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Recommendations on Public Health Management of Invasive Group A Streptococcal (iGAS) Disease

Provincial Infectious Diseases Advisory Committee (PIDAC)

September 2014

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The **Provincial Infectious Diseases Advisory Committee on Communicable Diseases (PIDAC-CD)** is a multidisciplinary committee of health care professionals with expertise and experience in communicable diseases. PIDAC-CD provides advice to Public Health Ontario on communicable disease issues in Ontario, taking into account a focus on those activities where the impact on the community extends beyond the hospital and long-term care home, such as community settings outside of the health sector (e.g., schools and day nurseries), retirement homes and others as appropriate.

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This document was developed by the Provincial Infectious Diseases Advisory Committee on Communicable Diseases (PIDAC-CD). PIDAC-CD is a multidisciplinary scientific advisory body that provides evidence-based advice to Public Health Ontario regarding multiple aspects of infectious disease identification, prevention and control. PIDAC-CD's work is guided by the best available evidence and updated as required. Best Practice documents and tools produced by PIDAC-CD reflect consensus positions on what the committee deems prudent practice and are made available as a resource to public health and health care providers.

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About This Document

These recommendations were developed for Ontario public health practitioners and health care professionals who are involved in the case and contact management of invasive Group A Streptococcal disease. These recommendations should serve as a companion resource to the following documents, upon which they build:

- The *Ontario Public Health Standards, Infectious Diseases Protocol, 2013,* Group A Streptococcal Disease, Invasive (iGAS) chapter, Appendices A and B,[1,2] or as current (available at http://www.health.gov.on.ca/english/providers/program/pubhealth/oph_standards/ophs/infdispro.html)

- The 2006 Public Health Agency of Canada *Communicable Disease Report* supplement *Guidelines for the Prevention and Control of Invasive Group A Streptococcal Disease,*[3] or as current (available at http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06pdf/32s2_e.pdf

Evidence for Recommendations

The principles and practices recommended in this document are a synthesis of the best available scientific evidence and expert opinion of professionals from the fields of infectious diseases, infection prevention and control, public health and epidemiology. As new evidence arises, these recommendations will be updated as required.

NOTES: This document provides recommendations for consideration and reflects currently available evidence and expert opinion for public health management of invasive Group A Streptococcus disease. Health units and health care settings are encouraged to work toward applying these recommendations.

Provincial Infectious Diseases Advisory Committee (PIDAC)

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Executive Summary

Provincial Infectious Diseases Advisory Committee on Communicable Diseases (PIDAC-CD) developed these recommendations for consideration in response to inquiries from Ontario local public health units about the public health management of invasive Group A Streptococcal (iGAS) disease. These recommendations should serve as a companion resource to the following documents, upon which they build:

- The *Ontario Public Health Standards, Infectious Diseases Protocol, 2013,* Group A Streptococcal Disease, Invasive (iGAS) chapter, Appendices A and B,[1,2] or as current (available at http://www.health.gov.on.ca/english/providers/program/pubhealth/oph_standards/ophs/infdispro.html)

- The 2006 Public Health Agency of Canada *Canada Communicable Disease Report* supplement *Guidelines for the Prevention and Control of Invasive Group A* Streptococcal Disease,[3] or as current (available at http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06pdf/32s2_e.pdf)

PIDAC-CD's recommendations, which are informed by the best available evidence and expert opinion, pertain to six public health management issues for iGAS disease. In summary, PIDAC-CD recommends the following:

Evidence of severity

1. For the purpose of public health management (i.e., to inform chemoprophylaxis for eligible close contacts), a determination of whether or not iGAS disease was a cause of death should be made only if an iGAS case dies within 7 days of diagnosis.
2. For the purpose of public health management of iGAS disease, GAS pneumonia should not be used as a sole indicator of severity.
3. For the purpose of public health management of iGAS disease, the definition of soft-tissue necrosis should not include superficial or chronic soft-tissue necrosis/gangrene, or acute or chronic cellulitis. Soft-tissue necrosis should be acute in nature and deeper than the skin (e.g., necrotizing fasciitis, myositis and gangrene), as determined by the clinician.

Contact management

4. The Public Health Agency of Canada guidelines' definition of close contacts should be used to identify groups eligible for chemoprophylaxis,[3] i.e., persons exposed to a confirmed severe iGAS case in the 7 days prior to onset of symptoms in the case or up to 24 hours after the case's initiation of antimicrobial therapy and:
    - Spent 4 hours/day on average in the previous 7 days, OR 20 hours/week with the case, or
    - Shared the same bed or had sexual relations with the case, or
    - Had direct mucous membrane contact with oral or nasal secretions of the case or unprotected direct contact with an open skin lesion of the case, or
    - Shared needles (i.e., for injection drug use) with the case, or
    - In certain circumstances, selected child care and hospital contacts.

If numerous groups of people are identified as eligible for chemoprophylaxis, public health practitioners could give first priority to the timely administration of antibiotic prophylaxis to close contacts in high-risk groups as outlined in the U.S. Centers for Disease Control and Prevention iGAS management guideline (e.g., persons over 65 years, and those with HIV infection, diabetes, chickenpox, cancer, heart disease, injection drug use or steroid use).[4 p.952]

5. Public health units' advice to close contacts on monitoring for signs and symptoms of iGAS should be consistent with the Public Health Agency of Canada guidelines' recommendation to "seek medical attention immediately should they develop febrile illness or any other clinical manifestation of GAS infection within 30 days of diagnosis in the index case." [3, p.4]

Screening in long-term care facilities

6. Public health units and health care providers should follow the Public Health Agency of Canada (PHAC) guidelines for screening in long-term care facilities (LTCFs) for GAS to avoid unnecessary screening/rescreening.[3] As per the PHAC guidelines,[3] if a confirmed case of invasive GAS disease is identified in a LTCF, conduct a retrospective chart review to identify an excess of confirmed or suggested GAS among residents in the preceding 4 to 6 weeks. If an excess of GAS infection is identified (as below), consider screening for GAS (i.e., throat, nose and skin lesion cultures) in:

    - All patient care staff, and non-patient care staff with a positive history of suggested recent GAS infections and
    - All residents in LTCF with < 100 beds, OR, residents in the same unit as the iGAS case and
    - Contacts of that case if necessary in LTCF with ≥ 100 beds, OR residents in the same unit as the iGAS case and contacts of that case if necessary, OR more broadly as suggested by resident or staff movements or epidemiologic evidence.

The PHAC guidelines defines an excess of GAS infection in a LTCF as: [3, p.4]

- > 1 case of culture-confirmed iGAS per 100 residents per month, or
- ≥ 2 cases of culture-confirmed iGAS per month in facilities with <200 residents, or
- > 4 cases of suggested invasive or non-invasive GAS per 100 residents per month.

Introduction

Purpose

Provincial Infectious Diseases Advisory Committee on Communicable Diseases (PIDAC-CD) has provided these recommendations for consideration in response to inquiries from Ontario local public health units about the public health management of invasive Group A Streptococcal (iGAS) disease. Specifically, the recommendations provide clarification on the following:

Evidence of severity

1. Determination of the cause of death in an iGAS case for the purposes of chemoprophylaxis
2. Utility of pneumonia as a sole indicator of severity
3. Definition of soft-tissue necrosis as an indicator of severity

Contact management

4. Definition of close contacts
5. Duration of monitoring of close contacts of an iGAS case for signs and symptoms of GAS infection: 21 versus 30 days

Screening in long-term care facilities

6. Indications for screening in long-term care facilities (LTCFs) for GAS

Evidence Review and Expert Consultation

Objectives

To identify and review relevant peer-reviewed and grey literature that addressed the six iGAS public health management issues that were the focus of these PIDAC-CD recommendations (see Purpose).

To obtain and consider expert opinion to supplement gaps in existing evidence on the six iGAS public health management issues that were the focus of these PIDAC-CD recommendations (see Purpose).

