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Update on Invasive Group A Streptococcal Disease

Dr. Liane Macdonald

PHO Rounds

January 31, 2024

Disclosures – Liane Macdonald

Relationships with commercial interests

- No relationships with commercial interests

Other

- Employed at Public Health Ontario as public health physician
- Co-applicant on CIHR-funded research projects (communicable diseases-related) and has received travel/accommodation support from Queen's and NOSM Public Health Preventive Medicine Programs to attend residency program events

Learning Objectives

By the end of this session, participants are able to:

- Summarize recent epidemiological trends in iGAS activity in Ontario and Canada.
- Describe the current approach to iGAS whole genome sequencing and reporting at the National Microbiology Laboratory (NML).
- Identify key considerations in iGAS outbreak management in long-term care.
- Appreciate the contribution of whole genome sequencing to the investigation and management of iGAS outbreaks.

Outline

- Overview and international context
- Recent epidemiology of iGAS in Ontario
- iGAS testing at the NML and national iGAS trends
- Recurrent *emm* 89 iGAS outbreak in a multi-level elder care facility in Montreal, 2019 and 2022
- Question and answer period

Overview and international context

Invasive Group A Streptococcal Disease or iGAS

- Invasive form of infection with Group A Streptococcus (GAS), which occurs when *Streptococcus pyogenes* enters a normally sterile site
  - GAS is a common cause of milder infections, e.g., pharyngitis, skin infections
- Transmission occurs via contact with the respiratory (e.g., nose, throat) secretions or lesions (e.g., wound) of an infectious person
  - Also via respiratory particles, or sharing injection drug use equipment
- Can progress rapidly to severe / life-threatening illness or death
  - E.g., Streptococcal toxic shock syndrome, necrotizing fasciitis or myositis, meningitis

National case definition: Invasive group A streptococcal disease - Canada.ca

Appendix 1: Case Definitions and Disease Specific Information Disease: Group A Streptococcal Disease, invasive (iGAS)

Risk factors for iGAS include

- Being a young child or infant, or older adult (e.g., > 65 years)
- Being peripartum (pregnant or postpartum), or post-surgical
- Skin breakdown (e.g., burns, wounds, chickenpox)
- Chronic underlying medical conditions
- Immunocompromised
- Preceding / concurrent viral infections (e.g., influenza, varicella)
- Using injection drugs
- Experiencing homelessness

Public Health Ontario. Invasive Group A Streptococcal (iGAS) disease in Ontario: October 1, 2022 to September 30, 2023. [Internet]. Toronto: Public Health Ontario; 2023 [cited 2023 Oct 30]. Available from: https://www.publichealthontario.ca/-/media/Documents/I/2022/igas-enhanced-epi-children-0-to-17-years-of-age.pdf?rev=dba59da9cb7143969219831897c3a1fb&sc_lang=en.
Public Health Agency of Canada. Group A Streptococcal diseases: For health professionals. [Internet]. Ottawa: Public Health Agency of Canada; 2023. [cited 2023 Nov 16]. Available from: https://www.canada.ca/en/public-health/services/diseases/group-a-streptococcal-diseases/health-professionals.html. ;
Ontario Agency for Health Protection and Promotion (Public Health Ontario). Invasive Group A streptococcal disease in Ontario: 2016-17 seasonal summary. Toronto, ON, Queen's Printer for Ontario; 2018. Available from: https://www.publichealthontario.ca/-/media/documents/S/2018/seasonal-summary-igas-2016-17.pdf.
Sherwood E, Vergnano S, Kakuchi I, Bruce MG, Chaurasia S, David S, Dramowski A, Georges S, Guy R, Lamagni T, Levy-Bruhl D, Lyytikäinen O, Naus M, Okaro JO, Oppegaard O, Vestrheim DF, Zulz T, Steer AC, Van Beneden CA, Seale AC. Invasive group A streptococcal disease in pregnant women and young children: a systematic review and meta-analysis. Lancet Infect Dis. 2022 Jul;22(7):1076-1088. doi: 10.1016/S1473-3099(21)00672-1.
Barnes M, Youngkin E, Zipprich J, et al. Notes from the Field: Increase in Pediatric Invasive Group A Streptococcus Infections — Colorado and Minnesota, October–December 2022. MMWR Morb Mortal Wkly Rep 2023;72:265–267. DOI: http://dx.doi.org/10.15585/mmwr.mm7210a4.

