symptoms do not start to improve within 3 to 5 days or if they worsen rapidly or significantly at any time. Expert advice suggests that the rapid Strep A tests could be useful in this group.

People who are most likely to benefit from an antibiotic

People with a FeverPAIN score of 4 or 5, or a Centor score of 3 or 4 are most likely to benefit from an antibiotic. In this group of people either an immediate or a back-up antibiotic prescription should be considered taking into account both the unlikely event of complications if antibiotics are withheld and the possible adverse effects of antibiotics. Expert advice suggests that the rapid Strep A tests could be useful in this group.

Recommended antibiotics

NICE's antimicrobial prescribing guidance on sore throat (NG84) makes recommendations on which antibiotic should be chosen for both adults and children. The first choice for adults aged 18 years and over is Phenoxymethylpenicillin (500mg four times a day or 1000mg twice a day for 5 to 10 days). Alternative first choices for penicillin allergy or intolerance are Clarithromycin (250mg to 500mg twice a day for 5 days) or Erythromycin (250mg to 500mg four times a day or 500mg to 1000mg twice a day for 5 days). Erythromycin is preferred in women who are pregnant.

The first choice for children and young people under 18 years is Phenoxymethylpenicillin. Alternative first choices for penicillin allergy or intolerance are Clarithromycin or Erythromycin. Dosing for all the options vary according to age and body weight.

3.4 Patient issues and preferences

Use of the rapid tests for Strep A infection may provide more information to patients to help them decide whether they wish to have antibiotics or not. Where the tests are available in community pharmacies, they may increase access to healthcare for people who find getting an appointment with their GP difficult because of their working hours or carer responsibilities. Expert advice suggests that in some circumstances, using the tests could increase access and the number of people requesting antibiotics, who would previously have managed their sore throat with self-care only.

4 Comparator

The comparator for this assessment is antibiotic prescribing on the basis of clinical judgement and clinical scoring tools alone. This is described above in

section 3.3 (diagnostic and care pathway). The clinical scoring tools which may be used in NHS practice are FeverPAIN and Centor/modified Centor (Mclsaac).

The reference standard for assessing the accuracy of the rapid tests is microbiological culture of throat swabs in a laboratory.

5 Scope of the assessment

Table 3 Scope of the assessment

Decision question	Does using rapid tests for Group A Streptococcal infection as an adjunct to clinical scoring tools to guide antibiotic prescribing in people aged 5 and over with sore throats represent a clinical- and cost effective use of NHS resources?
Populations	<p>People aged 5 and over presenting to a healthcare provider with symptoms of an acute sore throat who are identified as being more or most likely to benefit from an antibiotic by a clinical scoring tool.</p> <p>Potential subgroups include:</p> <ul style="list-style-type: none"> • Children aged 5 to 14* • Adults aged 15 to 75 • Adults aged over 75** <p>* children aged 5 to 14 are thought to be at greatest risk of developing Scarlet fever</p> <p>** Adults aged over 75 are thought to have the greatest case mortality rate for invasive Group A Strep.</p>
Interventions	<ul style="list-style-type: none"> • Clearview exact Strep A cassette (Abbott) • Clearview exact Strep A dipstick (Abbott) • BD Veritor plus system group A Strep (Beckton Dickinson) • Strep A rapid test cassette (Biopanda Reagents) • Strep A rapid test dipstick (Biopanda Reagents) • NADAL Strep A test strip (Nal von Minden) • NADAL Strep A cassette (Nal von Minden) • NADAL Strep A plus cassette (Nal von Minden) • NADAL Strep A plus test strip (Nal von Minden) • NADAL Strep A scan test (Nal von Minden) • OSOM Strep A test (Sekisui diagnostics) • QuikRead Go Strep A test kit (Orion Diagnostica) • Alere TestPack Plus Strep A (Abbott)

