Mass prophylaxis in an outbreak of invasive group A streptococcal disease in a residential aged care facility

Bhakti R Vasant, Kari A J Jarvinen, Ning-Xia Fang, Helen V Smith and Amy V Jennison

# Abstract

In September 2016, an invasive group A streptococcal disease outbreak occurred among residents of a residential aged care facility. An expert advisory group recommended mass prophylaxis for residents and staff in addition to strict infection control practices to prevent further spread. Whole genome sequencing confirmed the cases were related.

# Background and methods

Group A streptococci (GAS) can cause serious diseases including necrotising fasciitis and toxic shock syndrome. Invasive GAS (iGAS) outbreaks in residential aged care facilities (RACF) are associated with high case fatality (25%–60%).1,2 Prompt outbreaks control is therefore important. Targeted prophylaxis for GAS carriers or mass prophylaxis for staff and residents may have a role.3 Variations are noted in guideline recommendations for prophylaxis (Table 1).

Table 1: Recommendations for targeted or mass prophylaxis to control iGAS outbreaks in RACFs 4,6–9

| Guideline | Type of prophylaxis recommended (targeted or mass) |
| --- | --- |
| Queensland | Mass\* |
| Northern Territory | Mass |
| Canada | Targeted |
| UK | Targeted or mass prophylaxis to be considered |

\* Queensland iGAS guidelines were in development at the time of the outbreak.

In Queensland, iGAS (GAS isolation from a sterile site) is a notifiable condition.4 Notifications of iGAS in a RACF in 2016 resulted in public health investigations of a suspected iGAS outbreak. Laboratory investigations were undertaken to confirm whether the RACF iGAS cases were related.

Ethics approval was not required because outbreak identification, characterisation and control are covered under the Public Health Act 2005, Queensland.5

# Description of outbreak

In September 2016, a large metropolitan Public Health Unit (PHU) in Queensland was notified of two iGAS cases in elderly residents in the same wing of a RACF (wing A). The first case was hospitalised for cellulitis and GAS bacteraemia. The PHU provided a fact sheet to the RACF following notification of the first case and requested notification of additional cases.

The second wing A resident case of iGAS was notified two weeks later. As two epidemiologically linked iGAS cases were identified within three months, the criteria for a suspected iGAS outbreak were met.4 As Queensland’s guidelines for public health management of iGAS were in development during the outbreak, an expert advisory group (EAG) was convened to ascertain whether prophylaxis should be recommended for wing A residents and staff. Options included recommending no prophylaxis, recommending targeted prophylaxis or recommending mass prophylaxis to wing A residents and staff. The latter was recommended and carried out.

In November 2016, the PHU was notified of a case of GAS bacteraemia in another resident from wing A. The likely nidus of infection was a chronic ulcer.

# Laboratory investigations

GAS isolates from the three cases were submitted to the Queensland Forensic and Scientific Services (FSS, the Queensland Health Public Health Reference Laboratory) for Whole Genome Sequencing through their in-house NexteraXT library preparation and Illumina NextSeq500 sequencing workflow. Fastq sequences are located in ENA project PRJEB23078. The emm type, spe exotoxin gene detection, multi-locus sequence types (MLST) and emm locus arrangement were determined from de novo assembled sequences using Ridom SeqSphere+ with alleles from the CDC MLST scheme (<https://pubmlst.org/spyogenes/>) and CDC emm data base (<https://www2a.cdc.gov/ncidod/biotech/strepblast.asp>). Sequences were mapped to the reference genome Streptococcus pyogenes M1 strain (Genbank accession NC\_002737) and core single nucleotide polymorphism (SNP)s identified using the Snippy pipeline (<https://github.com/tseemann/snippy>). A Maximum Likelihood tree was generated from the SNP alignment, using the Fast Tree plugin in Geneious R7 software (figure 1).

Isolates from cases 1 and 2 showed limited genetic variation to each other (17 SNP differences) and were more genetically related to each other than other emm 12 isolates isolated from Queensland in the 12 months prior to these cases (n= 9, SNP distance >251 SNPs) (Figure 1). The isolates from cases 2 and 3 showed even less genetic distance (6 SNP differences). This limited genetic variation and plausible epidemiological link between cases support the hypothesis that the three iGAS cases in wing A were related (Table 2).

Figure 1. Phylogenetic Maximum Likelihood Tree showing SNP differences between *emm12* isolates isolated in a 12 month period up to and including the case cluster.

