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PRACTICE GUIDELINES

# Guidelines for prevention and control of group A streptococcal infection in acute healthcare and maternity settings in the UK

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**KEYWORDS**

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**Summary** Hospital outbreaks of group A streptococcal (GAS) infection can be devastating and occasionally result in the death of previously well patients. Approximately one in ten cases of severe GAS infection is healthcare-associated. This guidance, produced by a multidisciplinary working group, provides an evidence-based systematic approach to the investigation of single cases or outbreaks of healthcare-associated GAS infection in acute care or maternity settings.

The guideline recommends that all cases of GAS infection potentially acquired in hospital or through contact with healthcare or maternity services should be investigated. Healthcare workers, the environment, and other patients are possible sources of transmission. Screening of epidemiologically linked healthcare workers should be considered for healthcare-associated cases of GAS infection where no alternative source is readily identified. Communal facilities, such as baths, bidets and showers, should be cleaned and decontaminated between all patients especially on delivery suites, post-natal wards and other high risk areas. Continuous surveillance is required to identify outbreaks which arise over long periods of time. GAS isolates from in-patients, peri-partum patients, neonates, and post-operative wounds should be saved for six months to facilitate outbreak investigation. These guidelines do not cover diagnosis and treatment of GAS infection which should be discussed with an infection specialist. Crown Copyright © 2011 Published by Elsevier Ltd on behalf of The British Infection Association. All rights reserved.

## Introduction

The overriding trend over the last century has been one of dramatic decline in severe GAS infections. However, the last three decades have witnessed periodic upsurges in Europe and beyond.<sup>1</sup> The reasons for these changes are not understood, but might represent evolutionary shifts in circulating strains, driven by population immunity. Current estimates of annual incidence of severe GAS infection range from 2 to 5 per 100,000 population in developed countries, with case fatality rates ranging from 8 to 23%.<sup>1–4</sup> Data collected in 2003–04 as part of a European project recorded a rate of 3.33 cases per 100,000 population in England, Wales and Northern Ireland.<sup>5</sup>

## Incidence of healthcare-associated and postpartum GAS infection

Between 5 and 12% of cases of severe GAS infection are found to be healthcare-associated.<sup>1,3–6</sup> UK data in 2003–04 identified 9% of severe GAS infections as being healthcare-

associated, most (58%) being post-surgical infections.<sup>5</sup> Between 2 and 11% of all severe GAS infections are associated with recent childbirth, a rate of approximately 0.06 per 1000 births.<sup>5–7</sup> Findings from the 2006–08 triennial report on maternal deaths identified an increase in the numbers of maternal deaths associated with GAS genital tract sepsis from around 1 death per annum in 2000–02 to 4 per annum in 2006–08.<sup>8</sup> Several of these deaths were in women with a recent respiratory tract infection or women with family members with recent history of sore throats. Infection in the mother carries a further immediate risk of infection in the baby.<sup>9,10</sup>

## Outbreaks of GAS in acute care settings

A review of healthcare-associated invasive GAS infections in Ontario between 1992 and 2000 identified one in 10 cases as being linked to an outbreak.<sup>6</sup> Hospital outbreaks of GAS infection can escalate rapidly, be prolonged and result in both patients and healthcare workers (HCWs) being infected.<sup>6</sup> The national reporting system for significant health protection incidents in England (HPA Incident Reporting Information System) identified 10 outbreaks of the GAS infection in hospital settings during 2008 and 2009 combined. Surgical, obstetrics and gynaecology, and burns units are most commonly involved in hospital outbreaks, although outbreaks have been seen in a wide range of different hospital settings.<sup>6</sup> Investigation of these outbreaks has identified a range of transmission routes: colonised HCWs to patients, environmental sources to patients, and patient-to-patient transmission. Patients with both community and healthcare-associated GAS infection have initiated hospital outbreaks with secondary cases typically arising within one month of the index case although longer intervals have been documented.<sup>6</sup> In HCWs, throat colonisation is the most common source, although skin, vaginal and rectal colonisation have also been linked to outbreaks.<sup>6,11</sup>

### Glossary

GAS	group A streptococcus
HPA	Health Protection Agency
iGAS	invasive group A streptococcus
IPCT	infection prevention and control team (or equivalent)
HCW	healthcare worker
OH	Occupational Health
PPE	personal protective equipment
SIGN	Scottish Intercollegiate Guidelines Network
STSS	streptococcal toxic shock syndrome
SUI	serious untoward incident

- Algorithm 1** Management of a single case of GAS infection.

### Healthcare-associated GAS infection

A healthcare-associated GAS infection is defined as a GAS infection that is neither present nor incubating at the time of admission but considered to have been acquired following admission to hospital or as a result of healthcare interventions in other healthcare facilities. Typically, onset of GAS infection is >48 h after admission, or postoperatively at any time after admission and for up to seven days post discharge.

### Outbreak

An outbreak should be considered if there are two or more cases of suspected GAS infection related by person or place. These cases will usually be within a month of each other but the interval may extend to several months. It should be noted that the interval between cases in published outbreak reports for GAS has, on occasion, extended to more than a year. Reference laboratory typing from culture-proven cases is needed to confirm that cases are related.

### Infection prevention and control of GAS infection

The successful management of every case of GAS is important, not only to prevent spread and possible serious infections, but also to investigate if transmission is occurring from an ongoing and preventable source. All GAS infections suspected of being healthcare-associated should be investigated further (see [Algorithm 1](#)).

### Reporting cases

All cases of suspected GAS infection identified in acute care settings or maternity units, including stand-alone midwife led units, and any cases identified within seven days of discharge or delivery that could have been healthcare-associated should be reported to the infection prevention and control team (IPCT) or equivalent.

Invasive GAS infection is a notifiable disease in England, Wales and Scotland.<sup>13</sup> All iGAS infections should be discussed with the local health protection specialist so that contact assessment can be initiated according to existing national guidance.<sup>9</sup>

Outbreaks of GAS infection and deaths in patients with healthcare-associated GAS infection should be reported as serious untoward incidents via normal reporting routes.

In the event of a death due to confirmed or suspected GAS - see *Communication with, and advice to, mortuary and pathology staff*.

#### Recommendations

- All cases of suspected GAS infection identified in the acute care setting or maternity units and stand alone midwife led units and any cases identified within seven days of discharge or delivery that could have been healthcare-associated should be reported to the IPCT.
- All iGAS cases should be discussed with and notified to the local health protection specialist by the relevant clinician and microbiologist.

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### Initial investigations

Initial investigations should establish if the infection or colonisation with GAS is community or healthcare-associated. It should be established if the patient had symptoms or signs consistent with GAS infection such as sore throat or skin infection on or just prior to admission or childbirth. Intra-familial spread of GAS is common and enquiries should be made as to whether close personal contacts or visitors are suffering from any illness that could be attributable to GAS. Identification of a close personal contact with symptoms or signs of GAS infection reduces the likelihood that the infection was acquired from a healthcare source. Symptomatic close contacts should seek advice from their GP. The infection should be considered to be healthcare-associated if symptoms and signs of infection were not present on admission and they have developed during a hospital stay or within 7 days of discharge from hospital or post delivery, with no other obvious source of transmission. In this case, screening of HCWs as a possible source should be considered - see *Transmission from healthcare worker to patient*.