	<ul style="list-style-type: none"> • Bionexia Strep A plus cassette (Biomerieux) • Bionexia Strep A dipstick (Biomerieux) • Biosynex Strep A (Biosynex) • Sofia Strep A FIA (Quidel) • Alere i Strep A (Abbott) • Alere i Strep A 2 (Abbott) • Cobas Strep A assay on Liat system (Roche) • Xpert Xpress Strep A (Cepheid) <p>All rapid tests would be used in conjunction with clinical judgement and a clinical scoring tool such as FeverPAIN or Centor.</p>
Comparator	<p>Antibiotic prescribing decisions using clinical judgement and a clinical scoring tool such as FeverPAIN or Centor.</p> <p>The reference standard for assessing the accuracy of the rapid Strep A tests is microbiological culture of throat swabs.</p>
Healthcare setting	<p>Primary care</p> <ul style="list-style-type: none"> • Medical services • Pharmacy services • Urgent care/walk in services <p>Secondary care</p> <ul style="list-style-type: none"> • Urgent care/walk in services • Emergency departments
Outcomes	<p>Intermediate measures for consideration may include:</p> <ul style="list-style-type: none"> • Diagnostic accuracy • Discordant results with standard microbiology tests • Time to test results • Test failure rate • Time to antimicrobial prescribing decision • Changes to antimicrobial prescribing decision • Number of appointments required per episode • Number of delayed or immediate antibiotic prescriptions issued <p>Clinical outcomes for consideration may include:</p> <ul style="list-style-type: none"> • Morbidity, including post-strep A infection complications such as rheumatic fever and side-effects from antibiotic therapy • Mortality

	<ul style="list-style-type: none"> • Contribution to antimicrobial stewardship and onward transmission of infection
	<p>Patient-reported outcomes for consideration may include:</p> <ul style="list-style-type: none"> • Health-related quality of life • Patient or carer satisfaction with test and antimicrobial prescribing decision • Healthcare professional satisfaction with test and antimicrobial prescribing decision
	<p>Costs will be considered from an NHS and Personal Social Services perspective. Costs for consideration may include:</p> <ul style="list-style-type: none"> • Cost of equipment, reagents and consumables for rapid tests • Costs of throat swabs and microbiological culture • Cost of staff and associated training • Costs associated with treatment • Costs associated with onward transmission • Costs associated with antimicrobial resistance • Medical costs arising from testing and care such as appointments in primary care or attendance at an urgent care centre • Medical costs arising from adverse events, including those associated with false negative results and missed treatment, and false positive test results and inappropriate treatment
	<p>The cost-effectiveness of interventions should be expressed in terms of incremental cost per quality-adjusted life year.</p>
Time horizon	<p>The time horizon for estimating clinical and cost effectiveness should be sufficiently long to reflect any differences in costs or outcomes between the technologies being compared.</p>

6 Other issues for consideration

The reference standard for assessing the accuracy of the rapid tests is microbiological culture of throat swabs. This is unlikely to be 100% accurate and the impact of this may need to be explored in sensitivity analyses.

Several scenarios for implementing the tests may need to be explored through modelling. For example during a primary care consultation, a patient could have a rapid test during the initial consultation or they could be referred to a practice nurse or to a community pharmacy for testing. There may also be differences in the populations presenting to each healthcare setting which may need to be taken into account.

An economic model has previously been used to assess the cost effectiveness of a rapid antigen detection test with FeverPAIN compared with FeverPAIN alone to guide antibiotic prescribing for sore throat in primary care (Little et al. 2014). The PRImary Care Streptococcal Management study (PRISM) compared 5 rapid antigen detection tests in an in-vitro evaluation, developed and validated the FeverPAIN clinical score and compared 3 antimicrobial prescribing strategies (delayed prescribing, prescribing guided by FeverPAIN; prescribing guided by FeverPAIN and a rapid antigen detection test). The results of the cost effectiveness analysis suggested that using FeverPAIN alone was more cost effective than in conjunction with a rapid antigen detection test.