Methodology

Literature search

With guidance from PIDAC-CD and Public Health Ontario Communicable Diseases staff, Public Health Ontario Library Services conducted focused literature searches for relevant peer-reviewed and grey literature published between January 1998 and March 2012. An updated literature search (see below) conducted in April and May 2013 yielded no new relevant results.

Peer-reviewed literature search strategy

Electronic health databases were searched for peer-reviewed literature on key concepts (see Tables 1 and 2). Search strategies for each database were constructed using MeSH subject headings and keywords combined with Boolean operators. Only English-language documents were examined. Subject headings and keywords are summarized in Table 1. Databases and publication date limits used for focused searches are summarized in Table 2. Additional details on the search strategy and results are available here: https://secure.publichealthontario.ca/en/BrowseByTopic/InfectiousDiseases/PIDAC/Pages/iGAS_Evidence_Review_Expert_Consultation_and_Search_Strategies.aspx

Grey literature search

Searches of the peer-reviewed literature did not produce a high yield of relevant results. As such, a web search was performed using Google to identify relevant grey literature. The websites of major public health agencies were the focus of the search, such as www.phac-aspc.gc.ca and www.cdc.gov. The websites of all Canadian provincial and territorial health ministries were searched, as well as those of international and national organizations. Additionally, a Google search was performed, limiting the results to .gov, .org, and .edu domains. Reference lists in highly relevant grey literature were also examined. Additional details on the search strategy and results are available here: https://secure.publichealthontario.ca/en/BrowseByTopic/InfectiousDiseases/PIDAC/Pages/iGAS_Evidence_Review_Expert_Consultation_and_Search_Strategies.aspx

Table 1: Key concepts and corresponding MeSH subject headings and keywords-peer-reviewed literature search

iGAS	Close contacts	Outbreak/transmission	Hospital/LTCF	Guidelines
Subject headings				
Streptococcus pyogenes/ Streptococcus Group A/ Group A Streptococcus infections/ adj2 invasive Group A Streptococcal infection/ Streptococcus infection/	cross infection/ disease transmission/ family/	disease transmission, infectious/ infectious disease transmission, professional-to-patient/ infectious disease transmission, patient-to-professional/ infectious disease transmission, vertical/ cross infection/ infection control/ bacterial transmission/ hospital infection/ cross infection/	hospital infection/ long-term acute care hospital/ health facilities/ long-term care/ health care facility/ hospital/	Not applicable
Keywords				
• streptococcal disease • iGAS • streptococcal infections	• case-patient "person to person" • intra-familial • close contact • carriage • shared environment • person to person • familial carriage • intimate contact	• outbreak • disease transmission	Not applicable	Guideline recommend

iGAS, invasive Group A Streptococcal disease; LTCF, long-term care facility.

Table 2: Databases and publication date limits—peer-reviewed literature search

Focused search topic	Databases and publication date limits
iGAS infection and close contacts	CINAHL with Full Text, MEDLINE, Academic Search Premier, Nursing & Allied Health Collection, Comprehensive: 2002–2013
Definition of close contacts	CINAHL with Full Text, MEDLINE, Academic Search Premier, Nursing & Allied Health Collection, Comprehensive: 2002–2013
iGAS outbreaks in hospitals/long-term care facilities	MEDLINE, Embase: 2002–2013
Streptococcus pyogenes and transmission	MEDLINE, Embase: 2002–2013
iGAS guidelines	MEDLINE, Embase: 1998–2013

iGAS, invasive Group A Streptococcal disease.

Review of evidence

Literature search results (e.g., title and abstract) were reviewed for relevance by Public Health Ontario Library Services and Communicable Diseases staff. Peer-reviewed and grey literature that addressed at least one of the six specific iGAS public health management issues under consideration (see Purpose) was included. Studies addressing interventions in settings beyond the scope of these recommendations (e.g., acute care hospitals and child care centers) were excluded from the review.

Using guidelines identified via the grey literature search, jurisdictional comparisons of guidance on public health management of iGAS from public health organizations in Canada, the United Kingdom, the United States, Australia and Ireland were prepared (see Appendices 1 to 4 for a summary of findings of the jurisdictional comparisons).

PIDAC-CD members reviewed the most relevant evidence (i.e., peer-reviewed review articles and single studies, and the jurisdictional comparisons of public health management) via iterative critical discussion at multiple PIDAC-CD meetings about the quality and applicability of the evidence to the public health management of iGAS in Ontario.

Expert consultation

PIDAC-CD consulted Dr. Allison McGeer, Microbiologist and Infectious Disease Consultant, Mount Sinai Hospital, Toronto, and Professor, Department of Laboratory Medicine and Pathobiology and Dalla Lana School of Public Health, University of Toronto. In addition, on behalf of PIDAC-CD, PHO staff consulted with Dr. Theresa Lamagni, Epidemiologist, Health Protection Agency, UK (now Public Health England), for expert input in respect of time from iGAS diagnosis to death for surveillance purposes, management of iGAS outbreaks in long-term care facilities, and duration of monitoring for signs and symptoms recommended to contacts of iGAS cases. In addition, PIDAC-CD communicated with other external international experts (i.e., at the Centers for Disease Control and Prevention [CDC] in the United States; and the Queensland Government in Australia) to inform the jurisdictional comparisons. PIDAC-CD also considered this expert opinion via iterative discussion at multiple PIDAC-CD meetings.

Recommendations

Evidence of Severity

The Public Health Agency of Canada (PHAC) guidelines recommend chemoprophylaxis for close contacts of an iGAS case that is "severe," as per the PHAC iGAS case definitions (see Appendix 5).[3] The following three recommendations provide additional guidance on obtaining and interpreting evidence of severity for the purposes of public health management (i.e., chemoprophylaxis of close contacts of severe iGAS cases). The iGAS disease-specific chapter of the Ministry of Health and Long term Care *Ontario Public Health Standards Infectious Diseases Protocol* Appendices A and B align with these PHAC recommendations.[1,2]

1. Determination of the cause of death in an iGAS case for the purposes of chemoprophylaxis

Recommendation

> **For the purpose of public health management (i.e., to inform chemoprophylaxis for eligible close contacts), a determination of whether or not iGAS disease was a cause of death should be made only if an iGAS case dies within 7 days of diagnosis.**

Background

The PHAC guidelines' definition of a severe iGAS case includes "a confirmed case resulting in death."[3] As noted above, the PHAC guidelines also recommend chemoprophylaxis of close contacts of a severe iGAS case.[3] The iGAS disease-specific chapter of the *Ontario Public Health Standards Infectious Diseases Protocol* Appendices A and B contact management recommendations align with these PHAC recommendations.[1,2] To inform timely public health management (i.e., to determine whether to recommend chemoprophylaxis for eligible close contacts), when death occurs in a person with iGAS, public health units may need to determine whether or not GAS infection was a contributing cause of death. The case is classified as severe if iGAS is determined to be one of the causes of death.

The PHAC, U.S., Irish, Australian and U.K. management guidelines do not specify a time frame for attributing cause of death to GAS after GAS isolation.[3-7] For surveillance purposes only (and not to inform management), the U.K. has used 7 days after collection of a positive culture specimen as the time frame for identifying iGAS disease as the cause of death (personal communication; unreferenced, Dr. Theresa Lamagni, November 2011).

It is conceivable that someone may die from complications of an iGAS infection 14, 21, or even 30 days after infection,[8,9] but there is evidence from a prospective, population-based surveillance study in Ontario that the risk of death related to iGAS is highest in the first 7 days of infection.[9] In addition, an analysis of enhanced surveillance data from the UK in 2003-2004 found that death occurred within the first 7 days after specimen collection in 559 of 698 case-patients with severe S*. pyogenes* infections who died up to 30 days after collection of a culture-positive specimen.[8, p.1304] In general, the clinician most responsible for a patient is likely to be in the best position to determine the patient's contributing cause(s) of death; this likely also applies when death occurs in a patient with iGAS. However, public health units have found it difficult and time-consuming to determine whether iGAS was a contributing

cause of death, as clinicians have either not commented, or were unable to state with certainty whether or not GAS was a contributing cause of death.