Increasing iGAS activity has been reported in multiple jurisdictions since 2022, including among children

- United Kingdom (UK) and Europe
  - Increased iGAS and scarlet fever observed, particularly among children under 10 years, in multiple countries in 2022, including the UK, France, Ireland, the Netherlands, and Sweden
- United States
  - Earlier than usual 2022 seasonal increase in iGAS, concurrent with increases in respiratory viruses and non-invasive GAS infections; continued in early 2023 in some areas, even as respiratory virus activity declined, including in adults
- Australia
  - Increase in iGAS from mid- to late-2022 in a large pediatric hospital cohort
- Argentina
  - As of 6 November 2023, reported an increase in iGAS cases in 2023, with 49.5% in those < 16 years

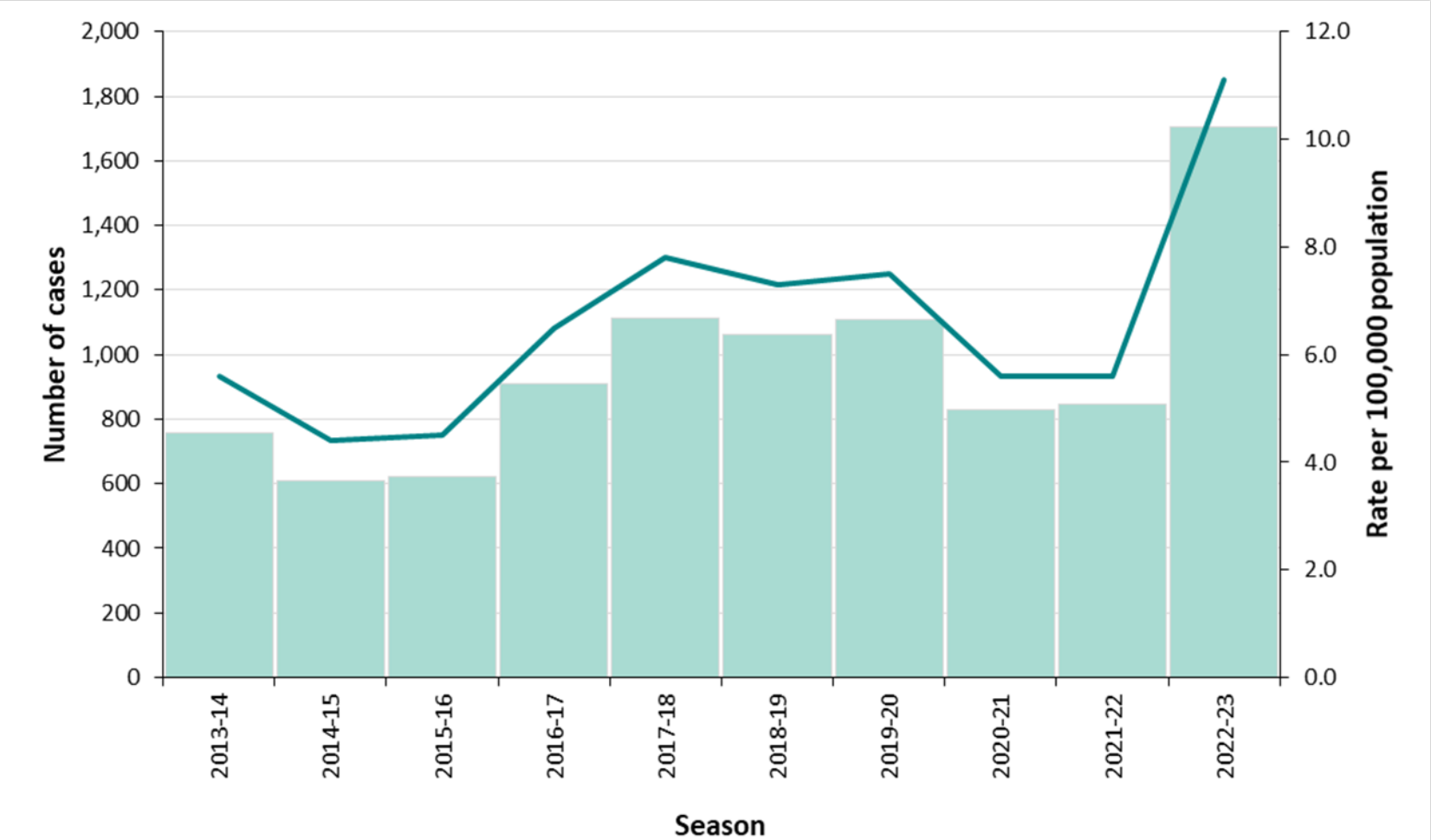
Increased incidence of scarlet fever and invasive Group A Streptococcus infection - multi-country (who.int);
Increase in Invasive Group A Strep Infections, 2022-2023 | CDC ; 2023-nov-17-phe-epidemiological-alert-invasive-disease-group-streptococci-eng (1).pdf;
Increase in invasive group A streptococcal disease among Australian children coinciding with northern hemisphere surges - The Lancet Regional Health – Western Pacific
Increase in Invasive Group A Strep Infections, 2022-2023 | CDC

Recent epidemiology of iGAS in Ontario

iGAS surveillance data in Ontario

- Cases of iGAS disease that meet the provincial case definition are notifiable to public health.
- An iGAS season is defined as October 1 to September 30.
- Analyses are based on data recorded in the integrated Public Health Information System (iPHIS).
  - Additional details and data caveats are available in Public Health Ontario's monthly iGAS Enhanced Epidemiologic Summary