Contacts of community-acquired cases of invasive GAS infection should be managed according to the existing community guidelines.<sup>9</sup>

#### Recommendations

- IPCT should establish whether the case is community or healthcare-associated.
- Further investigation of potential sources of infection is warranted for any case of GAS infection considered to be healthcare-associated.

*SIGN GRADING Good practice points*

### Prospective and retrospective surveillance

The interval between identified cases in published outbreak reports for GAS has, on occasion, extended up to one or more years,<sup>14</sup> and as such the IPCT should maintain ongoing GAS infection surveillance where a case of healthcare-associated GAS infection has been identified. The IPCT should review surveillance records for the past six months at a minimum to establish if the new case is sporadic or part of a possible outbreak of healthcare-associated GAS infection.

Following a case of healthcare-associated GAS infection the IPCT should consider prospective enhanced surveillance which may include, for example, sampling infected wounds of patients in the vicinity of the index case or who are being cared for by the same HCWs. In addition, the IPCT should be informed of any cases which may be caused by GAS, e.g. cases of puerperal sepsis treated empirically. Post-discharge surveillance, if required, would help identify healthcare-associated cases presenting after discharge.



### Recommendations

- IPCT should undertake a retrospective analysis of microbiology and surveillance records to identify possible linked cases of healthcare-associated GAS infection arising in the past 6 months.
- IPCT should maintain GAS continuous alert organism surveillance to identify outbreaks which may arise over prolonged periods of time.
- Following a case of healthcare-associated GAS infection the IPCT should consider prospective enhanced surveillance which may include, for example, sampling of infected wounds of patients in the vicinity of the index case or who are being cared for by the same HCWs.

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### Patient isolation

Patients diagnosed with or clinically suspected of having GAS infection should be isolated in a single room, with a self contained toilet and its own hand basin. Breast feeding should be supported where possible. Mother and baby should not be separated unless the mother or baby requires admission to an ICU. Notes and charts should be kept outside the room and patients should have dedicated equipment where possible.

It is frequently cited that isolation should continue for 24–48 h after commencement of appropriate antibiotic therapy. Studies suggesting that exclusion for 24 h of effective therapy is appropriate, have primarily been performed in children with pharyngitis or scarlet fever (Padfield, personal communication). However, case reports show that GAS can be isolated from superficial sites beyond 24 h of antibiotic treatment, including the drying umbilical cord.<sup>14,15</sup> In a recent case report of transmission from a patient with necrotising fasciitis to an HCW, this occurred 50 h after initiation of appropriate antimicrobial therapy.<sup>16</sup>

The working party felt that although there were some instances when patients should be isolated until culture negative, 24 h of effective therapy was appropriate for the majority of cases seen in hospitals; examples include necrotising fasciitis where there is significant discharge of potentially infectious body fluids, patients with infected eczema where there is a high risk of shedding, mothers and neonates on maternity units, and patients on burns units.

### Recommendations

- Patients with GAS should be placed in isolation for a minimum of 24 h of effective antibiotic therapy.
- Cases of necrotising fasciitis and other cases where there is significant discharge of potentially infected body fluids or high risk of shedding, mothers and neonates on maternity units and patients on burns units, should be isolated until culture negative.

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### Personal protective equipment (PPE)

Whilst the patient is considered infectious, HCWs must use personal protective clothing including disposable gloves and aprons when in contact with the patient and their equipment or immediate surroundings. Facial protection, such as a fluid repellent surgical mask and eye shield or visor, is recommended where a risk of transmission from droplets is identified; examples include bronchoscopy, suctioning or dressing wounds that are producing a large amount of exudate. Fluid repellent surgical masks with visors must be used at operative debridement/change of dressings for cases of necrotising fasciitis. If an HCW has any break in skin integrity e.g. a cut or skin lesion, this must be covered with a waterproof dressing. In the event of failure to comply with PPE or needlestick injury - see *Transmission from patient to healthcare worker*.

Visitors must be given information about how to prevent the transmission of infection, and shown how to use appropriate PPE when visiting the affected individual. The PPE required by visitors will depend on risk assessment of the factors affecting transmission (e.g. if there is a high risk of droplet transmission) and also the visitor's level of direct contact and involvement in the affected person's care.

### Recommendations

- HCWs should wear PPE including disposable gloves and aprons when in contact with the patient or their equipment and their immediate surroundings.
- Breaks in the skin must be covered with a waterproof dressing.
- Fluid repellent surgical masks with visors must be used at operative debridement/change of dressings of necrotising fasciitis and for procedures where droplet spread is possible.
- Visitors should be offered suitable information and relevant PPE following a risk assessment of the visitor's level of direct contact/involvement in the affected person's care.

*SIGN GRADING Good practice point*

### Hand hygiene

Semmelweis identified the importance of hand washing in preventing the spread of puerperal sepsis on maternity units.<sup>17</sup> HCWs must adhere to strict hand hygiene policy using an effective technique i.e. hand washing with soap and water or decontamination with alcohol hand rub before and after contact with the patient and/or their environment, regardless of the use of gloves and other protective measures.<sup>18</sup>

Where appropriate the patient and their visitors must be offered suitable information and facilities to encourage their own adherence to standard infection control practice including effective hand hygiene practice.

## Recommendations

- HCWs must adhere to strict hand hygiene policy.
- Visitors should be offered suitable information and facilities to be able to adhere to standard infection control practice, including good hand hygiene.

*SIGN GRADING Good practice points*

## Environmental cleaning

The isolation room, furniture and equipment must be cleaned daily as a minimum and terminal cleaning undertaken. Detergent and water followed by hypochlorite at 1000 ppm, or a combined product, is recommended for all environmental and equipment cleaning where a patient is known to have an infection, healthcare associated or otherwise.<sup>19,20</sup>

Communal facilities such as baths, bidets and showers should normally be cleaned and decontaminated between patients irrespective of whether they are known to be infected or not. In the case of delivery suites and early post-natal care this is particularly important because of the high risk of blood and body fluid contamination, the exposed nature of episiotomy wounds and the supporting evidence that these communal utilities have acted as the source of outbreaks - see *Environment as source of outbreak*.<sup>21–23</sup>

## Recommendations

- The isolation room, furniture, and equipment should be cleaned with detergent and water followed by hypochlorite at 1000 ppm daily (or combined detergent hypochlorite product).
- Communal facilities such as baths, bidets and showers should be cleaned and decontaminated between all patients especially on delivery suites, post-natal wards and other high risk areas, such as burns units.

*SIGN GRADING D/Good practice points.*

## Linen and waste

Whilst the patient is considered infectious, linen and waste must be handled as hazardous.<sup>24–27</sup>

## Recommendation

- Whilst the patient is considered infectious, linen and waste must be handled as hazardous.