Use of the tests may also contribute to antimicrobial stewardship and have an impact on onward transmission rates if there is a difference in antibiotic prescribing rates between the modelled pathways. It may not be possible to quantify this impact in the economic model, but the committee may need to consider this as an uncaptured benefit or disbenefit when discussing the results of the analyses.

7 Potential equality issues

NICE is committed to promoting equality of opportunity, eliminating unlawful discrimination and fostering good relations between people with particular protected characteristics and others.

The incidence of strep A, and associated infections such as scarlet fever are most common in children. The mortality rate associated with invasive Group A Strep is greatest in people aged over 75. Healthcare professionals may be more concerned about onward transmission of Strep A where a person is in close contact with someone who is pregnant or someone who is immunocompromised.

People with cognitive impairment may be less able to communicate their symptoms to a carer or healthcare professional. Injecting drug users are thought to be at a greater risk of developing invasive Group A Strep.

8 Potential implementation issues

Potential adoption levers identified by the NICE Adoption and Impact team include:

- The potential for the tests to support a diagnosis and a clinical decision to not prescribe antibiotics and encourage patients to self-care.

- The potential to reduce visits to primary care if the tests are done in alternative settings, such as a community pharmacy.

Potential adoption barriers identified by the NICE Adoption and Impact team include:

- The cost of the tests.
- The time required to process the test and interpret the result which may disrupt an appointment in primary care.
- Concerns regarding the reliability of the tests and missing an alternative diagnosis when the tests are used in community pharmacies.
- A belief that the tests may encourage over-medicalisation of sore throats and discourage people to self-care.

During the scoping workshop it was also highlighted that additional training may be required in community pharmacies around the use of clinical scoring tools such as FeverPAIN and Centor.

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Appendix A Glossary of terms

Cellulitis

A bacterial infection of the skin and tissues beneath the skin.

Glomerulonephritis

Damage to the glomeruli (filters in the kidneys) which is often caused by the immune system.

Group A Streptococcus (Strep A)

A bacterium which commonly colonises the skin and throat. It can cause a range of infections including tonsillitis and pharyngitis.

Lemierre syndrome

A rare complication of a bacterial throat infection where the bacteria spread to a neighbouring blood vessel causing blood clots.

Necrotizing fasciitis

A rare infection caused by Strep A that affects the tissue beneath the skin, including the muscles.

Para- and retro-pharyngeal abscess

An abscess in the throat.

Pharyngitis

Inflammation of the pharynx, which is at the back of the throat. It is commonly described as a sore throat. It is usually caused by a viral infection.

Phenoxymethylpenicillin

Antibiotic used to treat group A Streptococcus infections of the throat. It is also known as penicillin V.

Quinsy (peritonsillar abscess)

A complication of tonsillitis where an abscess forms between a tonsil and the wall of the throat.

Rheumatic fever

A complication that can occur after a Strep A infection of the throat. It is caused by the immune system's reaction to Strep A and is characterised by inflammation in the joints and heart problems (rheumatic heart disease), and can reoccur. People who have had rheumatic fever are therefore a high risk of a repeat infection if they have strep throat in the future.

Rheumatic heart disease

Damage to heart valves caused by rheumatic fever. If left untreated it can increase a person's risk of heart failure, arrhythmias, stroke, and endocarditis.

Strep throat

A bacterial infection in the throat caused by Strep A.

Streptococcal toxic shock syndrome

A severe illness caused by an invasive Strep A infection which results in shock and multiorgan failure.

Suppurative

Causing, or characterised by, production of pus.

Tonsillitis

Inflammation of the tonsils, usually caused by a viral infection.

Appendix B

Abbreviations

DNA	Deoxyribonucleic acid
PCR	Polymerase chain reaction
Strep A	Group A Streptococcus

Appendix C References

Fine AM, Nizet V and Mandl KD (2012) Large-Scale Validation of the Centor and Mclsaac Scores to Predict Group A Streptococcal Pharyngitis. Arch Intern Med; 172 (11), 847-852.

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