Beyond 7 days after the death of a patient with iGAS, in most cases there is very little benefit derived from determining iGAS as a cause of death; chemoprophylaxis is recommended for close contacts for only up to 7 days following last contact with a severe iGAS case.[3]

Additional comments

Should a person with iGAS die more than 7 days after diagnosis, public health contact management should remain similar to that for follow-up of contacts of a non-severe case (i.e., all contacts of cases should still be advised to monitor themselves for signs and symptoms of iGAS for 30 days after the date of last exposure to the case [see recommendation 5]). This recommendation does not affect the clinical death certification and other requirements for determining cause of death.

2. Utility of pneumonia as a sole indicator of severity

Recommendation

> **For the purpose of public health management of iGAS disease, GAS pneumonia should not be used as a sole indicator of severity.**

Background

The definition of a severe iGAS case from the PHAC guidelines includes a case of GAS pneumonia (see Appendix 5); the PHAC guidelines also recommend chemoprophylaxis of close contacts of a severe iGAS case.[3] The iGAS disease-specific chapter of the *Ontario Public Health Standards Infectious Diseases Protocol* Appendices A and B case definitions and contact management recommendations align with the PHAC recommendations.[1,2] Like the PHAC guidelines, the U.S., U.K. and Irish guidelines include pneumonia as a sole indicator of invasive disease for the purposes of public health management.[4,5,7]

Pneumonia has been identified as a common presentation of iGAS; for example, 11 per cent of iGAS cases presented with pneumonia in a prospective, population-based study in Ontario.[9] Field experience indicates that attributing pneumonia to GAS infection in a timely fashion (i.e., within 7 days in order to inform chemoprophylaxis recommendations) is a challenge. In the absence of microbiological confirmation from an appropriate respiratory sample, the determination of whether or not the pneumonia is caused by GAS rests with the clinician. The clinical diagnosis of GAS pneumonia is limited with respect to sensitivity and specificity, given that it is based largely on patient signs and symptoms and interpretation of chest x-rays. The challenges and complexity of attributing pneumonia to a causative organism in the context of managing community-acquired pneumonia have been well described.[10, 11] PIDAC-CD acknowledges the difficulty of diagnosing pneumonia in iGAS cases, and that severe iGAS cases with pneumonia would most likely have other evidence of severity to meet the case definition for severe iGAS (e.g., streptococcal toxic shock syndrome [STSS]). See Appendix 5 for case definitions.

PIDAC-CD's recommendation regarding the utility of pneumonia as a sole indicator of clinical severity was made in consultation with Dr. Allison McGeer (personal communication; unreferenced, January 2012).

3. Definition of soft-tissue necrosis as an indicator of severity

Recommendation

For the purpose of public health management of iGAS disease, the definition of soft-tissue necrosis should not include superficial or chronic soft-tissue necrosis/gangrene, or acute or chronic cellulitis. Soft-tissue necrosis should be acute in nature and deeper than the skin (e.g., necrotizing fasciitis, myositis and gangrene), as determined by the clinician.

Background

Health units have requested clarification about what conditions would meet the definition of soft-tissue necrosis as an indicator of severity in iGAS cases. Necrotizing soft-tissue infection typically presents with sudden onset of intense pain.[12-14] Necrotizing infections of the skin and soft tissue caused by GAS typically progress rapidly along the fascial planes, resulting in necrosis of subcutaneous tissue.[13] This does not include chronic gangrene or superficial infection, such as cellulitis and infected abscesses.

The PHAC guidelines state that an iGAS case with "soft-tissue necrosis (including necrotizing fasciitis, myositis and gangrene)"[3, p.3] is considered to be severe, and would trigger chemoprophylaxis recommendations for eligible close contacts. The iGAS disease-specific chapter of the *Ontario Public Health Standards Infectious Diseases Protocol* Appendices A and B case definitions and contact management recommendations align with the PHAC recommendations.[1,2]

Contact Management

4. Definition of close contacts

Recommendation

The Public Health Agency of Canada guidelines' definition of close contacts should be used to identify groups eligible for chemoprophylaxis,[3] i.e., persons exposed to a confirmed severe iGAS case in the 7 days prior to onset of symptoms in the case or up to 24 hours after the case's initiation of antimicrobial therapy and who:

- **Spent 4 hours/day on average in the previous 7 days, OR 20 hours/week with the case, or**
- **Shared the same bed or had sexual relations with the case, or**
- **Had direct mucous membrane contact with oral or nasal secretions of the case or unprotected direct contact with an open skin lesion of the case, or**
- **Shared needles (i.e., for injection drug use) with the case, or**
- **In certain circumstances, selected child care and hospital contacts.**

If numerous groups of people are identified as eligible for chemoprophylaxis, public health practitioners could give first priority to the timely administration of antibiotic prophylaxis to close contacts in high-risk groups as outlined in the U.S. Centers for Disease Control and Prevention iGAS management guideline (e.g., persons over 65 years, or with HIV infection, diabetes, chickenpox, cancer, heart disease, injection drug or steroid use).[4, p.952]

Background

PHAC guidelines

The current PHAC guidelines recommend chemoprophylaxis for close contacts of severe iGAS cases.[3] The PHAC guidelines' definition of close contacts (see Appendix 4 and 5) is used to inform contact management, including identification of groups eligible for chemoprophylaxis.

The efficacy and optimal regimen of antibiotic prophylaxis for contacts has not been well established, but the PHAC guidelines currently advise that chemoprophylaxis be offered to close contacts of a case of iGAS with evidence of severity, such as STSS, necrotizing fasciitis, meningitis or death. The purpose of prophylaxis is to eradicate nasopharyngeal colonization of GAS and prevent disease.

Comparison of guidelines

The PHAC guidelines differ from the U.S., U.K., Irish and Australian iGAS public health management guidelines (refer to Appendix 1),[4-7,15] highlighting the differences in recommendations for chemoprophylaxis that can be developed from similar evidence (see below). Different jurisdictions have followed different lines of reasoning in the development of their guidelines. The 2002 U.S. guidelines are directed at the host factors influencing susceptibility to iGAS disease,[4] whereas the Canadian guidelines attempt to target the bacteria and its virulence with antibiotic use.[3] The relative importance of infection associated with host factors versus infection associated with GAS strain is unknown; this leads to uncertainty in determining the most effective approach to preventing infection.

Evidence of risk of iGAS disease in contacts from population-based studies

Two North American prospective, population-based surveillance studies have quantified the risk of iGAS disease among household contacts.[9,16] Davies et al estimated the rate of iGAS in identified household contacts via active surveillance in the Ontario population.[9] Over the study period (January 1992 to June 1995), four cases occurred in a total of 1,360 household contacts of sporadic iGAS cases. Three household cases occurred in husband and wife pairs, and one case between adult siblings.[9] These observations translate to a rate of 294 cases per 100,000 (95 per cent confidence interval 80–750 cases per 100,000) over the 3.5 year study period.[9]

Robinson et al estimated the risk of iGAS transmission among household contacts in the United States.[16] Over the course of the study period (January 1997 to April 1999), one confirmed case in 1,514 household contacts was reported: a husband-wife pair. A second child–parent probable case pair was also reported, but laboratory confirmation was not made. These data translate to a rate of iGAS among close household contacts of 66 per 100,000 using only laboratory-confirmed cases, or 132.1 per 100,000 using both laboratory-confirmed and probable cases.[16]

In addition, a follow up study using enhanced surveillance from England, Wales and Northern Ireland in 2003 identified five household clusters of iGAS: three mother-neonate pairs and two husband and wife pairs.[7, p.356] The risk of further cases in mother or baby was therefore estimated to be high when iGAS occurs in mother or baby in the neonatal period. Using these U.K. data, the number needed to treat (i.e., to receive chemoprophylaxis) to prevent one iGAS case among other household contacts was over 2,000 persons, assuming that chemoprophylaxis was 100 per cent effective.[7]

Assessment of evidence base for existing guideline recommendations

There is no strong scientific evidence to quantify the risk of iGAS disease among household contacts of cases. In the PHAC guidelines, the targeted chemoprophylaxis of close contacts linked to severe iGAS cases is based on expert opinion and biological plausibility.[3] Consistency between a particular strain and severity of infection has been observed for other infectious agents, but not for iGAS. The broader

definition of close contacts in the PHAC guidelines relative to other jurisdictions—in particular, the inclusion of those with direct mucous membrane contact with the oral/nasal secretions of a case, and those having sexual contact with or having shared a bed with a case—are also based on expert opinion and biological plausibility.[3] There are no observational studies or case reports documenting transmission of GAS after this type of contact.