*SIGN GRADING Good practice points*

## Transferring patients

In order to minimise the risk of cross-infection, the transfer of any patient with an infection to another healthcare

facility is not recommended unless unavoidable or essential for the individual's clinical care. Isolation dictates that the movement of patients for non-clinical reasons should be minimised. Details of the risk of infection must be effectively communicated to the ambulance service, the receiving ward/department or facility, and the receiving IPCT must be informed using the inter-healthcare transfer form. If it is found that a case of GAS could have acquired the infection in another hospital, that information should be relayed to the referring hospital.

## Recommendations

- Transfer only if unavoidable or essential for the patient's care.
- Details of the risk of infection must be effectively communicated to the ambulance service, the receiving facility, IPCT and if appropriate, the referring hospital.

*SIGN GRADING Good practice points*

## Infections occurring in mothers and babies

Although peri-partum GAS infection is typically acquired at the time of or after childbirth from both exogenous and endogenous sources,<sup>28,29</sup> pregnant women who are found to be infected with or carrying GAS earlier in pregnancy should be treated at the time and have this clearly documented in the maternity notes.<sup>30</sup>

Babies born to infected or colonised mothers may become colonised and this can be detected by swabbing of the umbilicus, ears and nose. Occasionally the baby may develop infection including invasive disease.<sup>31–36</sup> Maternal and neonatal infection tend to be closely related in terms of timing. Mother and baby should not be separated unless the mother or baby requires admission to an ICU.

Following the identification of infected mother–baby pairs in the UK, interim guidance for their management was published in 2004.<sup>9</sup> Antibiotics should be administered to mother and baby if either develops suspected or confirmed invasive GAS disease in the neonatal period (first 28 days of life). Of note, one neonatal sepsis and one necrotising fasciitis of the scalp have been reported in association with the use of foetal scalp electrodes.<sup>37</sup>

## Recommendations

- Antibiotics should be administered to mother and baby, if either develops suspected or confirmed invasive GAS disease in the neonatal period (first 28 days of life).

*SIGN GRADING C*

- Pregnant women infected or colonised with GAS prior to admission should be treated and have this clearly documented in the maternity notes.

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## Transmission from patient to close personal contacts

Antibiotics should not be routinely administered to contacts of GAS cases. Close personal contacts of a case of *invasive* GAS infection should receive written information outlining the signs and symptoms of invasive GAS infection and advised to seek medical attention if they develop such symptoms within 30 days of a diagnosis in the index case in accordance with previous guidance.<sup>9</sup> This is the responsibility of the local health protection specialist, although, local arrangements should be made so that patient information is available and can be given to the relatives in the acute care setting - see [Appendix 3](#). Close personal contacts are defined as the same as for meningococcal disease, that is sharing a household or kissing contacts within the seven days prior to the onset of the illness.<sup>38</sup>

### Recommendations

- Antibiotics should not be routinely administered to all contacts of GAS cases.
- The local health protection specialist should be notified of all iGAS infections.
- Close contacts of iGAS cases should receive written information and have a heightened awareness of the signs and symptoms of GAS for 30 days after the diagnosis in the index patient.
- Close contacts of iGAS cases should seek urgent medical advice if they develop such symptoms within 30 days of a diagnosis in the index case in accordance with previous guidance.

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## Transmission from patient to healthcare worker

Transmission from patient to HCW has been most frequently described in the context of necrotising fasciitis where multiple contacts may become infected or colonised.<sup>39,40</sup> One HCW with dermatitis developed cellulitis of the arm within 48 h of nursing a patient without gloves.<sup>41</sup> Transmission has also been described during a post mortem - see *Communication with, and advice to, mortuary and pathology staff*.<sup>42</sup>

Appropriate PPE should be worn - see *Personal protective equipment (PPE)*. HCWs who have performed direct physical procedures on a patient with GAS infection, e.g. mouth-to-mouth resuscitation, should be advised by the IPCT on the signs and symptoms of GAS disease and advised to seek medical advice if they develop such symptoms within 30 days of a diagnosis in the index case.<sup>9</sup> Any such exposed HCW should be referred to occupational health.

Antibiotic prophylaxis should be considered for HCWs who sustain a needlestick injury or direct contamination of mucous membranes or breaks in the skin with material potentially infected with GAS. The decision to treat should be made on a case-by-case basis after discussion between a microbiologist or other infection specialist and an occupational health practitioner, taking into account the type of exposure and length of time the patient has been on

antibiotics. The working party recommends HCWs receive a 3 day course of amoxicillin (500 mg, orally, three times a day) in these instances, unless there is evidence of active infection in the HCW, where a full course should be given.

### Recommendations

- HCWs working without appropriate PPE whilst a patient is infectious should be advised about the signs and symptoms of GAS infection for 30 days after the diagnosis in the index patient and if symptomatic seek urgent medical advice.
- Any such exposures should be referred to occupational health. Antibiotic prophylaxis should be considered for HCWs who sustain a needlestick injury or direct contamination of mucous membranes or breaks in the skin with potentially infectious material.

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## Transmission from patient to patient

Transmission from patient to patient is minimised with isolation and full compliance with standard precautions for infection prevention and control. The IPCT should establish if other recent cases are connected. Patients with both community and healthcare-associated GAS infection and colonised and infected HCWs have seeded hospital outbreaks.<sup>6</sup> Antibiotics should not be routinely administered to contacts of GAS except in exceptional circumstances - see *Use of chemoprophylaxis*. Consideration should be given to providing information to patients in close contact with the index case if there has been significant close contact prior to infection control procedures being instituted - see *Communication with, and advice to, close contacts* and [Appendix 3](#).

## Transmission from healthcare worker to patient

Although many healthcare-associated GAS infections will be due to endogenous flora, some patients will have acquired their infection from a HCW - see *Healthcare workers as source of outbreak*. Depending on the circumstances of the case in question, and where there is no other obvious source of transmission, the IPCT should consider screening HCWs in contact with the patient.

For a single case of healthcare-associated GAS, all HCWs in contact or working in close proximity to the patient (patient's bed space, theatre, delivery room) should be considered as possible sources of healthcare-associated GAS. The HCWs most likely to have transmitted GAS are those with direct contact with the patient within seven days of the onset of the infection. In particular, the following groups should be considered for screening:

- those present in theatre and performing post-operative dressing changes for surgical cases<sup>6,43</sup>
- those performing vaginal examinations or dealing with episiotomies and those present at delivery for maternity cases<sup>6</sup>

The IPCT may wish to take a step-wise approach to their investigations accordingly. The IPCT should consider asking HCWs to present to Occupational Health for screening if they have been symptomatic with a sore throat or skin infection, or have had skin lesions/dermatitis/eczema or vaginitis or pruritus ani during the week prior to the index patient's onset of infection - see example letter [Appendix 4](#). The IPCT may decide to screen asymptomatic HCWs in certain circumstances e.g. screening theatre staff following a post-operative case of necrotising fasciitis. The HCWs should be seen and screened by an occupational health practitioner.