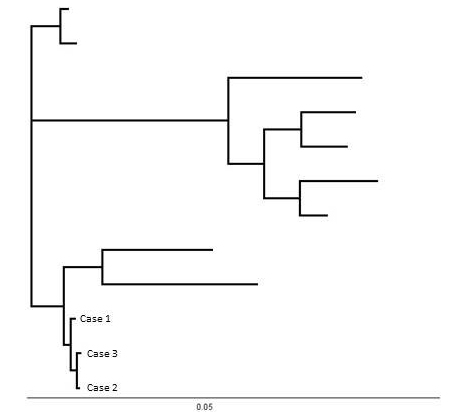


Table 2: Group A streptococcal isolates from residents with iGAS in a residential aged care facility outbreak, 2016

| Case | *emm* sequence type | *spe* genes detected | *spe* genes not detected | MLST ST | *emm* locus | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *mga* | *mrp* | *emm* | *enn* | *scpA* |
| Case 1 | 12 | B, C, Z, F, G, H | J, ssa | 36 | + | - | + | - | + |
| Case 2 | 12 | B,C, Z, F, G, H | J, ssa | 36 | + | - | + | - | + |
| Case 3 | 12 | B,C, Z, F, G, H | J, ssa | 36 | + | - | + | - | + |

# Public Health Response

The EAG recommended mass prophylaxis for residents and staff of wing A after case 2 to ensure that individuals with asymptomatic carriage were treated and to reduce the risk of GAS transmission to non-carriers. Staff who opted not to receive antibiotics were recommended to undergo screening for nasopharyngeal GAS carriage. Carriers were recommended to be excluded from work until completing 48 hours of a suitable antibiotic (phenoxymethylpenicillin, cephalexin or azithromycin). All wing A staff opted to receive antibiotics.

Facility management, staff and visiting medical practitioners were advised that staff cohorting and strict infection control practices (including hand hygiene and environmental cleaning) were required to prevent further spread of iGAS.

All wing A residents and staff, including case 3, commenced chemoprophylaxis by early October 2016. When case 3 was notified more than one month after outbreak identification, the PHU recommended increased vigilance for additional cases and reinforced the importance of infection control practices. No further iGAS cases were notified from the RACF.

# Discussion

Due to the severity of iGAS infection, preventing transmission is important in institutional settings such as RACFs.10,11 Prevention and control strategies include: (1) early identification of iGAS infection through surveillance and communication to the RACF, (2) infection prevention and control strategies (particularly hand hygiene and wound management) and (3) targeted or mass antibiotic prophylaxis.11

A review by Cummins and colleagues reported no clear advantage to either targeted or mass antibiotic prophylaxis in controlling iGAS outbreaks in RACFs.3 Smith and colleagues reported using mass prophylaxis to control a rapidly evolving RACF outbreak with a high case fatality rate after targeted prophylaxis was unsuccessful. In this outbreak, strain persistence was associated with poor infection control practices. 12 Marsden and colleagues also reported that infection control deficiencies may lead to poor outbreak control, despite the implementation of antibiotic prophylaxis.11

To ensure judicious antibiotic use, facility and outbreak characteristics should be considered before recommending targeted or mass prophylaxis. In this outbreak, iGAS cases were confined to one wing and all residents and staff received antibiotic prophylaxis. Facility staff were also advised about the importance of infection control. Although additional prophylaxis was not recommended following the third iGAS case, the importance of infection control was highlighted. Further iGAS cases were not detected.

Controlling iGAS outbreaks in RACFs requires a multi-faceted approach involving staff awareness, early identification of cases, scrupulous infection control practices and situation-specific consideration of antibiotic prophylaxis.

# Author details

Dr Bhakti R. Vasant, Public Health Physician 1

Dr Kari A.J. Jarvinen, Public Health Physician 1

Dr Ning-Xia Fang, Senior Scientist 2

Helen V. Smith, Supervising Scientist 2

Dr Amy V. Jennison, Supervising Scientist 2

1. Metro South Public Health Unit, Queensland Health
2. Forensic and Scientific Services, Queensland Health

## Corresponding Author

Dr Bhakti R Vasant  
Metro South Public Health Unit PO Box 333 Archerfield Qld 4108  
Ph: (07) 3176 4000  
Email: Bhakti.Vasant@health.qld.gov.au

# Acknowledgements

We thank Candice Colbran, Alison Kenny, Alicia Eyres, Rachel Perry and Deborah Judd for their assistance with the Public Health management of the iGAS outbreak; David Looke for infectious diseases advice; Public Health Physicians of Queensland for their contribution to the Expert Advisory Group; Vicki Hicks for the laboratory work; and Christine Guglielmino for her contribution to establishing the Group A Streptococcus bioinformatics analysis.