Given that only expert opinion is available to explain the differences between guidelines, PIDAC-CD suggests that the PHAC guidelines are appropriate in the Ontario context.

PIDAC-CD also recognizes that some iGAS case and contact investigations have unique and challenging circumstances, logistics and epidemiology, and may require clinical judgment to identify close contacts that should be considered for chemoprophylaxis. While guidelines may provide a point of reference, they are not meant to be a substitute for good judgment on the part of clinicians and public health authorities. The interpretation of guidelines may at times differ from one practitioner to the next.

It is not expected that the application of clinician/public health authority judgment will result in a decision to administer chemoprophylaxis to anyone who would not be routinely included as a close contact in accordance with the PHAC guidelines. It is also anticipated that difficult decisions will have to be made by clinicians and public health authorities in defining the close contacts of a particular iGAS case, especially when the extent of direct mucous membrane contact cannot be well established.

Regardless, all close contacts should routinely receive education on the signs and symptoms of iGAS and be advised to seek medical care should symptoms develop. Emphasis on this standard practice should not be lost as public health practitioners devote efforts to identifying groups eligible for chemoprophylaxis.

5. Duration of monitoring of close contacts of an iGAS case for signs and symptoms of GAS infection: 21 versus 30 days

Recommendation

> **Public health units' advice to close contacts on monitoring for signs and symptoms of iGAS should be consistent with the PHAC guidelines' recommendation to "seek medical attention immediately should they develop febrile illness or any other clinical manifestation of GAS infection within 30 days of diagnosis in the index case".[3, p.4]**

Background

The Ministry of Health and Long-Term Care *Ontario Public Health Standards Infectious Diseases Protocol, 2013,* Group A Streptococcal Disease, Invasive (iGAS) chapter states, "all close contacts of invasive disease should be instructed about the signs and symptoms of GAS infection and advised to seek medical attention if they develop within 30 days after exposure to case." [1, p. 6] This is based on the PHAC guidelines,[3] which are in line with the U.S., U.K. and Irish management guidelines.[4,5,7]

There is limited evidence to accurately determine the time it may take for an exposed individual to develop signs and symptoms of GAS.[3] Most secondary cases should occur well before 30 days, but the 30-day duration covers the time that an exposed individual is most likely to present with signs and symptoms of infection. According to Heymann, the incubation period for GAS is 1 to 3 days;[17] however, it is thought that in a person who is colonized with GAS it may take longer (7 to 14 days)[3] for the GAS to

become invasive and symptoms to present (personal communication; unreferenced, Dr. Allison McGeer, August 2012). Recommending that contacts self-monitor for signs and symptoms for 30 days simplifies communications and provides an extra few days as a precaution.

Screening in Long-Term Care Facilities

6. Indications for screening in long-term care facilities for GAS

Recommendation

Public health units and health care providers should follow the PHAC guideline for screening in long-term care facilities (LTCFs) for GAS to avoid unnecessary screening/rescreening.[3]

As per the PHAC guidelines,[3], if a confirmed case of invasive GAS disease is identified in a LTCF, conduct a retrospective chart review to identify an excess of confirmed or suggested GAS among residents in the preceding 4 to 6 weeks. If an excess of GAS infection is identified, consider screening for GAS (i.e., throat, nose and skin lesion cultures) in:

- **All patient care staff, and**
- **All residents in LTCF with < 100 beds, OR, residents in the same unit as the iGAS case and contacts of that case if necessary in LTCF with ≥ 100 beds, OR residents in the same case unit as the iGAS case and contacts of that case if necessary, OR more broadly as suggested by resident or staff movements or epidemiologic evidence.**

The PHAC guidelines[3, p.4] defines an excess of GAS infection in a LTCF as:

- **> 1 case of culture-confirmed iGAS per 100 residents per month, or**
- **≥ 2 cases of culture-confirmed iGAS per month in facilities with <200 residents, or**
- **> 4 cases of suggested invasive or non-invasive GAS per 100 residents per month.**

Background

Regarding screening in LTCFs, the PHAC guidelines state the following, which apply (as stated below) in a LTCF in which there is a confirmed case of **invasive** GAS disease:

- When a confirmed case of invasive GAS disease … occurs in a LTCF such as a nursing home, the facility should […] conduct a retrospective chart review of the entire facility's residents over the previous 4 to 6 weeks for culture-confirmed cases of GAS disease and any suggested cases of non-invasive or invasive GAS infection, including skin and soft tissue infections (e.g., pharyngitis and cellulitis) and excluding pneumonia and conjunctivitis not confirmed by culture.[3]

An excess of GAS infection or a LTCF outbreak is defined by the PHAC guidelines as follows:

- An incidence rate of culture-confirmed invasive GAS infections of > 1 per 100 residents per month or at least two cases of culture-confirmed invasive GAS infection in 1 month in facilities with fewer than 200 residents or an incidence rate of suggested invasive or non-invasive GAS infections of > 4 per 100 residents per month.[3, p.4]

Subsequently, the PHAC guidelines suggest the following action if an excess of GAS infection is identified:

- All patient care staff should be screened for GAS with throat, nose and skin lesion cultures. In LTCF with < 100 beds, all residents should be screened for GAS. In LTCF with 100 beds or greater, screening can be limited to all residents within the same care unit as the infected case and contacts of the case if necessary, unless patient and care staff movement patterns or epidemiologic evidence (e.g., from the chart review) suggest that screening should be conducted more broadly.[3, p.7]

The literature review revealed that the PHAC guidelines on screening for asymptomatic carriers in an iGAS outbreak are not consistent with those of other jurisdictions. For example, both the Irish and the U.K. guidelines do not explicitly recommend screening; instead, they recommend testing and treating those who may become symptomatic with potential GAS pharyngitis or skin infections during the outbreak.[5, 7] PIDAC-CD carefully considered the more liberal PHAC screening recommendations, including their cost-effectiveness, and concluded that there was an absence of strong or convincing evidence for a particular screening approach. The different approaches are largely based on expert opinion and biological plausibility, rather than on strong scientific evidence. Public Health Ontario will continue to analyze local surveillance data on recent iGAS LTCF outbreaks in an attempt to better inform current guidelines.