Incidence of iGAS by season: Ontario, October 1, 2013 to September 30, 2023

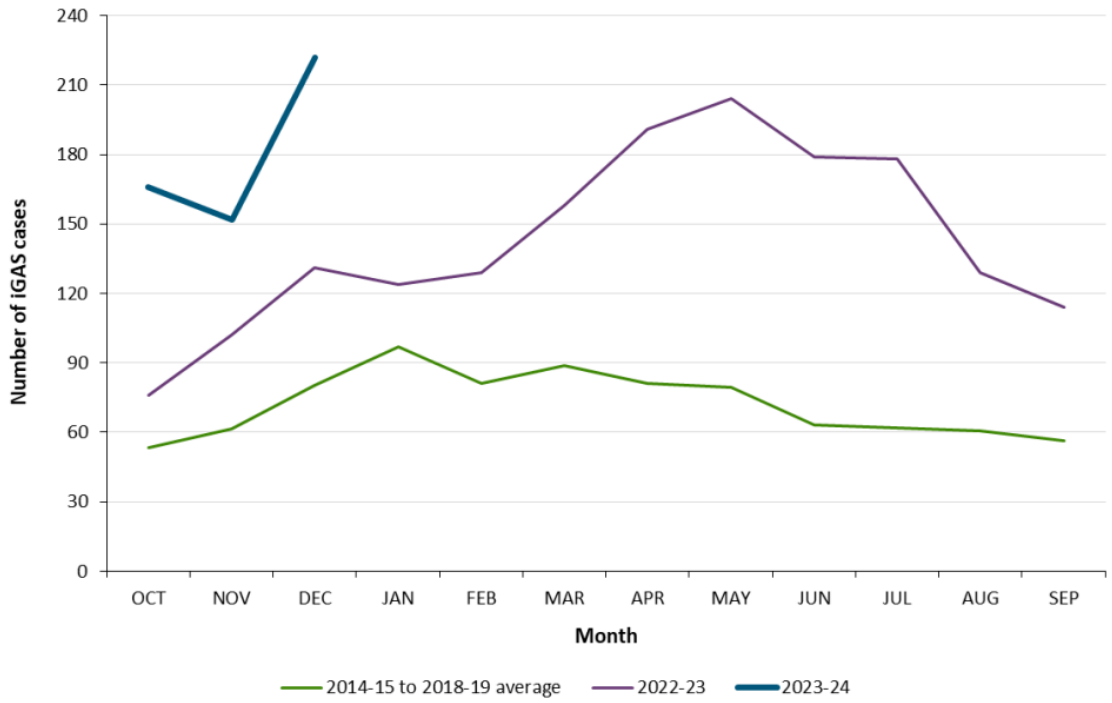


Data source: Case data: Ontario. Ministry of Health. Integrated Public Health Information System (iPHIS) [database]. Toronto, ON: King's Printer for Ontario [extracted 15 January 2024]; Population data: Statistics Canada; Ministry of Finance.

An increase in iGAS activity in all age groups was observed in Ontario in the 2022-23 season vs. pre-pandemic seasons, further increasing in late 2023

- Oct. 2022 to Sept. 2023:
  - Increased activity above expected in all age groups, into the late spring and summer
  - Multiple *emm* types observed, most frequently *emm* 1 and 12 where available
- Oct. to Dec. 2023 vs. 2022 (as of Jan. 8):
  - Further increased confirmed case counts (540 vs. 309) and 1.8-fold increase in rate per 100,000 population
    - Highest rates in ≥ 65, 5-9 and 1-4 years
  - Hospitalization: 76.3% of cases
  - Fatal outcome reported in 8.9% (caution: data lags)

Figure 1: Confirmed iGAS Case Counts by Month Across all Ages: Current Season (October 1, 2023 – December 31, 2023)* Compared to the 2022-23 Season (October 1, 2022 – September 30, 2023) and the Five Pre-Pandemic Season Average (October 1, 2014 – September 30, 2019)