# References

1. Thigpen MC, Thomas DM, Gloss D, Park SY, Khan AJ, Fogelman VL, et al. Nursing home outbreak of invasive group A streptococcal infections caused by 2 distinct strains. Infect Control Hosp Epidemiol 2007;28:68–74
2. Auerbach SB, Schwartz B, Williams D, Fiorelli MG, Adimora AA, Breiman RF, et al. Outbreak of invasive group A streptococcal infections in a nursing home. Arch Intern Med 1992;152:1017–22
3. Cummins A, Millership S, Lamagni T, Foster K. Control measures for invasive group A streptococci (iGAS) outbreaks in care homes. J Infect 2012;64:156–61
4. Queensland Health. Invasive Group A Streptococcal Disease [internet]. Queensland Health 2017 [cited June 2017]. Available from URL: <https://www.health.qld.gov.au/cdcg/index/igas>
5. The State of Queensland. Public Health Act 2005 [internet]. The State of Queensland 2005 [current as at 1 September 2017, cited 31 October 2017]. Available from: https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/P/PubHealA05.pdf
6. Northern Territory Government Department of Health. Public health management of invasive group A streptococcal infection [internet].Northern Territory Government 2015 [cited June 2017]. Available from URL: http://digitallibrary.health.nt.gov.au/prodjspui/bitstream/10137/1187/1/iGAS%20guidelines%20Nov%202015.pdf
7. Public Health Ontario. Recommendations on public health management of invasive group A streptococcal (iGAS) disease [internet]. Public Health Ontario 2014 [cited June 2017]. Available from URL: https://www.publichealthontario.ca/en/eRepository/iGAS\_Recommendations\_on\_Public\_Health\_Management.pdf
8. Public Health Agency of Canada. Archived – 6.0 Management of Invasive GAS Disease [internet]. Public Health Agency of Canada 2006 [cited June 2017]. Available from URL: [http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06vol32/32s2/6-manage-eng.php#6.3](http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06vol32/32s2/6-manage-eng.php%236.3)
9. Health Protection Agency. Interim UK guidelines for management of close community contacts of invasive Group A stretpcoccal disease (iGAS) [internet]. Health Protection Agency 2008 [cited June 2017]. Available from URL: https://www.gov.uk/government/uploads/system/uploads/attachment\_data/file/327473/iGAS190308\_flow\_chart.pdf
10. The 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;35:950–9
11. Marsden J, Dettinger L, Fraser G, Waller K, Moll M, Weltman M, et al. Invasive group A Streptococcus in a skilled nursing facility – Pennsylvania 2009–2010. Morb Mortal Wkly*Rep* 2011;60(42):1445–9
12. Smith A, Li A, Tolomeo O, Tyrrell GJ, Jamieson F, Fisman D. Mass antibiotic treatment for group A Streptococcus outbreaks in two long-term care facilities. Emerg Infect Dis 2003; 9(10):1260–65

**Communicable Diseases Intelligence**

ISSN: 2209-6051 Online

**Communicable Diseases Intelligence (CDI) is a peer-reviewed scientific journal published by the Office of Health Protection, Department of Health. The journal aims to disseminate information on the epidemiology, surveillance, prevention and control of communicable diseases of relevance to Australia.**

**Editor:** Cindy Toms

**Deputy Editor:** Simon Petrie

**Design and Production:** Kasra Yousefi

**Editorial Advisory Board:** David Durrheim, Mark Ferson, John Kaldor, Martyn Kirk and Linda Selvey

**Website**: <http://www.health.gov.au/cdi>

**Contacts**Communicable Diseases Intelligence is produced by:   
Health Protection Policy Branch, Office of Health Protection, Australian Government Department of Health  
GPO Box 9848, (MDP 6) CANBERRA ACT 2601

**Email:** [cdi.editor@health.gov.au](mailto:cdi.editor@health.gov.au)

**Submit an Article**You are invited to submit your next communicable disease related article to the Communicable Diseases Intelligence (CDI) for consideration. More information regarding CDI can be found at: <http://health.gov.au/cdi>.

Further enquiries should be directed to: [cdi.editor@health.gov.au](mailto:cdi.editor@health.gov.au).

This journal is indexed by Index Medicus and Medline.

Creative Commons Licence - Attribution-NonCommercial-NoDerivatives CC BY-NC-ND

© 2019 Commonwealth of Australia as represented by the Department of Health

This publication is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International Licence from <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode> (Licence). You must read and understand the Licence before using any material from this publication.

**Restrictions**The Licence does not cover, and there is no permission given for, use of any of the following material found in this publication (if any):

* the Commonwealth Coat of Arms (by way of information, the terms under which the Coat of Arms may be used can be found at [www.itsanhonour.gov.au](http://www.itsanhonour.gov.au/));
* any logos (including the Department of Health’s logo) and trademarks;
* any photographs and images;
* any signatures; and
* any material belonging to third parties.

**Disclaimer**Opinions expressed in Communicable Diseases Intelligence are those of the authors and not necessarily those of the Australian Government Department of Health or the Communicable Diseases Network Australia. Data may be subject to revision.

**Enquiries**Enquiries regarding any other use of this publication should be addressed to the Communication Branch, Department of Health, GPO Box 9848, Canberra ACT 2601, or via e-mail to: [copyright@health.gov.au](mailto:copyright@health.gov.au)

**Communicable Diseases Network Australia**Communicable Diseases Intelligence contributes to the work of the Communicable Diseases Network Australia.  
<http://www.health.gov.au/cdna>