Appendices

Appendix 1: Jurisdictional comparison of recommendations for chemoprophylaxis

Jurisdiction	Recommendation for chemoprophylaxis
Australia (Queensland)[6]	• Communicable disease control manual[6] • Public Health Units may initiate mass antibiotic prophylaxis of children aged 2 to 12 years to control acute post-streptococcal glomerulonephritis outbreaks

Australia (Victoria)[15]	• Department of Health, Victoria, Australia,[15] control of contacts:
	  • Consider the diagnosis in symptomatic contacts; few people who come in contact with GAS will develop invasive GAS disease. At present the role of antibiotic prophylaxis for close contacts of cases of invasive GAS infection is uncertain;
	  • However, in certain circumstances, antibiotic therapy may be appropriate for those at higher risk of infection

Canada[3]	• Chemoprophylaxis is recommended for all close contacts of severe iGAS cases
Ireland[5]	• Chemoprophylaxis should be administered to close contacts if they have symptoms suggestive of localized GAS infection; mother and baby if either develops iGAS in the neonatal period (first 28 days of life)
United Kingdom[7]	• Antibiotic prophylaxis should be given only to the following: mother and neonate if either develops iGAS; close contacts if they develop symptoms of strep A infection (e.g., sore throat, fever, skin infection); all household contacts if more than one iGAS case occurs in a household within a 30-day period
United States [4]	• May be given to all household contacts where a member has one of the following risk factors: over 65 years, HIV infection, diabetes, chickenpox, cancer, heart disease, injection drug use, steroid use.

Appendix 2: Jurisdictional comparison of management guidance related to iGAS and death

Jurisdiction	Attribution of cause of death to GAS
Australia (Queensland, Victoria)[6,15]	Not addressed
Canada[3]	Not addressed; no time frame specified after Group A Streptococcal (GAS) isolation
Ireland[5]	Not addressed
United Kingdom[7]	Not addressed
United States[4]	Not addressed; no time frame specified after GAS isolation

Appendix 3: Jurisdictional comparison of guidance related to iGAS and pneumonia

Jurisdiction	Reference to pneumonia	Comment
Australia (Queensland, Victoria)[6,15]	• Not addressed	No national guidance on invasive GAS
Canada[3]	• Group A Streptococcal pneumonia specified in definition of severe case (p. 3, Table 2)	Under infection-control measures to prevent transmission of invasive GAS in health care institutions: "For the purpose of infection control, GAS pneumonia with or without a positive blood culture is considered an invasive infection, although not identified as such for reporting" (p. 22)
Ireland[5]	• Other causes of invasive GAS, including focal infection, autoimmune disease and malignancy. • The clinical presentation of iGAS may include other invasive disease, such as focal iGAS: meningitis, pneumonia, peritonitis, puerperal sepsis, osteomyelitis, septic arthritis and surgical wound infections (p. 21)	Document represents expert opinion of iGAS subcommittee, following a review of the scientific literature and a consultation exercise. Clinical component of case definition (current as of January 1, 2004) includes an acute febrile illness that may be associated with streptococcal toxic shock syndrome (p. 6)
United Kingdom[7]	• Includes pneumonia as part of definition, under "other invasive disease"	Three clinical syndromes are described. The third covers "infections characterized by the isolation of GAS from a normally sterile site in patients not meeting the criteria for streptococcal toxic shock syndrome or necrotizing fasciitis. Included in this group are bacteremia with no identified focus and focal infections such as meningitis, pneumonia…" close contacts, (p. 355)
United States[4]	• Invasive Group A Streptococcal infections may manifest as any of several clinical syndromes, including pneumonia or bacteremia in association with cutaneous infection	As per CDC case definition (p. 32)

Appendix 4: Jurisdictional comparison of the definition of close contacts

Jurisdiction	Definition of close contact
Australia (Queensland, Victoria)[6,15]	Not defined
Canada[3]	• Those spending 4 hours per day on average in the previous 7 days or 20 hours per week with the case • Those with the following types of contact with the iGAS case: sharing the same bed, sexual relations, direct mucous membrane contact with oral or nasal secretions of an iGAS case or direct contact with the open skin lesion, shared needles
Ireland[5]	Household contacts: • All contacts living in the same household as a case of iGAS within the 7 days prior to the case patient becoming ill Other close contacts: • Persons who share sleeping arrangements OR • Persons who have had direct mucous membrane contact with the oral or nasal secretions of a case within 7 days prior to case patient illness
United Kingdom[7]	• Someone who has had prolonged close contact with a case in a household-type setting during the 7 days prior to the onset of illness
United States[4]	• Those spending at least 24 hours with the index case in the 7 days prior to the onset of the case patient's symptoms

Appendix 5: iGAS case definitions from the PHAC guidelines

Below are the PHAC iGAS definitions for confirmed case, severe case and close contact discussed in the supplement Guidelines for the Prevention and Control of Invasive Group A Streptococcal Disease (p. 3. Table 1), available at http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06vol32/32s2/index-eng.php.[3] These definitions are of importance to the queries from public health units:

- **Confirmed case:** Laboratory confirmation of infection, with or without clinical evidence of invasive disease.[a] Laboratory confirmation requires the isolation of group A streptococcus *(Streptococcus pyogenes)* from a normally sterile site.

- **Severe [iGAS] case:** Case of STSS [streptococcal toxic shock syndrome], soft-tissue necrosis (including necrotizing fasciitis, myositis or gangrene), meningitis, GAS pneumonia, other life-threatening conditions or a confirmed case resulting in death.

    - **Close contact:** In order to be considered a close contact, there must have been exposure to the case during the period from 7 days prior to the onset of symptoms in the case to 24 hours after the case's initiation of antimicrobial therapy.

        - Household contacts of a case who have spent at least 4 hours/day on average in the previous 7 days or 20 hours/week with the case
        - Non-household persons who share the same bed with the case or had sexual relations with the case
        - Persons who have had direct mucous membrane contact with the oral or nasal secretions of a case (e.g., mouth-to-mouth resuscitation, open-mouth kissing) or unprotected direct contact with an open skin lesion of the case
        - Injection drug users who have shared needles with the case
        - Selected LTCF contacts (see Section 6.3 of the PHAC guidelines)[3]
        - Selected child care contacts (see Section 6.4 of the PHAC guidelines)[3]
        - Selected hospital contacts (see Annex 3 of the PHAC guidelines)[3]

[a] Clinical evidence of invasive disease may be manifested as several conditions. These include:

a) STSS, which is characterized by hypotension (systolic blood pressure ≤ 90 mmHg in adults or < 5th percentile for age in children) and at least two of the following signs:

i. renal impairment (creatinine level ≥ 177 μmol/L for adults)

ii. coagulopathy (platelet count ≤ 100,000/mm or disseminated intravascular coagulation)

iii. liver function abnormality (SGOT [AST], SGPT [ALT] or total bilirubin ≥ 2x upper limit of normal)

iv. adult respiratory distress syndrome (ARDS)

v. generalized erythematous macular rash that may desquamate

b) soft-tissue necrosis, including necrotizing fasciitis, myositis or gangrene;

c) meningitis; or

d) a combination of the above.

Appendix 6: Search strategies

Search Strategies

iGAS infection and close contacts peer-reviewed literature search

SEARCH 1: CINAHL with Full Text, Show allMEDLINE, Academic Search Premier, Nursing & Allied Health Collection: Comprehensive

#	Query
S7	(Streptococcus pyogenes or Streptococcus group A or Invasive group A Streptococcus infections) AND intimate contact
S6	(Streptococcus pyogenes or Streptococcus group A or Invasive group A Streptococcus infections) AND (cross infection or disease transmission)
S5	(Streptococcus pyogenes or Streptococcus group A or Invasive group A Streptococcus infections) AND (cross infection or disease transmission)
S4	(family or intra-familial or case-patient or “person to person” or shared environment or carriage or familial carriage or “close contact”) AND (Streptococcus pyogenes or Streptococcus group A or Invasive group A Streptococcus infections) AND (cross infection or disease transmission)
S3	(STREPTOCOCCUS pyogenes OR STREPTOCOCCAL infections) AND (family or intra-familial)
S2	(STREPTOCOCCUS pyogenes OR STREPTOCOCCAL infections) AND cross
S1	(STREPTOCOCCUS pyogenes OR STREPTOCOCCAL infections) AND "close contact"

SEARCH 2:

#	Searches
1	Streptococcus pyogenes /
2	Streptococcus group A/ or group A streptococcal infection/ or Streptococcus infection/ or bacterial infection/
3	1 or 2
4	family/
5	intra-familial.mp.
6	close contact.mp.
7	carriage.mp.