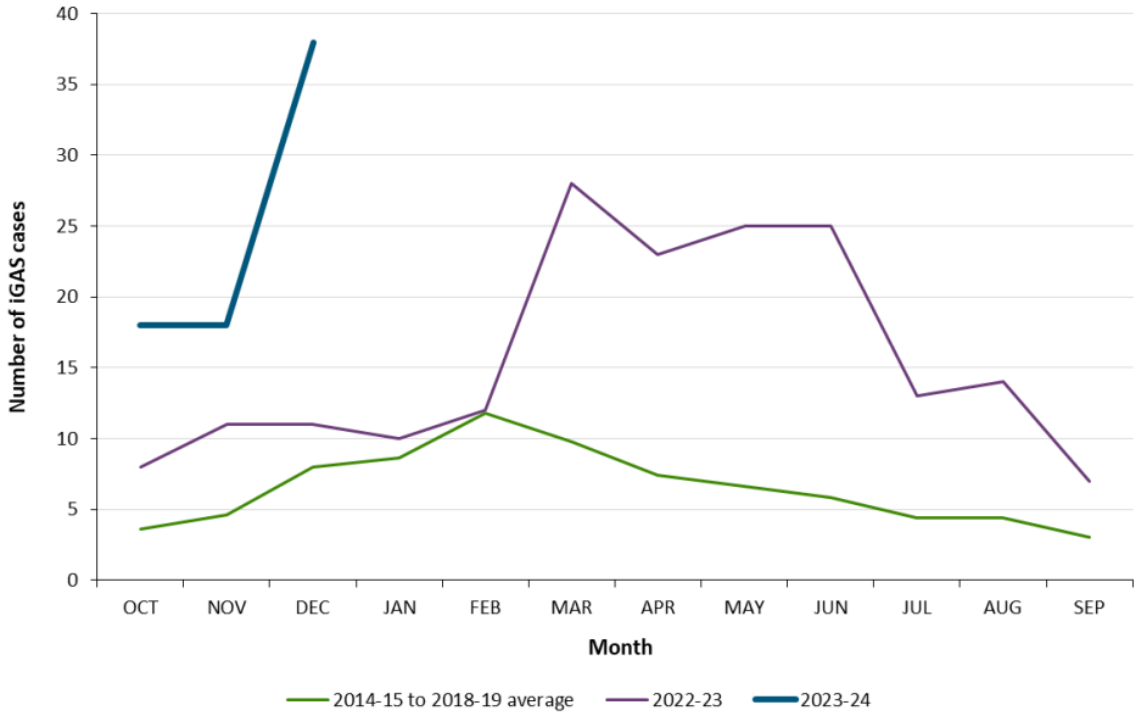
Data source: iPHIS *Data for the 2023- 2024 season includes cases reported up to December 31, 2023. Data for the most recent reporting month should be interpreted with caution due to reporting and/or data entry lags. The data for this report were based on information entered in iPHIS as of: January 8, 2024 at 9 a.m. for cases reported October 1, 2022 onwards. October 10, 2023 at 9 a.m. for cases reported during the five pre-pandemic seasons.

Invasive Group A Streptococcal (iGAS) Disease in Ontario: October 1, 2023 to December 31, 2023 (publichealthontario.ca) Invasive Group A Streptococcal (iGAS) Disease in Ontario: October 1, 2022 to September 30, 2023 (publichealthontario.ca)

An increase in iGAS activity was observed in the pediatric population in Ontario in the 2022-23 season vs. pre-pandemic seasons, further increasing in late 2023

- Oct. 2022 to Sept. 2023:
  - Increased activity above expected starting in October, peak in March
- Oct. to Dec. 2023 vs. 2022 (as of Jan. 8):
  - Increase in confirmed iGAS cases in children 0-17 years (74 vs. 30 cases)
  - In children < 10 years of age, a 3.2-fold increase in the rate per 100,000 population
  - Hospitalization: 79.7%
  - Fatal outcome reported in 6 children (8.1%) (caution: data lags)

Figure 2: Confirmed iGAS Case Counts by Month in Children 0-17 Years of Age: Current Season (October 1, 2023 – December 31, 2023)* Compared to the 2022-23 Season (October 1, 2022 – September 30, 2023) and the Five Pre-Pandemic Seasons (October 1, 2014 – September 30, 2019)



Data source: iPHIS *Data for the 2023- 2024 season includes cases reported up to December 31, 2023. Data for the most recent reporting month should be interpreted with caution due to reporting and/or data entry lags. The data for this report were based on information entered in iPHIS as of: January 8, 2024 at 9 a.m. for cases reported October 1, 2022 onwards. October 10, 2023 at 9 a.m. for cases reported during the five pre-pandemic seasons.

Invasive Group A Streptococcal (iGAS) Disease in Ontario: October 1, 2023 to December 31, 2023 (publichealthontario.ca)

Pediatric iGAS cases with a fatal outcome reported: Ontario, October 1, 2022 to September 30, 2023 – Preliminary findings

- 12 children (0-17 years) with iGAS had a fatal outcome reported
  - Most (11/12) of these fatal outcomes were reported in children < 10 years of age
  - *N.B.*: Data analyzed in July 2023; no additional fatal outcomes reported through September 2023.
- Range of clinical presentations before/on sample collection date reported (e.g., vomiting, sore throat), and range of iGAS presentations (e.g., sepsis/STSS, pneumonia)
- Risk factors included having a chronic illness / underlying medical condition (5/12), or a recent strep infection (3/12)
- Very short time interval reported from symptom onset to hospitalization and death
  - Median 2 days (interquartile range: 1-4): episode date (symptom onset) to hospitalization
  - Median 4 days (interquartile range: 2-7): episode date to date of death
- *emm* types 1 and 12 were detected, where available (5/12)