Few studies of GAS throat carriage in the healthy adult population have been undertaken, but of those conducted, carriage rates of 5% or less are reported, with most studies reporting carriage in less than 1%.<sup>44–47</sup> Similarly, studies of GAS vaginal and rectal colonisation, restricted to pregnant women, report carriage rates of 1% or less.<sup>48,49</sup> As such, a positive screening result should be considered as indicative of likely source of transmission and dealt with as such whilst awaiting typing results. Please refer to *Screening of healthcare workers* for further advice on HCW screening and section *Management of colonised and infected healthcare workers* for management of GAS colonised or infected healthcare staff.

### Recommendations

- All HCWs in contact with the patient, either in direct contact or working in the close vicinity (patient's bed space), should be considered as possible sources of healthcare-associated GAS.
- HCWs in contact with a case of healthcare-associated GAS should be considered for screening if they have suffered a sore throat or skin infection, or have had skin lesions/dermatitis/eczema, vaginitis or pruritus ani within seven days of the onset of the infection in the patient. If so, the HCW should be seen and relevant swabs taken by occupational health. Isolates from positive swabs should be sent for typing along with the patient isolate if not already sent.
- The IPCT may decide to screen asymptomatic HCW in certain circumstances.

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### Communication with, and advice to, mortuary and pathology staff

There are reports of invasive streptococcal infections acquired by healthcare workers from patients, including a case of necrotising fasciitis following needlestick injury in a mortician.<sup>42,50</sup> In the event of a patient death the mortuary staff should be informed of the risk of infection and routes of transmission such that the necessary precautions can be undertaken. A cadaver bag should be used. The body can be viewed, but no embalming or other preparation of the body should take place.<sup>51</sup> Pathology staff should also be informed when unfixed tissue from a case of necrotising fasciitis is sent for examination.

### Recommendations

- In the event of death, the hospital mortuary staff should be informed of the risk of infection and routes of transmission.
- Pathology staff should be informed when unfixed tissue from a case of necrotising fasciitis is sent for examination.

*SIGN GRADING Good practice point*

### Communication with, and advice to, close contacts

It is important that suitable and accurate information is communicated to any patient with iGAS infection and their close personal contacts by the responsible consultant or a member of their team - see, [Appendices 2 and 3](#). The local health protection specialist in liaison with the IPCT should ensure relevant information is given in written form to close personal contacts in accordance with existing community guidance— see [Appendix 2 and Transmission from patient to close personal contacts](#). All HCWs should be fully informed at handover of shifts so that communication with the patient and their family is consistent, accurate, and documented.

### Recommendations

- Suitable and accurate information should be provided promptly to the patient and close personal contacts for iGAS infections.
- Effective hand over between health care teams should ensure communication with the patient with iGAS infection and their close personal contacts is consistent, accurate and documented.

*SIGN GRADING Good practice points*

### Management of an outbreak of GAS infection

The investigation and control of single cases of GAS also applies to cases in outbreaks.

#### Formation of outbreak control team

When a suspected or confirmed outbreak of GAS has been identified, interventions to prevent further transmission and further cases should be put in place immediately (see [Algorithm 2](#)). The Director of Infection Prevention and Control, infection control doctor or deputy should set up an outbreak control team. The make-up of the team will depend on the nature of the outbreak, but may include infection control nurses, a consultant microbiologist, consultant from the specialty involved, occupational health adviser, local health protection specialist, local commissioning lead, cleaning manager, bed manager, appropriate healthcare manager and communications adviser. A member of the IPCT should supervise the daily management of the outbreak and oversee the immediate implementation of preventative measures.



## Recommendation

- An outbreak control team should be convened to manage and control an outbreak of GAS infection.  
*SIGN GRADING D*

## Epidemiological investigation

A case definition should be agreed. Time lines are useful to establish overlap, or not, of hospital stays. Detailed patient histories and in-patient journeys should be explored to establish common exposures and timely investigation of possible sources of infection should be undertaken. Previous investigations of outbreaks are helpful in identifying the likely routes of transmission. Other patients, HCWs and the environment are possible sources of outbreaks, as described below.

A retrospective analysis of all GAS infection diagnosed in hospital patients in the past 6 months should be performed by the IPCT to find links with other cases. Prospective microbiological surveillance for further GAS cases should be undertaken. Establish contact with the reference laboratory to agree priority for typing of outbreak isolates.

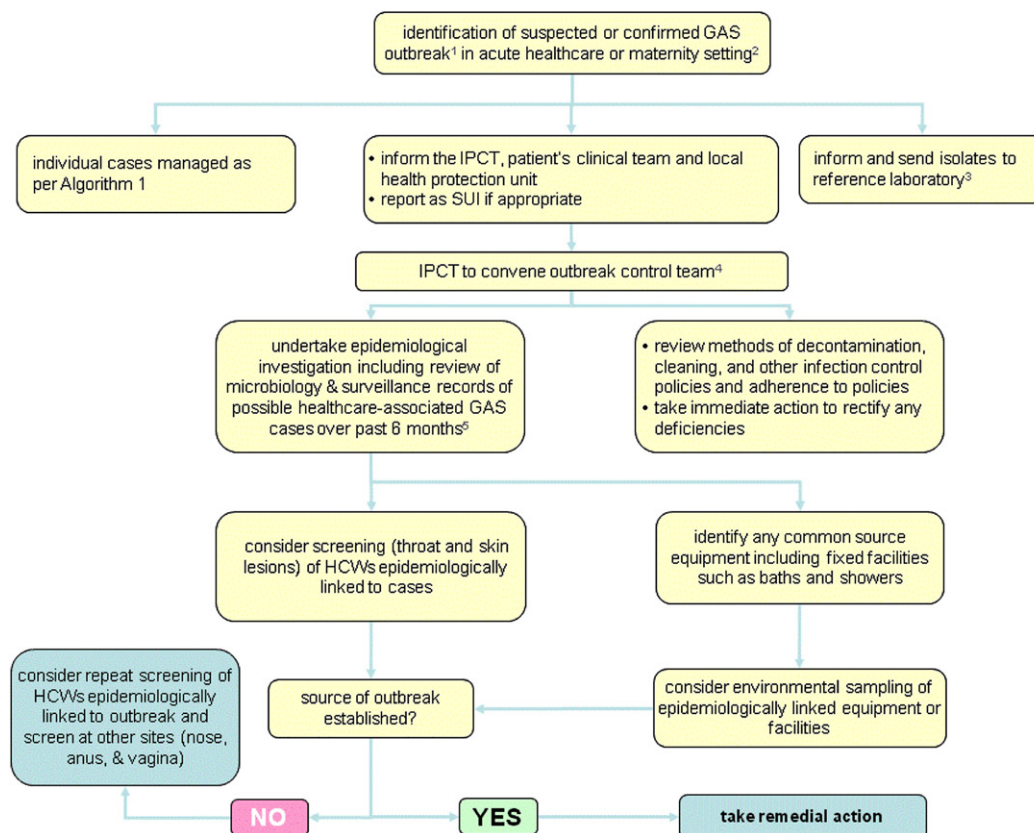
## Healthcare workers as source of outbreak

Surgeons, nurses, anaesthetists, midwives, and wound care teams have all been implicated in transmission of GAS to patients, either whilst infected or colonised.<sup>14,31,40,43,52–60</sup>