#	Searches
8	shared environment.mp.
9	person to person.mp.
10	familial carriage.mp.
11	intimate contact.mp.
12	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13	disease transmission/
14	cross infection/dm, ep, pc [Disease Management, Epidemiology, Prevention]
15	13 or 14
16	3 and 12 and 15
17	limit 16 to (english language and yr="2008 -Current")
18	3 and 15
19	limit 18 to (human and english language and yr="2008 -Current")
20	1 and 15
21	limit 20 to (english language and yr="2008 -Current")
22	Streptococcus group A/ 3468
23	15 and 22
24	limit 23 to (english language and yr="2008 -Current")
25	17 or 21 or 24

iGAS infection and definition of close contacts web/grey literature search

APIC Text: http://text.apic.org/item-75/chapter-71-streptococci/basic-principles

CANADA

Newfoundland and Labrador, Department of Health & Community Services Disease Control Division. Guideline for management of invasive group A streptococcal disease across the continuum of care. St. Johns, NL: Government of Newfoundland and Labrador; 2009. Available from: http://www.health.gov.nl.ca/health/publichealth/cdc/invasive_groupa_streptococcal_management.pdf

Yukon Health and Social Services, Yukon Communicable Disease Control. Invasive Group A Streptococcal disease. Whitehorse, YT: Government of Yukon; 2011. Available from: http://www.hss.gov.yk.ca/pdf/ycdc_igas.pdf

Alberta Health and Wellness. Public Health notifiable disease management guidelines: Streptococcal disease – Group A, Invasive. Government of Alberta; c2003-2011. Available from: http://web.archive.org/web/20130530040130/http://www.health.alberta.ca/documents/Guidelines-Streptococcal-Disease-Group-A-Invasive-2011.pdf

Manitoba Health, Communicable Disease Control Unit. Communicable disease management protocol: invasive group A streptococcal disease. Winnipeg, MB: Province of Manitoba; 2007. Available from: http://www.gov.mb.ca/health/publichealth/cdc/protocol/igas.pdf

Saskatchewan Ministry of Health. Communicable disease control manual. Section 2: respiratory and direct contact. Regina, SK: Government of Saskatchewan; 2010. Available from: http://www.health.gov.sk.ca/cdc-section2

Nova Scotia Department of Health and Wellness, Communicable Disease Prevention and Control. Nova Scotia communicable disease manual. Direct contact, respiratory routes, and through the provision of healthcare. Halifax, NS: Province of Nova Scotia, Crown copyright; nd. Available from: http://www.gov.ns.ca/hpp/publications/cdc_section_8.pdf

BC Centre for Disease Control. Streptococcal disease, Invasive, Group A: definition [Internet]. Vancouver, BC: BCCDC; 2012 Dec 27. Available from: http://www.bccdc.ca/dis-cond/a-z/_s/StreptococcalDiseaseInvasiveGroupA/overview/default.htm

UNITED KINGDOM

Public Health England, Health Protection Agency. Interim UK guidelines for management of close community contacts of invasive group A streptococcal disease (iGAS). London: Crown Copyright; 2008. Available from: http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1229673231242

Public Health England. Guidelines on streptococcal infections: questions & answers for close community contacts of cases of iGAS [Internet]. London: Crown Copyright; 2010 July 13 [cited 2013 September 09]. Available from: http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/StreptococcalInfections/Guidelines/strepInvasiveGroupAStrepiGAS/

UNITED STATES OF AMERICA

National Center for Immunization and Respiratory Diseases. Investigating clusters of group A streptococcal disease. Recommendations for local and state health agencies involved in public health investigations of GAS infections [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2007 Dec 10. Available from: http://www2.cdc.gov/ncidod/dbmd/abcs/calc/calc_new/start_investigation.htm

New York State, Department of Health. Streptococcal infections (invasive group A strep, GAS) [Internet]. Albany, NY: NY State Department of Health; 2011 Nov. Available from: http://www.health.ny.gov/diseases/communicable/streptococcal/group_a/fact_sheet.htm

Ohio Department of Health. Infectious disease control manual. Section III: reportable diseases and syndromes: streptococcus, group A, invasive. Columbus, OH: Ohio Department of Health; 2014. Available from: http://www.odh.ohio.gov/pdf/IDCM/strpa.pdf

South Carolina Department of Health and Environmental Control (DHEC). Bureau of disease control: group A streptococcal [Internet]. Columbia, SC: DHEC; c2013. Available from: http://www.scdhec.gov/health/disease/group-a-streptococcal.htm

West Virginia Bureau for Public Health, Division of Infectious Disease Epidemiology. Invasive group A streptococcal disease (IGAS) and streptococcal toxic shock syndrome (STSS) surveillance protocol. Charleston, WV: State of West Virginia; 2011. Available from: http://www.dhhr.wv.gov/oeps/disease/IBD_VPD/IBD/Documents/IGAS_Protocol.pdf

AUSTRALIA

Victorian State Government, Department of Health. Streptococcal disease (group A beta-haemolytic streptococcus) [Internet]. Melbourne, VC: State of Victoria; 2007 Feb 10. Available from: http://ideas.health.vic.gov.au/bluebook/streptococcal.asp

iGAS guidelines peer-reviewed literature search

iGAS guidelines 1998-current (EMBASE)

SEARCH 1:

Embase 1988 – 2011 Week 40

#	Searches
1	iGAS.mp.
2	exp Streptococcus/
3	exp Streptococcal Infections/
4	streptococcal disease.mp
5	group A.mp.
6	2 or 3 or 4
7	5 and 6
8	invasive group A streptococc*.mp.
9	1 or 8
10	(guideline* or recommend*).mp.
11	9 and 10
12	7 and 10
13	11 or 12
14	limit 13 to yr="1998 -Current"
15	from 14 keep 10, 12, 16, 18, 25, 28…

iGAS Guidelines – 1998-current (MEDLINE)

SEARCH 2:

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) **1946 to Present**

#	Searches
1	iGAS.mp.
2	exp Streptococcus/
3	exp Streptococcal Infections/
4	group A.mp.
5	invasive group A streptococc*.mp.
6	2 or 3
7	4 and 6
8	1 or 5
9	(guideline or recommend*).mp.
10	8 and 9
11	7 and 9
12	10 or 11
13	from 12 keep 2-3, 5-6, 9, 14-15, 21, 27...

iGAS guidelines grey literature (Google)

Invasive group A streptococcus guidelines

Search strategy: A web search was performed using Google to identify grey literature regarding guidelines relating to invasive group A streptococcus. The websites of major public health agencies were the focus of the search, such as www.phac-aspc.gc.ca and www.cdc.gov. The websites of all Canadian provincial and territorial health ministries were searched, as well as those of international and national organizations (see below for a list of websites searched). Additionally, a Google search was performed, limiting the results to .gov, .org., and .edu domains. References in highly relevant results were also examined.

Relevant results:

INTERNATIONAL

World Health Organization, Department of Child and Adolescent Health and Development. Discussion papers on child health: a review of the technical basis for the control of conditions associated with group A streptococcal infections. Geneva: WHO; 2005 [cited 2011 Oct 13]. Available from: http://whqlibdoc.who.int/hq/2005/WHO_FCH_CAH_05.08.pdf

CANADA

Alberta:
Alberta Health and Wellness. Public Health notifiable disease management guidelines: Streptococcal disease – Group A, Invasive. Government of Alberta; c2003-2011. Available from: http://web.archive.org/web/20130530040130/http://www.health.alberta.ca/documents/Guidelines-Streptococcal-Disease-Group-A-Invasive-2011.pdf

British Columbia:
BC Centre for Disease Control. Communicable disease control: invasive group A streptococcal disease. Victoria, BC: BCDC; 2008 [cited 2011 Oct 13]. Available from: http://www.bccdc.ca/NR/rdonlyres/75D280A8-D5B4-430F-9E65-F52C3D35C366/0/EPI_Guideline_GASFeb08_20100324.pdf.