Ontario. Ministry of Health. Integrated Public Health Information System (iPHIS) [database]. Toronto, ON: King's Printer for Ontario [extracted 2023 July 4].
Invasive Group A Streptococcal (iGAS) Disease in Ontario: October 1, 2022 to September 30, 2023 (publichealthontario.ca)

Preliminary analysis of data on the M1UK genotype in Ontario: Increasing monthly percent positivity

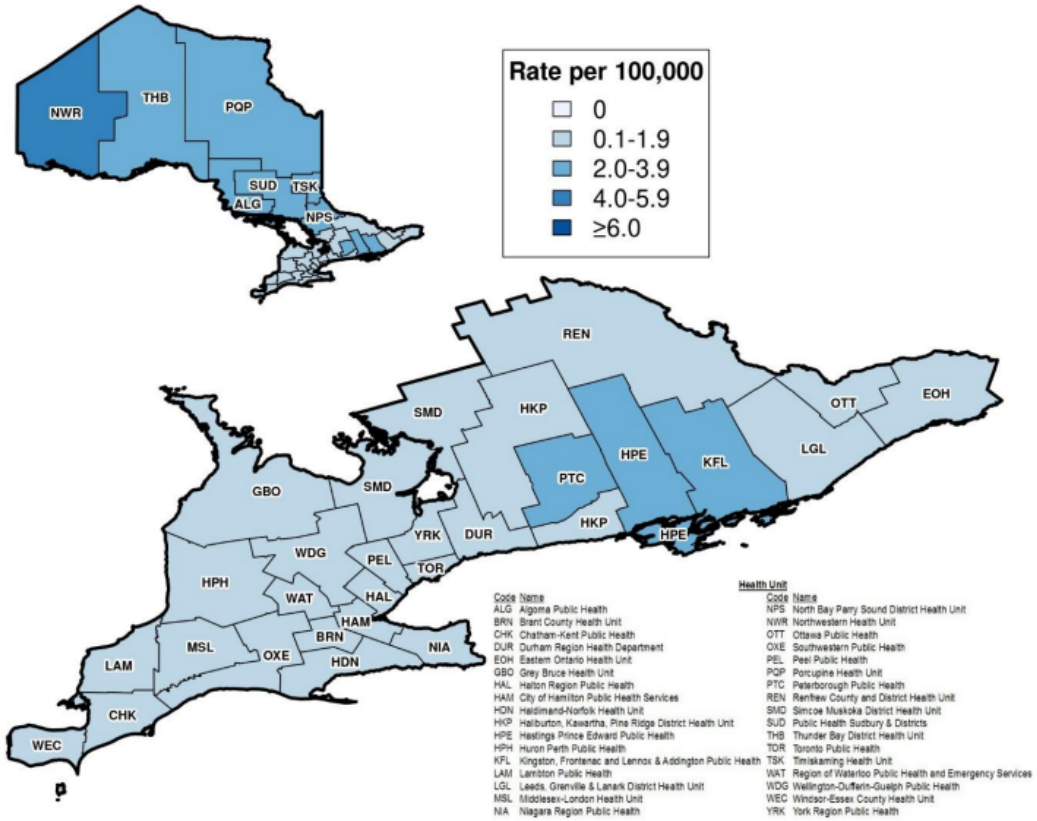
- As of July 2023, NML began reporting M1UK results for *emm* 1 isolates
  - M1UK is a hyper-virulent sublineage of *emm* 1, first detected in England, and was associated with increased incidence scarlet fever and iGAS
- Based on PHO Laboratory data:
  - From June to December 2023:
    - 117/183 (63%) *emm* 1 isolates tested were positive for the M1UK genotype
  - In December 2023: (caution: data lags)
    - 29/35 (80%) *emm* 1 isolates tested were positive for the M1UK genotype

Zhi X, Li HK, Li H, Loboda Z, Charles S, Vieira A, Huse K, Jauneikaite E, Reeves L, Mok KY, Coelho J, Lamagni T, Sriskandan S. Emerging Invasive Group A Streptococcus M1UK Lineage Detected by Allele-Specific PCR, England, 20201. Emerg Infect Dis. 2023 May;29(5):1007-1010. doi: 10.3201/eid2905.221887. Epub 2023 Apr 5. PMID: 37019153; PMCID: PMC10124639.

PHO Laboratory Information Management System [extracted on January 22, 2024].