In Canada, symptomatic HCWs account for 8.2% of outbreaks and colonised, asymptomatic HCWs for 34%.<sup>61</sup> Of the outbreaks linked to colonised healthcare workers, throat colonisation is the most common site of colonisation although skin, vaginal and rectal colonisation have also been linked to outbreaks.<sup>6,11,54</sup>

Rates of transmission can be high with throat carriage.<sup>6,31,43,52,55,61</sup> The post-operative infection rates from an anaesthetist and surgeon with asymptomatic throat colonisation reached 7% and 7.5% respectively in patients not receiving prophylaxis.<sup>43,55</sup> In obstetric care, two midwives found to be positive in the throat transmitted GAS to 11 cases in an 11 day period.<sup>31</sup>

Colonisation and transmission of GAS from the anal, vaginal, perineal areas, skin and nose, without concurrent evidence of throat colonisation is well documented.<sup>6,41,43,54–57,59,60</sup> Recent Canadian research has revealed that this is the case in 29.5% of implicated cases.<sup>6</sup> Seven patients suffered post partum GAS infections over 14 months, strongly associated with one HCW rectally colonised.<sup>57</sup> A nurse with colonised atopic dermatitis transmitted GAS to 1.4% of women who delivered while she was



1. An outbreak should be considered if there are two or more cases of suspected GAS infection related by person or place. These cases will usually be within a month of each other but the interval may extend to several months.
2. Includes hospital in-patients, patients recently discharged ( $\leq 7$  days) and women who gave birth in any setting including at home.
3. Clearly label isolates sent to the reference laboratory as being part of a suspected outbreak to prioritise processing. Epidemiological investigations and preventive measures should not await results of typing.
4. Outbreak control team may include infection control doctor and nurses, consultant microbiologist, consultant from the specialty involved, occupational health adviser, local health protection specialist, cleaning manager, bed manager, appropriate healthcare manager, local commissioning lead and communications adviser.
5. Other patients, HCWs, equipment and the environment are possible sources of outbreaks. Develop time lines and in-patient journeys to identify overlaps of hospital stays and common exposures.

**Algorithm 2** Management of an outbreak of GAS infection.

on duty.<sup>60</sup> In both these cases family members of the HCW were also colonised.<sup>57,60</sup> Seven cases of post partum GAS (18%) were infected by an obstetrician found to be anally colonised.<sup>56</sup> A surgeon with nasal but no throat carriage caused GAS infection in a surgical patient and in a second patient in whom he had only administered a vaccine.<sup>58</sup>

Although HCWs are more likely to transmit GAS if they have direct patient contact, it has been suggested that spread can occur from 'cloud HCWs', who are colonised rectally, vaginally, or on the skin, by airborne dispersal as indicated by volumetric or settle plate air cultures.<sup>59,62</sup>

Some of these outbreaks may evolve over several months.<sup>14,57</sup> Twenty-eight cases of GAS infection, including four cases of iGAS infection and three deaths over a nine-month period, occurred in patients being cared for by a wound care team.<sup>14</sup> Longitudinal surveillance by the IPCT is important.

### Screening of healthcare workers

The outbreak control team may choose to screen, depending on the circumstances of the outbreak, those with closest contact first - see *Transmission from healthcare worker to patient*. Less than 5% of the adult population are likely to carry GAS in their throat so a positive screening result should be considered as indicative of the likely source of transmission and acted upon accordingly until typing proves otherwise.<sup>44-47</sup>

For asymptomatic HCWs epidemiologically linked to cases of healthcare-associated GAS infection, swabs of throat and skin lesions (including all exfoliating skin conditions) should be taken initially. Samples from dry skin lesions should be taken with a moistened swab. Other sites known to be implicated in transmission are nose, anus and vagina, and screening of these is advised when a HCW is implicated in transmission and throat and skin lesions are negative. Recommended sites are anus, vagina, and anterior nares, as carriage at these sites have all been linked to outbreaks - see *Transmission from healthcare worker to patient*.

Screening is best carried out by an occupational health practitioner for confidentiality reasons and so that HCWs can be examined for skin lesions and dermatitis. Details on the management of HCWs who screen positive for GAS are given in section *Management of colonised and infected healthcare workers*.

Symptomatic HCWs should be managed in liaison with the GP and occupational health practitioner. They should be advised by an occupational health practitioner regarding workplace adjustments and fitness for work. Alternative duties in non-clinical settings may be appropriate.

#### Recommendations

- Initial HCW screening should include throat and skin lesions.
- HCWs may need to be examined for skin lesions and dermatitis by an occupational health practitioner.
- Other sites known to be implicated in transmission are nose, anus, and vagina, and screening of these sites is advised when a HCW is implicated in transmission and throat and skin lesions are negative.

*SIGN GRADING D*

### Environment as source of outbreak

Baths, bidets and showers have all been implicated in transmission of GAS during outbreaks. A review of hospital GAS outbreaks identified an environmental source in 9.8% of outbreaks (6 of 61).<sup>6</sup> There are reports of streptococci surviving in dust, and on fomites, and reports of environmental reservoirs being implicated in outbreaks.<sup>63</sup> McKee showed that, simply by undressing and moving around, an infected surgeon contaminated the environment with GAS.<sup>59</sup>

Environmental sources are particularly prominent in maternity outbreaks. In an outbreak involving six cases of GAS over 10 days, all were found to have had a vaginal delivery and a daily bath compared to those who were non-infected who had had caesarean sections and had not used the bath.<sup>21</sup> In a further maternity outbreak, where infections were restricted to those using the shower, environmental sampling showed the hand held shower to be heavily contaminated and the toilet seat next to the shower to be scantily contaminated.<sup>22</sup> On a Scottish maternity unit, eight mothers and three infants developed GAS infection and GAS was isolated from a bidet common to all the infected mothers. None of the mothers who had exclusively used a separate toilet/bidet were affected.<sup>23</sup>

In addition, bathrooms have been implicated in transmission of infection on maternity units of both group G streptococcus and group C streptococcus.<sup>64,65</sup>

Communal facilities such as baths, bidets and showers should be cleaned and decontaminated between patients. The working group agreed that particularly in the case of high risk areas such as delivery suites and post natal care, baths, showers and bidets should be cleaned and decontaminated between each patient use. This is particularly important because of the high risk of blood and body fluid contamination, exposed nature of episiotomy wounds and supporting evidence that these communal facilities are sources of outbreaks. This should be after all patients irrespective of whether they are known to be infected or not.

#### Recommendations

- The method and frequency of cleaning and decontamination of equipment and relevant ward areas should be reviewed.
- Communal facilities such as baths, bidets and showers should be decontaminated between all patients especially on delivery suites, post-natal wards and other high risk areas, such as burns units.

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### Environmental sampling

If the epidemiological investigation suggests common exposure to a potential environmental source, relevant environmental sampling should be undertaken.<sup>66</sup> Large sterile swabs of gauze, moistened in 0.9% sodium chloride, wiped across a large part of the surface of the implicated equipment and then placed into broth, is more likely to yield

positive results than small areas swabbed with standard medical swabs. Decontaminating the equipment is imperative before further use and if feasible, the equipment should be taken out of use whilst awaiting the results of cultures. Decontamination may have taken place before sampling leading to false negative results. In this instance, a risk assessment of the continued use of the equipment including the type and frequency of decontamination should be reviewed.