Manitoba:
Manitoba Health, Communicable Disease Control Unit. Communicable disease management protocol: invasive group A streptococcal disease. Winnipeg, MB: Province of Manitoba; 2007 [cited 2011 Oct 13]. Available from: http://www.gov.mb.ca/health/publichealth/cdc/protocol/igas.pdf

Newfoundland and Labrador:
Newfoundland and Labrador, Department of Health & Community Services Disease Control Division. Guideline for management of invasive group A streptococcal disease across the continuum of care. St. Johns, NL: Government of Newfoundland and Labrador; 2009. Available from: http://www.health.gov.nl.ca/health/publichealth/cdc/invasive_groupa_streptococcal_management.pdf

Northwest Territories:

Northwest Territories Health and Social Services. Northwest Territories infection control policy and procedure regarding the care of the deceased with an infectious disease. Yellowknife, NT: Office of the Chief Medical Health Officer; 2008 [cited 2011 Oct 13]. Available from: http://www.hss.gov.nt.ca/sites/default/files/page_82_nwt_infection_control_policy_and_procedures_on_care_of_the_deceased_with_an_infectious_disease.pdf

Ontario:

Ontario. Ministry of Health and Long-Term Care. Infectious diseases protocol, 2013. Appendix A: disease-specific chapters. Chapter: Group A streptococcal disease, invasive. Toronto, ON: Queen's Printer for Ontario; 2013 (or as current). Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/gas_chapter.pdf

Ontario. Ministry of Health and Long-Term Care. Infectious diseases protocol, 2013. Appendix B: provincial case definitions for reportable diseases. Disease: Group A streptococcal disease, invasive (iGAS).Toronto, ON: Queen's Printer for Ontario; 2013 (or as current). [cited 2013 Nov 29]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/gas_cd.pdf

Ontario. Ministry of Health, Public Health Branch. Guidelines for management of contacts of cases of invasive group A streptococcal disease (GAS) including streptococcal toxic shock syndrome (STSS) and necrotizing fasciitis. Toronto, ON: Queen's Printer for Ontario; 1995. Available from: http://microbiology.mtsinai.on.ca/protocols/pdf/k5c.pdf.

Ontario Hospital Association; Ontario Medical Association. Group A streptococcal disease surveillance protocol for Ontario hospitals. Toronto, ON: Ontario Hospital Association; 2010 [cited 2011 Oct 13]. Available from: http://web.archive.org/web/20120816012041/http://www.oha.com/Services/HealthSafety/Documents/Protocols/Group%20A%20Streptococcal%20Protocol%20Reviewed%20and%20Revised%20November%202010.pdf

Québec:

Lefebvre J; Laboratoire de santé publique du Québec. Surveillance en laboratoire des infections invasive sévère à *Streptococcus pygogenes.* Montréal, QC: Institut national de santé publique du Québec; 2000 [cited 2011 Oct 13]. Available from: http://www.inspq.qc.ca/pdf/publications/049_streptococcus_pyogenes_2000.pdf.

Institut national de santé publique du Québec. STATLABO: Statistiques d'analyses du Laboratoire de santé publique du Québec. 2009 [cited 2011 Oct 13];8(4). Available from: http://www.inspq.qc.ca/pdf/bulletins/statlabo/STATLABO-Vol08No04.pdf.

Saskatchewan:

Saskatchewan Ministry of Health. Communicable disease control manual. Section 2: respiratory and direct contact. Group A streptococcal disease – invasive (iGAS). Regina, SK: Government of Saskatchewan; 2011[cited 2011 Oct 13]. Available from: http://www.health.gov.sk.ca/cdc-section2

UNITED KINGDOM

Health Protection Surveillance Centre, Invasive Group A Streptococcus Sub-Committee. The management of invasive group A streptococcal infections in Ireland. Dublin: HPSC; 2006 [cited 2011 Oct 13]. Available from: http://www.hpsc.ie/hpsc/A-Z/Other/GroupAStreptococcalDiseaseGAS/Publications/File,2080,en.pdf

Davies, SC, Chief Medical Officer (Interim). Re: Influenza, meningococcal infection and other bacterial co-infection including pneumococcal and invasive group A streptococcal infection (IGAS). London, UK: Department of Health; 2011 [2011 Oct 13]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/215814/dh_123647.pdf

UNITED STATES OF AMERICA:

Capapetis JR, Paar J, Cherian T. Standardization of epidemiologic protocols for surveillance of post-streptococcal sequelae: acute rheumatic fever, rheumatic heart disease and acute post-streptococcal glomerulonephritis. Bethesda, MD: National Institute for Allergy and Infectious Diseases; 2006 [cited 2011 Oct 13]. Available from: http://www.niaid.nih.gov/topics/strepThroat/Documents/groupasequelae.pdf.

Kotloff K, Van Beneden C. Standardization of epidemiologic protocols for surveillance of acute diseases caused by *Streptococcus pyogenes:* pharyngitis, impetigo, and invasive diseases. Bethesda, MD: National Institute for Allergy and Infectious Diseases; 2008 [cited 2011 Oct 13]. Available from: http://www.niaid.nih.gov/topics/strepThroat/Documents/acutegroupastrep.pdf.

U.S. states and municipalities:

Massachusetts Department of Public Health, Bureau of Communicable Disease Control. Guide to surveillance, reporting and control. Group A *Streptococcus* (invasive). Boston, MA: Commonwealth of Massachusetts; 2006 [cited 2011 Oct 13]. Available from: http://www.mass.gov/eohhs/docs/dph/disease-reporting/guide/group-a-strep.pdf

Ohio Department of Health. Infectious disease control manual. Section III: reportable diseases and syndromes: streptococcus, group A, invasive. Columbus, OH: Ohio Department of Health; 2014 [cited 2011 Oct 13]. Available from: http://www.odh.ohio.gov/pdf/IDCM/strpa.pdf

West Virginia Bureau for Public Health, Division of Infectious Disease Epidemiology. Invasive group A streptococcal disease (IGAS) and streptococcal toxic shock syndrome (STSS) surveillance protocol. Charleston, WV: State of West Virginia; 2011 [cited 2011 Oct 13]. Available from: http://www.dhhr.wv.gov/oeps/disease/IBD_VPD/IBD/Documents/IGAS_Protocol.pdf

Kansas Department of Health and Environment. Group A streptococcus, invasive infections including streptococcal toxic shock syndrome: disease management and investigative guidelines. Topeka, KS: KDHE; 2010 [cited 2011 Oct 13]. Available from: http://www.kdheks.gov/epi/Investigation_Guidelines/Strep_A_Invasive_DIG.pdf.