Rate of confirmed cases of iGAS reported in October to December 2023 by public health unit in Ontario

Figure 4. Monthly rate of confirmed cases of iGAS reported in the current season (October 1, 2023 – December 31, 2023) by public health unit: Ontario*



https://www.publichealthontario.ca/-/media/Documents/I/2023/igas-enhanced-epi-2023-2024.pdf?rev=d40aec17872045159044c8467b7f17e9&sc_lang=en

Summary: Ontario has observed an ongoing increase in iGAS activity in all age groups, including children

- Historically high iGAS activity was observed in Ontario from October 2022 to September 2023 in all age groups, compared to five pre-pandemic seasons
- From October to December 2023, iGAS activity exceeded 2022 and recent pre-pandemic counts and rates for these months
  - Rates were highest in adults 65 years and older, and children 5-9 and 1-4 years
  - Rates increased greater than 3-fold among children < 10 years of age in Oct.-Dec. 2023, compared to Oct.-Dec. 2022
- Multiple *emm* types continue to be detected in Ontario
  - To date, the majority of *emm* 1 isolates tested were positive for the M1UK genotype
- Close monitoring and information sharing with partners is ongoing

- Thank you very much to:
  - Ontario public health unit teams supporting iGAS surveillance activities;
  - the Public Health Ontario Communicable Diseases team and Public Health Ontario Laboratory team supporting provincial iGAS surveillance activities, including analyses presented here, including Michael Whelan, Saranyah Ravindran, Karen Johnson, Dr. Julianne Kus and Kirby Cronin; and,
  - Public Health Agency of Canada partners, including at the National Microbiology Laboratory.

For More Information About This Presentation, Contact:

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Canada

iGAS Testing at the National Microbiology Laboratory and National iGAS Trends

Dr. Alyssa Golden, National Microbiology Laboratory, Winnipeg

PHO Rounds, January 31, 2024

PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH

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Part 1:

National Laboratory Surveillance of Invasive Streptococcal Disease in Canada (eSTREP)

National Laboratory Surveillance of Invasive Streptococcal Disease in Canada (eSTREP)

- Characterizes **invasive *Streptococcus pneumoniae*, *Streptococcus pyogenes* (group A streptococcus, GAS) and *Streptococcus agalactiae* (group B streptococcus, GBS)** in order to:
  - Monitor trends in serotype/*emm* type and antimicrobial resistance
  - Support outbreak investigations
  - Inform vaccine development and treatment guidelines.

- GAS isolates characterized using the *emm* sequencing CDC protocol available at: http://www.cdc.gov/streplab/M-ProteinGene-typing.html and and whole genome sequencing (Illumina Nexseq500, Galaxy workflows and WADE molecular typing).

eSTREP Program Overview

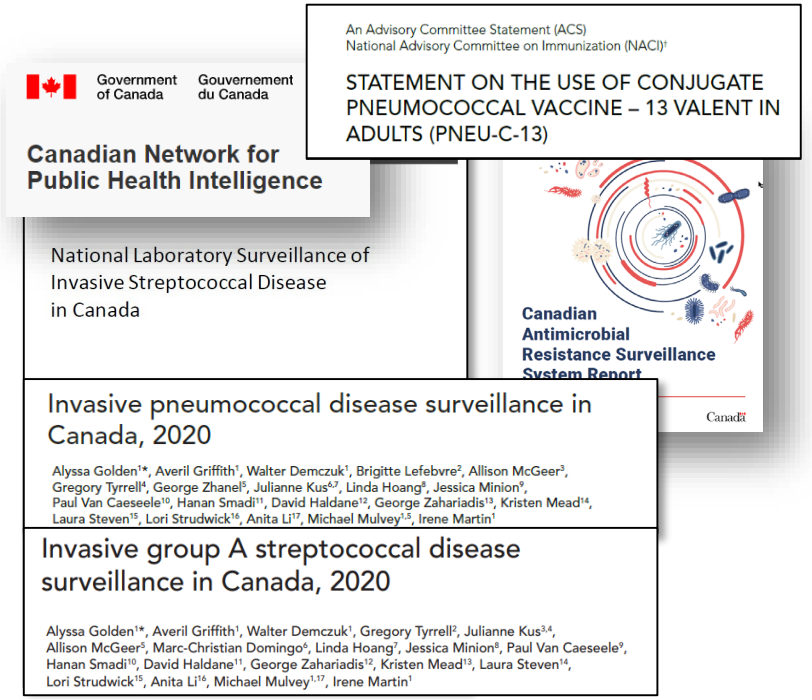
All Provincial/Territorial Laboratories from across Canada (and NB hospitals)

Send isolates to the NML

National Microbiology Laboratory (NML)

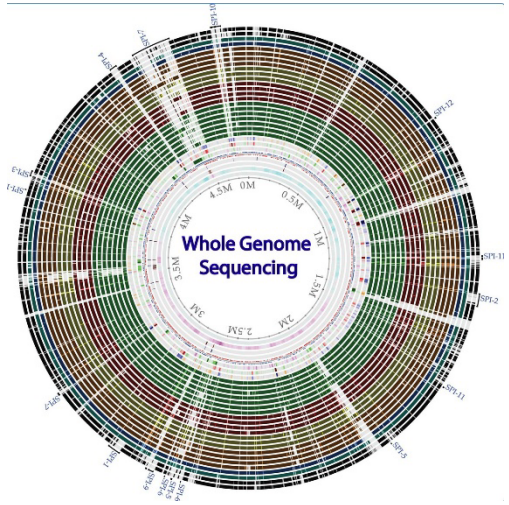
Performs molecular and microbiological AMR characterization of isolates