### Recommendation

- In a possible outbreak environmental sources of transmission should be considered and relevant sampling undertaken.

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## Screening of patients

Screening patients can establish the extent of the outbreak and identify patients at risk of subsequent GAS disease. The extent of contact tracing, including patients who have been discharged, should be decided by the outbreak control team and will be dependent on the circumstances of the outbreak and whether a source has been identified. The normally short incubation period of GAS infection (1–3 days) should be taken into consideration. Many patients will have received antibiotic treatment for other conditions which would have covered GAS during the period in question. In many instances, information regarding the nature of infections and the likely symptoms can be given to patients deemed at risk rather than chemoprophylaxis. The disadvantage of screening when a source has not been identified is that acquisition of the outbreak strain may subsequently occur after screening. The advantage is that it may help to elucidate the source more clearly.

## Use of chemoprophylaxis

Chemoprophylaxis aims to eradicate carriage in those who have newly acquired the invasive strain and who may themselves be at risk of infection.

In the community setting, chemoprophylaxis is only recommended for the entire household if two or more cases of iGAS infection occur in the same household within a 30-day time period. About 2000 contacts need to be treated to prevent one case, assuming 100% efficacy.<sup>9</sup> In the healthcare setting, routine chemoprophylaxis is not recommended following a single case, except in mother or baby cases during the neonatal period.<sup>9</sup> However, during an outbreak, recommendations for chemoprophylaxis can be made by the outbreak control team according to the specific scenario, taking into account the nature of the outbreak - number of cases, severity of cases, vulnerability of patients, and source of the outbreak. The length of prophylaxis and the choice of antimicrobial should be agreed locally based on the clinical circumstances, whether the source has been identified and eliminated, the susceptibility of the patients, and the likely site of infection if it occurred.

### Recommendation

- Recommendations for chemoprophylaxis should be made by the outbreak control team on a case by case basis.

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## Communication strategy

Patients, close contacts and HCWs should be provided with clear, concise information about the outbreak – see [Appendix 2 and 3](#). As an important part of prevention is enhanced surveillance, information should be provided to hospital medical or surgical teams and primary care teams, as appropriate, to encourage heightened awareness of the symptoms of GAS, to take specimens from potentially infected wounds, to give early treatment where GAS is suspected, and to promptly notify the outbreak control team - see *Prospective and retrospective surveillance*.

It should be noted that iGAS can cause press interest and press office advice should be obtained in these circumstances. It may require an ongoing press briefing in some circumstances.

### Recommendations

- Patients, close contacts and HCWs should be provided with clear, concise information about the outbreak.
- Information should be provided to relevant HCWs to encourage heightened awareness of the symptoms of GAS, to take specimens from symptomatic patients, give early treatment where GAS is suspected, and promptly notify the outbreak control team.
- Consider active involvement of a press officer to deal with media enquiries.

*SIGN GRADING Good practice points*

## Management of colonised and infected healthcare workers

### Treatment of infection

HCWs with suspected or confirmed GAS infection e.g. pharyngitis or infected skin lesions, pose a potential risk to patients both through direct transmission of the organism to patients or indirectly through contamination of the hospital environment. The degree of risk to patients will be dependent upon closeness of patient contact involved in the HCW's duties and HCWs with symptoms of GAS infection pose a greater risk than asymptomatic carriers.<sup>67</sup> All HCWs with symptoms of possible GAS infection should inform and seek advice from their line manager and/or contact occupational health for guidance on performance of clinical duties on the basis of a risk assessment. Treatment of infection should be undertaken in liaison with the HCW's GP. Where a risk assessment has indicated that an HCW's infection poses a risk to patients, the HCW should be excluded from work until 24 h of appropriate treatment and resolution of symptoms has occurred.



## Eradication of carriage

There are no randomised controlled trials that establish the most appropriate first-line therapy in the HCW setting, where timely eradication of carriage is important. Further transmission following failure of eradication or re-infection is well documented, occurring in four out of four cases in one review.<sup>6</sup> Eradication of carriage is therefore recommended in all cases where onward transmission of GAS has occurred (see Algorithm 3 for treatment options).

In the general population, penicillin V results in eradication of GAS in around 80% of cases.<sup>68,69</sup> The failure rate in terms of eradication increases with duration of follow up and found to be as high as 65% at 3 months in one study.<sup>70</sup> Clindamycin eradicates colonisation in 100% of patients who have failed penicillin therapy for GAS throat carriage at 4–6 days,<sup>69</sup> but eradication success at nine weeks post treatment may fall to 85%.<sup>71</sup> It is not clear whether this reflects failure of eradication or re-infection. There is no robust evidence on which to base recommendations for eradication of vaginal and anal colonisation.

Although there is evidence suggesting that cephalosporins may produce higher clearance rates than penicillins,<sup>72–75</sup> the working group felt that the evidence did not justify a recommendation for their use as a standard first line therapy for eradication; it was felt that the

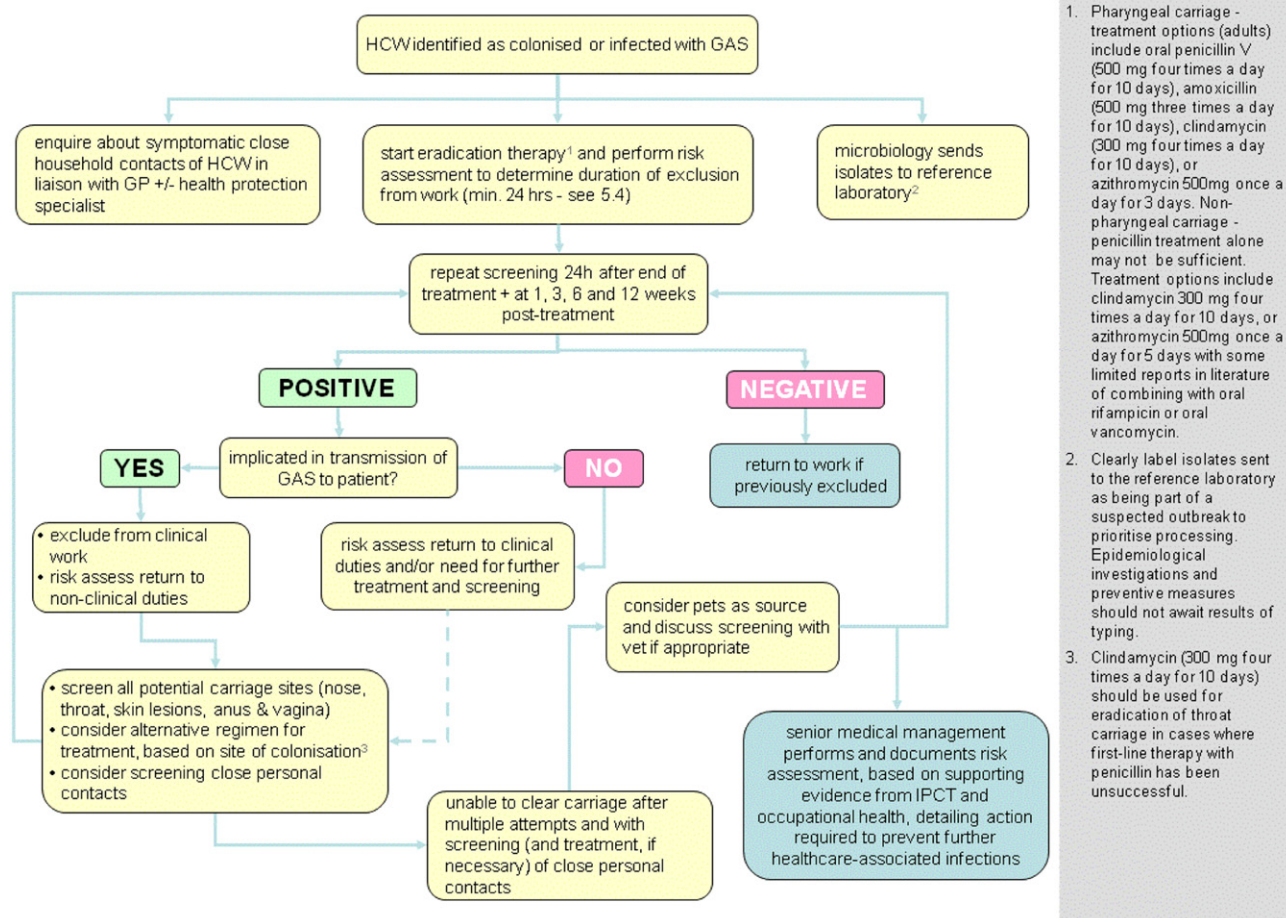
associated risks (such as selection of *Clostridium difficile*) outweighed the benefits although they may be appropriate in some cases as directed by an infection specialist.