Website checklist: Infectious diseases

☑ www.phac-aspc.gc.ca
☑ www.msss.gouv.qc.ca
☑ www.hc-sc.gc.ca
☑ www.inspq.qc.ca
☑ health-evidence.ca/
☑ www.gnb.ca/0051/index-e.asp
☑ www.cps.ca
☑ www.gov.ns.ca/DHW
☑ www.cma.ca
☑ www.gov.pe.ca/health
☑ www.gov.bc.ca/health
☑ www.health.gov.nl.ca
☑ www.healthlinkbc.ca
☑ www.hss.gov.nu.ca
☑ www.bccdc.ca
☑ www.hlthss.gov.nt.ca
☑ www.health.alberta.ca
☑ www.hss.gov.yk.ca
☑ www.health.gov.sk.ca
☑ www.who.int/
☑ www.gov.mb.ca/health
☑ www.cdc.gov/
☑ www.publichealthontario.ca
☑ www.ecdc.europa.eu/
☑ www.health.gov.on.ca
☑ www.idsociety.org
☑ https://www.oma.org/
☑ www.isid.org/

Streptococcus pyogenes and transmission peer review literature

SEARCH 1 - MEDLINE

#	Query	Limiters/Expanders
S5	((MH "Disease Transmission, Infectious")) and (S4)	Search modes - Boolean/Phrase
S4	(MH "Disease Transmission, Infectious")	Search modes - Boolean/Phrase
S3	((MH "Infectious Disease Transmission, Professional-to-Patient") OR (MH "Infectious Disease Transmission, Patient-to-Professional") OR (MH "Infectious Disease Transmission, Vertical") OR (MH "Disease Transmission, Infectious") OR (MH "Cross-Sectional Studies")) AND MH "Streptococcus pyogenes"	Search modes - Boolean/Phrase
S2	(MH "Infectious Disease Transmission, Professional-to-Patient") OR (MH "Infectious Disease Transmission, Patient-to-Professional") OR (MH "Infectious Disease Transmission, Vertical") OR (MH "Disease Transmission, Infectious") OR (MH "Cross-Sectional Studies")	Search modes - Boolean/Phrase

#	Query	Limiters/Expanders
S1	(MM "Streptococcus pyogenes")	Search modes - Boolean/Phrase

SEARCH 2 - EMBASE

#	Searches
1	exp disease transmission/pc [Prevention]
2	Staphylococcus infection/ or bacterial transmission/ or hospital infection/ or cross infection/or infection control/
3	Streptococcus pyogenes/
4	Streptococcus group A/
5	bacterial transmission/ or hospital infection/ or cross infection/ or infection control/
6	3 or 4
7	1 or 5
8	6 and 7
9	limit 8 to (english language and yr="2002 - Current")
10	from 9 keep 1-2, 4, 6, 18, 22, 32-33...

iGAS outbreaks in hospitals/long-term care facilities peer reviewed literature

SEARCH - MEDLINE

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) **1946 to Present**

#	Searches
1	outbreak*.mp.
2	Streptococcus group A/
3	Streptococcus pyogenes/
4	long term care/

#	Searches
5	health care facility/
6	hospital/
7	Streptococcus infection/ or Streptococcus pneumoniae/ or bacteremia/ or Streptococcus
8	Health Facilities/
9	disease outbreaks.mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, dv, kw, nm, ps, rs, ui]
10	Streptococcal Infections.mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, dv, kw, nm, ps, rs, ui]
11	*Streptococcus infection/et [Etiology]
12	*Streptococcus group A/
13	*long term acute care hospital/
14	disease transmission.mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, dv, kw, nm, ps, rs, ui]
15	2 or 3 or 10 or 11 or 12
16	hospital infection/
17	4 or 5 or 6 or 8 or 13
18	9 or 16
19	1 and 15 and 17 and 18

References

1. Ontario. Ministry of Health and Long-Term Care. Infectious diseases protocol, 2013. Appendix A: disease-specific chapters. Chapter: Group A streptococcal disease, invasive. Toronto, ON: Queen's Printer for Ontario; 2013 [cited 2013 May 25]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/gas_chapter.pdf

2. Ontario. Ministry of Health and Long Term Care. Infectious diseases protocol, 2013. Appendix B: provincial case definitions for reportable diseases. Disease: Group A Streptococcal disease, invasive (iGAS). Toronto, ON: Queen's Printer for Ontario; 2013 [cited 2013 Mar 20]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/gas_cd.pdf.

3. Public Health Agency of Canada. Supplement: guidelines for the prevention and control of invasive group A streptococcal disease. CCDR. 2006 [cited 2012 Dec 10];32(Suppl 2):1-26. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06vol32/32s2/index-eng.php.

4. Prevention of Invasive Group A streptococcal Infections Workshop Participants. Prevention of invasive group A streptococcal disease among household contacts of case patients and among postpartum and postsurgical patients: recommendations from the Centers for Disease Control and Prevention. Clin Infect Dis. 2002 [cited 2013 Apr 24];35(8):950-9. Available from: http://cid.oxfordjournals.org/content/35/8/950.full.pdf+html

5. Health Protection Surveillance Centre (Ireland), Invasive Group A streptococcus Sub-Committee. The management of invasive group A streptococcal infections in Ireland. Dublin: Health Protection Surveillance Centre; 2006 [cited 2013 Apr 24]. Available from: http://www.hpsc.ie/hpsc/A-Z/Other/GroupAStreptococcalDiseaseGAS/Publications/File,2080,en.pdf

6. Queensland Health. Communicable diseases control manual: a clinician's guide to the prevention and control of infectious diseases of public health importance. 5th ed. Herston: State of Queensland; 2011 [cited 2013 Apr 24]. Available from: http://www.health.qld.gov.au/ph/documents/cdb/19682.pdf.

7. Health Protection Agency, Group A Streptococcal Working Group. Interim UK guidelines for management of close community contacts of invasive group A streptococcal disease. Commun Dis Public Health. 2004;7(4):354-61.

8. Lamagni TL, Neal S, Keshishian C, Powell D, Potz N, Pebody R, et al. Predictors of death after severe streptococcus pyogenes infection. Emerg Infect Dis. 2009 [cited 2013 Apr 24];15(8):1304-7. Available from: http://wwwnc.cdc.gov/eid/article/15/8/pdfs/09-0264.pdf

9. Davies HD, McGeer A, Schwartz B, Green K, Cann D, Simor AE, et al. Invasive group A streptococcal infections in Ontario, Canada. Ontario Group A Streptococcal Study Group. N Engl J Med. 1996 [cited 2013 Apr 24];335(8):547-54. Available from: http://www.nejm.org/doi/pdf/10.1056/NEJM199608223350803.

10. Mandell AL, Thomas JM, Grossman RF, Chow AW, Hyland RH; Canadian Infectious Disease Society; Canadian Thoracic Society. Summary of Canadian guidelines for the initial management of community-acquired pneumonia: an evidence-based update by the Canadian Infectious Disease Society and the Canadian Thoracic Society. Can Respir J. 2000 [cited 2013 Jun 1];7(5):371-82. Available from: http://www.respiratoryguidelines.ca/sites/all/files/Community-acquired-Pneumonia-Guidelines-2000.pdf

11. Mandell LA, Wunderink RG, Anzueto A, Bartlett JG, Campbell GD, Dean NC, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis. 2007;44(Suppl 2):S27-72.

12. Stockmann C, Ampofo K, Hersh AL, et al. Evolving epidemiologic characteristics of invasive group A streptococcal disease in Utah, 2002–2010. Clin Infect Dis. 2012;55(4):479-87.

13. De Waele JJ. Management of necrotizing skin and soft tissue infections. Expert Rev Anti Infect Ther. 2012;10(7):805-14.

14. Bisno AL, Cockerill FR 3rd, Bermudez CT. The initial outpatient-physician encounter in group A streptococcal necrotizing fasciitis. Clin Infect Dis. 2000;31(2):607-8.

15. Passmore J, Kelpie L, Carapetis J. Surveillance for invasive group A streptococcal disease in Victoria—the first 12 months. Victor Infect Dis Bull. 2003 [cited 2013 Jun 1];6(2):30. Available from: http://docs.health.vic.gov.au/docs/doc/901E0FC6D9E36D49CA2578C400021107/$FILE/vidbv6i2.pdf

16. Robinson KA, Rothrock G, Phan Q, Sayler B, Stefonek K; Active Bacterial Core Surveillance/Emerging Infections Program Network. Risk for severe group A streptococcal disease among patients' household contacts. Emerg Infect Dis. 2003 [cited 2013 Jun 1];9(4):443-7. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2957982/pdf/02-0369.pdf

17. Heymann DL, editor. Control of communicable diseases manual. 19th ed. Washington, DC: American Public Health Association; 2008.

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