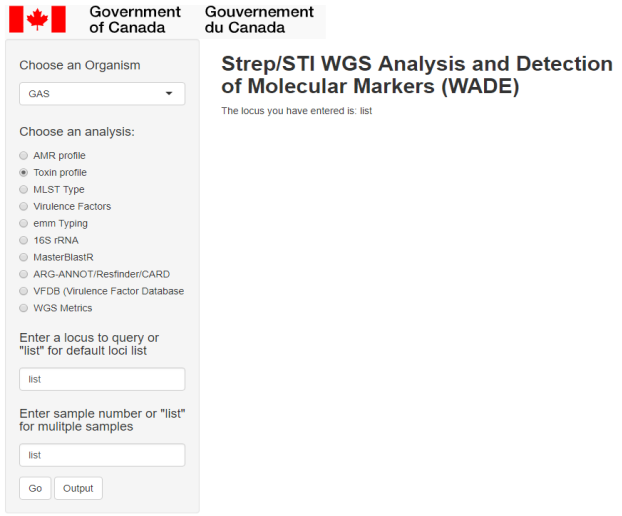
Reporting



Generate, consolidate and report actionable surveillance data; Provincially/Territorially, Nationally

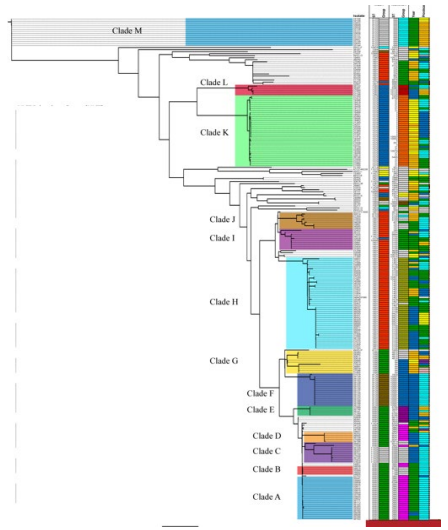
Streptococcus Molecular Typing using Genomics – Implemented Fall 2022





Outbreak Support

- Serotypes
- MLST
- *emm* types
- Toxin Typing
- Predicted AMR
- Virulence Factors



Ongoing Quality Control:

Emm typing by PCR: performed upon request for urgent samples only (eg. outbreaks).

ISO 17025 Accredited in 2023

WADE

https://github.com/phac-nml/wade

Typing

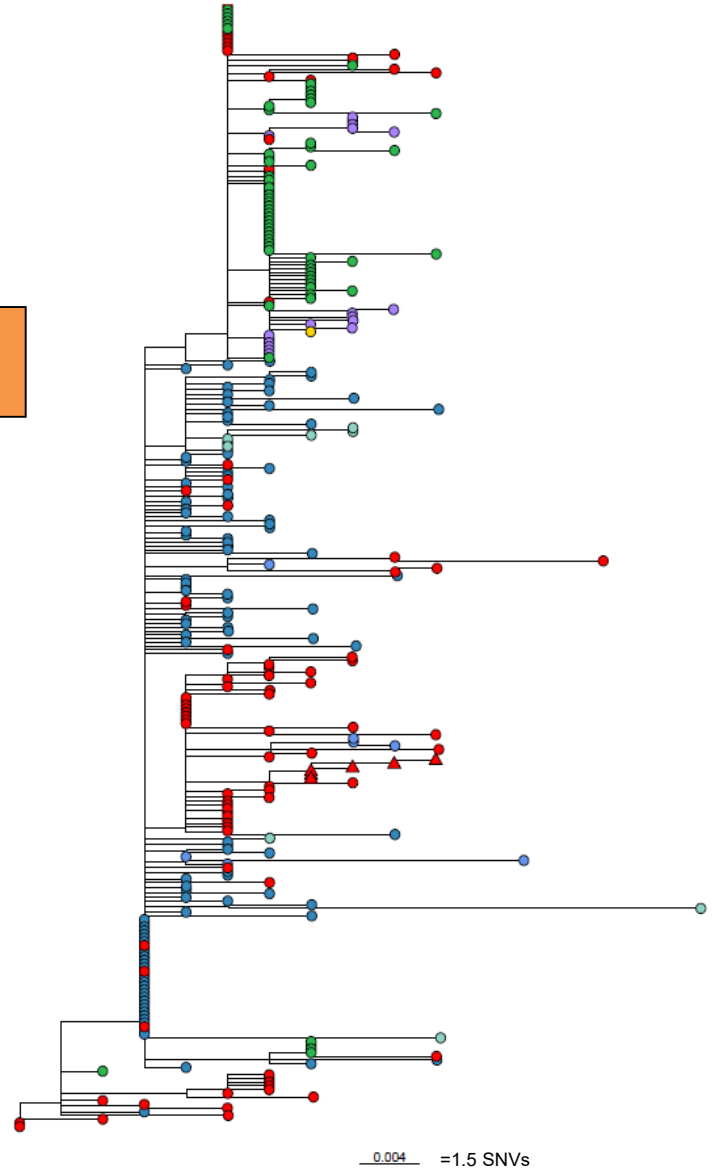
IPD
- *Serotype*
- *Predicted MICs*
- MLST
- Virulence genes