Decisions regarding antimicrobial therapy should be based on microbiological principles including reliable absorption of the antibiotic, site of colonisation, tolerability, and risk of side effects. Treatment regimes obtained from the literature include combinations of a penicillin, a macrolide or clindamycin with rifampicin or oral vancomycin (Table 1).

Clearance screens should be taken 24 h after the end of treatment and again at one, three, six, and twelve weeks post treatment. If persistent or recurrent GAS colonisation is found in the HCW early consideration should be given to possible sources of re-colonisation within the HCW's household. Screening throat and skin lesions of the HCWs' close child household contacts and throat, skin lesion, anal and vaginal swabs of close adult household contacts should be considered initially.

The exact duration of follow up to ensure clearance has not been reliably established, particularly as HCWs may become re-colonised from a close household contact.<sup>54,59,78</sup> In some cases it may be felt appropriate to screen for longer than that recommended above, particularly if colonisation has been difficult to eradicate.<sup>56</sup>

Whilst eradication is not essential for asymptomatic HCWs carrying GAS strains different from the case or



Algorithm 3 Management of colonised and infected healthcare workers by occupational health.



**Table 1** Antibiotic regimens used to eradicate healthcare worker carriage in published reports.

Antimicrobial used	Cases	Pharyngeal carriage cleared	Non-pharyngeal carriage cleared
Penicillin alone	12	3/3	6/9
Penicillin plus rifampicin	3	2/2	0/1
Penicillin plus vancomycin	1	0/0	1/1
Macrolide with/without rifampicin	2	2/2	0/0
Clindamycin with/without rifampicin	2	1/1	1/1
Vancomycin plus Rifampicin	1	0/0	1/1
Not named	3	1/1	2/2

Two HCWs treated with penicillin alone had primary treatment failure; 1 HCW treated with penicillin alone and 1 treated with penicillin and rifampicin initially cleared their carriage but were identified as re colonized with the same strain 4 and 15 months later, respectively. Retreatment attempts were ultimately successful in all 4. Successful re-treatment regimens were vancomycin plus rifampicin followed by long-term low-dose penicillin "prophylaxis," intramuscular penicillin given monthly for 1 year, intramuscular penicillin plus oral vancomycin, and intravenous penicillin plus vancomycin.<sup>54,56,76,77</sup>

Taken from Daneman et al, surveillance for hospital outbreaks of invasive group A streptococcal infections in Ontario, Canada, 1992 to 2000. Ann Intern Med August 21, 2007 147 with permission from the Annals of Internal Medicine.<sup>6</sup>

outbreak strain, IPCT and Occupational Health should risk assess return to work.

### Recommendations

- HCW contacts who have been screened and found to be positive for GAS should receive eradication therapy.
- Clearance screens should be taken 24 h after completing treatment, and again at 1, 3, 6, and 12 weeks following the end of treatment

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#### Pharyngeal carriage:

- Treatment options include oral penicillin V (500 mg four times a day for 10 days), amoxicillin (500 mg three times a day for 10 days), clindamycin (300 mg four times a day for 10 days), or azithromycin (maximum dose of 500 mg once a day) for 3 days.
- Clindamycin (300 mg four times a day for 10 days) should be used for eradication of throat carriage in cases where first-line therapy with penicillin has been unsuccessful.

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#### Non-pharyngeal carriage:

- Penicillin treatment alone may not be sufficient. Treatment options include clindamycin 300 mg four times a day for 10 days, or azithromycin 12 mg per kg per day (maximum 500 mg once a day) for 5 days with some limited reports in literature of combining with oral rifampicin or oral vancomycin.

*SIGN GRADING D*

### Failure of eradication

Close personal contacts can be the source of GAS to HCWs implicated in healthcare-associated transmission.<sup>54,59,63,78</sup>

If family members of an infected HCW are symptomatic, swabbing and antibiotic treatment should ideally be undertaken in liaison with the relevant GP. Swabbing of close

personal contacts, whether the contacts are symptomatic or not, could be considered where failure of eradication/re-colonisation occurs as carriage in such contacts may thwart attempts at long-term eradication.

If GAS cannot be eradicated from HCWs, and close personal contacts screen negative, there is some evidence to suggest that pets have been implicated in re-infection and this should be considered.<sup>79–82</sup>

In complex cases, such as failure of eradication or ongoing transmission resulting in lengthy exclusions or re-deployment, senior management should perform and document a risk assessment based on supporting evidence from infection control and occupational health.

### Recommendations

- Persistent or recurrent GAS colonisation may indicate re-colonisation within the household. Screening of household contacts should be considered in such circumstances.
- When considered necessary by the IPCT or occupational health physician, the health protection specialist should liaise with GPs regarding screening and treatment of close household contacts of HCWs infected or colonised with GAS.

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### Length of exclusion from work

#### Asymptomatic throat carriage and pharyngitis

Following a single case of GAS infection, HCWs with throat carriage on screening should stay away from clinical work until at least 24 h of appropriate treatment if asymptomatic, and, if symptomatic, until at least 24 h of appropriate treatment and resolution of symptoms has occurred. The majority of individuals (96%) with pharyngeal carriage will be culture-negative 24 h after starting treatment. (Padfield personal communication) The rate of successful eradication decreases over time, with some individuals relapsing many weeks after apparent successful eradication.<sup>71</sup>

In circumstances where carriage has been linked to an outbreak or confirmed transmission, the duration of exclusion from work should be decided on a case-by-case basis and will depend on the clinical situation, the likelihood and associated risk of further transmission, the site of colonisation and evidence of previous transmission.

Eradication of throat carriage (and therefore follow up screening) and continued exclusion from work are not essential if typing later excludes the HCW from being implicated in transmission but should be subject to a local risk assessment.

#### Skin lesions or other site colonisation

HCWs with active skin lesions are at increased risk of colonisation and shedding, and have been particularly associated with intra-hospital spread, including in the delivery suite.<sup>14,40,53,60</sup> A longer length of exclusion from work is required for HCWs with skin lesions, as time will be required for any infected skin lesions to heal, or in the case of dermatitis, for optimal resolution of the skin condition. The HCW should be reviewed by an occupational health physician, given advice regarding good skin care, and referred to a dermatologist if required. In general, these HCWs should not do clinical work until eradication is felt to have been effective. Enquiries should be made as to whether any close personal contacts are suffering from conditions that may be related to GAS infection, as re-colonisation from a close personal contact will frustrate efforts to clear carriage. Occupational health should liaise with the relevant GP if this is the case.

#### Recommendations

- HCWs with symptomatic GAS pharyngitis should stay away from clinical work until at least 24 h of appropriate therapy and resolution of symptoms has occurred. Asymptomatic HCWs should stay away from work until 24 h of appropriate therapy.
- A longer period of time may be required for HCWs with skin lesions or in other circumstances where carriage has been linked to an outbreak or confirmed transmission. This should be at the discretion of the IPCT team in liaison with the occupational health practitioner and discussed on a case-by-case basis after a risk assessment.

*SIGN GRADING Good practice points*

#### Microbiological investigation

All GAS isolates from in-patients, peri-natal patients and neonates, or identified as being from the immediate post discharge period e.g. post-operative wound swabs from general practice, should be saved by the microbiology laboratory for at least six months. This is important to capture all healthcare-associated GAS infections, including those that may occur after discharge, for retrospective analysis in the event of a potential outbreak.

All invasive isolates of GAS should be sent to the HPA Respiratory and Systemic Infections Laboratory, Streptococcus and Diphtheria Reference Unit (SDRU) as part of the ongoing surveillance of invasive disease due to GAS. Clinical and demographic details should be provided on the referral form.

*emm*-typing is the molecular gold standard for typing GAS and there are currently more than 180 *emm* types described globally. The determination of *emm*/M type together with the identification of opacity factor and the T protein are the key 'markers' for both phenotypic and molecular typing.<sup>83</sup> Further sub-typing may be required to define more clearly a potential outbreak and to monitor the investigation of a potential outbreak, including *emm* sequence sub-typing, and other methods based on sequencing and gene polymorphisms. Whilst results from *emm* typing of GAS isolates from clinical cases and screening isolates forms an essential part of outbreak investigation by providing further evidence of likely transmission routes, broader epidemiological investigations and control measures, including the issuing of prophylaxis where warranted, should not await typing results given the additional delays that might be incurred.

Rapid tests for the diagnosis of GAS are available; however, negative results should be confirmed by culture. The working group felt more work was needed to evaluate the advantage over 24 h culture in clinical settings, particularly in the detection of asymptomatic carriage, before recommendations could be made.

#### Recommendations

- GAS isolates from invasive disease should be referred to the reference laboratory for typing.
- The reference laboratory should be contacted if an outbreak is being investigated.

*SIGN GRADING Good practice points*

- Save all GAS isolates from in-patients, peri-partum patients, neonates, and those from post-operative wounds for six months.

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#### Applicability to other settings

The principles included in these guidelines could be usefully used for the investigation of GAS infection following home birth. Elements of this guidance could be usefully applied to other settings such as care homes given the similarities with hospitals in terms of vulnerability of the resident populations, close proximity of healthcare providers to residents and existence of communal facilities.<sup>88</sup> This is borne out by a study in the USA which found residents of long-term care facilities for the elderly have six times the risk of developing iGAS infection than elderly counterparts residing in the community and over one and half times the risk of death.<sup>84</sup> Cases arising in nursing or residential homes are more likely to form part of an outbreak, as is the case for hospital settings, given the potential for onward transmission in such settings.<sup>6,84</sup> The 2004 community guidelines provide further advice on contact management in relation to cases of invasive disease arising in institutional settings.<sup>9</sup>

#### Applicability to group C/G beta haemolytic streptococci

Outbreaks of puerperal sepsis caused by Lancefield group C and G streptococci beta-hemolytic streptococci have been

described in the literature, albeit less commonly than for group A streptococci.<sup>64,65,85,86</sup> Group C and G outbreaks have also been documented in burns units, general hospital wards, and outpatient clinics.<sup>86</sup> Outbreak investigations have suggested transmission occurs through similar mechanisms as group A streptococci, including from colonized healthcare workers to patients, although with a stronger emphasis on environmental sources, such as contaminated douches, showers and toilet seats.<sup>64,65,85,86</sup> In each instance, the outbreaks were controlled through strict infection control procedures and disinfection. Although there is less information on the incidence, transmission mechanisms and control of group G and C streptococcal outbreaks in hospital and maternity settings, given the similarities to group A streptococcal outbreaks and potential consequences of infection, extension of these guidelines to group C and G streptococcal strains would be a reasonable approach.

## Working group membership

Association of Medical Microbiologists  
(now British Infection Association)  
British Infection Society

British Society of Antimicrobial Chemotherapy  
Department of Health  
Faculty of Occupational Medicine  
of the Royal College of Physicians  
Health Protection Scotland  
Health Protection Agency

Hospital Infection Society

Infection Prevention Society  
Lee Spark NF Foundation  
Public Health Agency Northern Ireland

Public Health Medicine Environmental Group  
Public Health Wales

Royal College of Midwives

Royal College of Obstetrics & Gynaecology  
United Kingdom Clinical Pharmacy  
Association - Infection Management Group

## Review of guidance

The Working Group will consider updating these guidelines three years from publication. The decision on whether a full, partial or no update is needed will be made on the basis of whether new evidence has emerged since the evidence review was undertaken that would alter the recommendations contained within the guidelines, or whether any changes in healthcare practice or organisation have been implemented which alter the execution of the recommendations.

## Suggestions for further research

Further research is needed on the use of rapid tests for GAS, particularly for the detection of asymptomatic carriage. The eradication of GAS from chronic carriers deserves further attention also.

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## Consultation process

In accordance with the Health Protection Agency Policy and Guidance on the Development and Delivery of High Level Scientific Advice (OP001), these guidelines were open to public consultation for a three month period (14 May to 6 August 2010).<sup>87</sup> All comments received were shared with Working Group members with the designated senior responsible officer (SRO), Dr Joe Kearney, taking responsibility for analysing and responding to all comments.

## Acknowledgements

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## Appendix. Supplementary material

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jinf.2011.11.001](https://doi.org/10.1016/j.jinf.2011.11.001).

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