iGBS
- *Serotype*
- AMR
- MLST

iGAS
- *Emm type*
- AMR
- MLST
- Toxin profile

GC
- *Predicted MICs*
- NG-MAST
- NG-STAR
- MLST

Trees



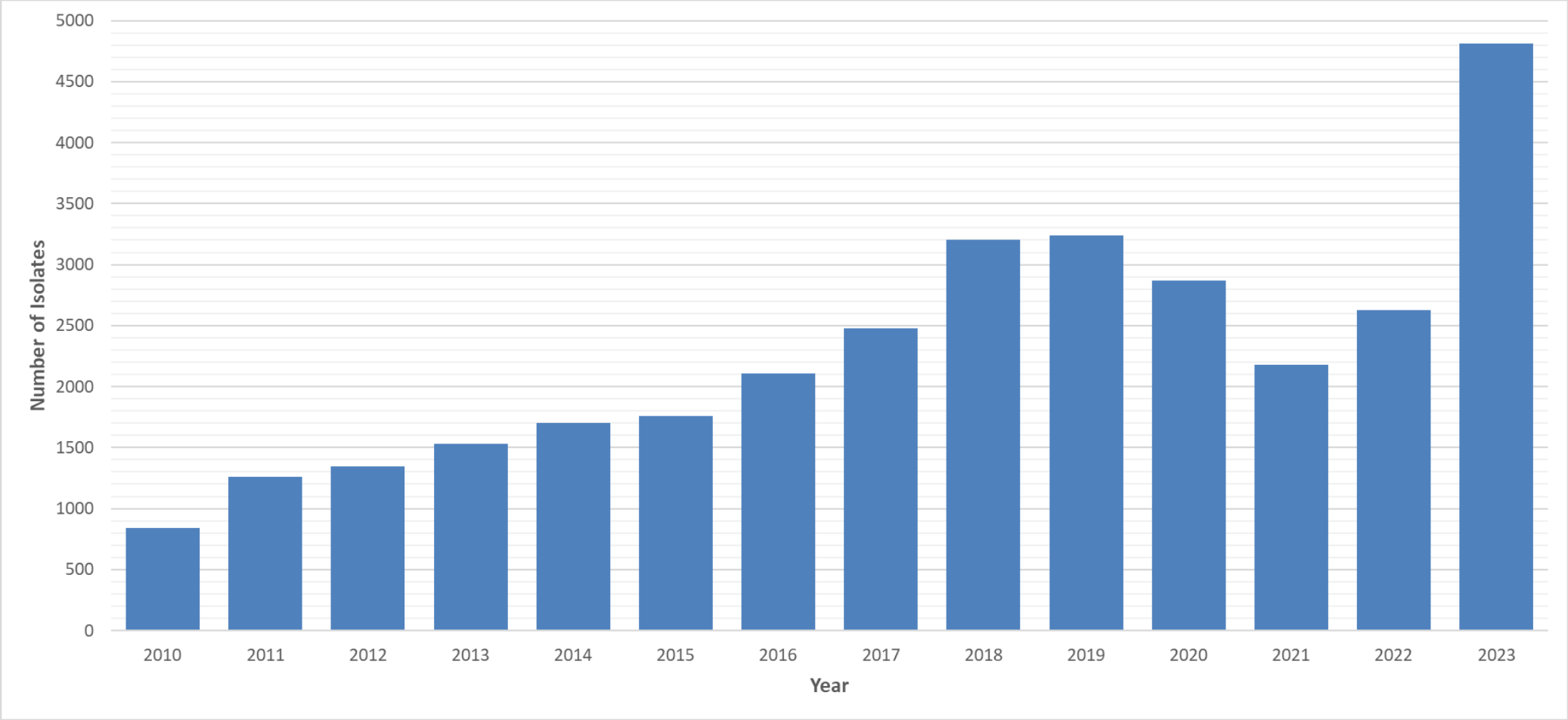
Outbreak and Case Cluster Analysis

- Between 2019-2023 Strep-STI has responded to over 60 outbreak, case cluster and special project requests.
  - Most P/Ts have requested assistance at least once.
  - Long-term care facilities/nursing homes, homeless shelters/rooming houses, military facilities, hospital wards, persons abusing substances, community/regional clusters/increases.
  - Over 20 different *emm* types
    - Common types for analysis were: *emm*81, *emm*89, *emm*76; more recently *emm*1.
- Two requests already in 2024.

Part 2:

National iGAS Trends

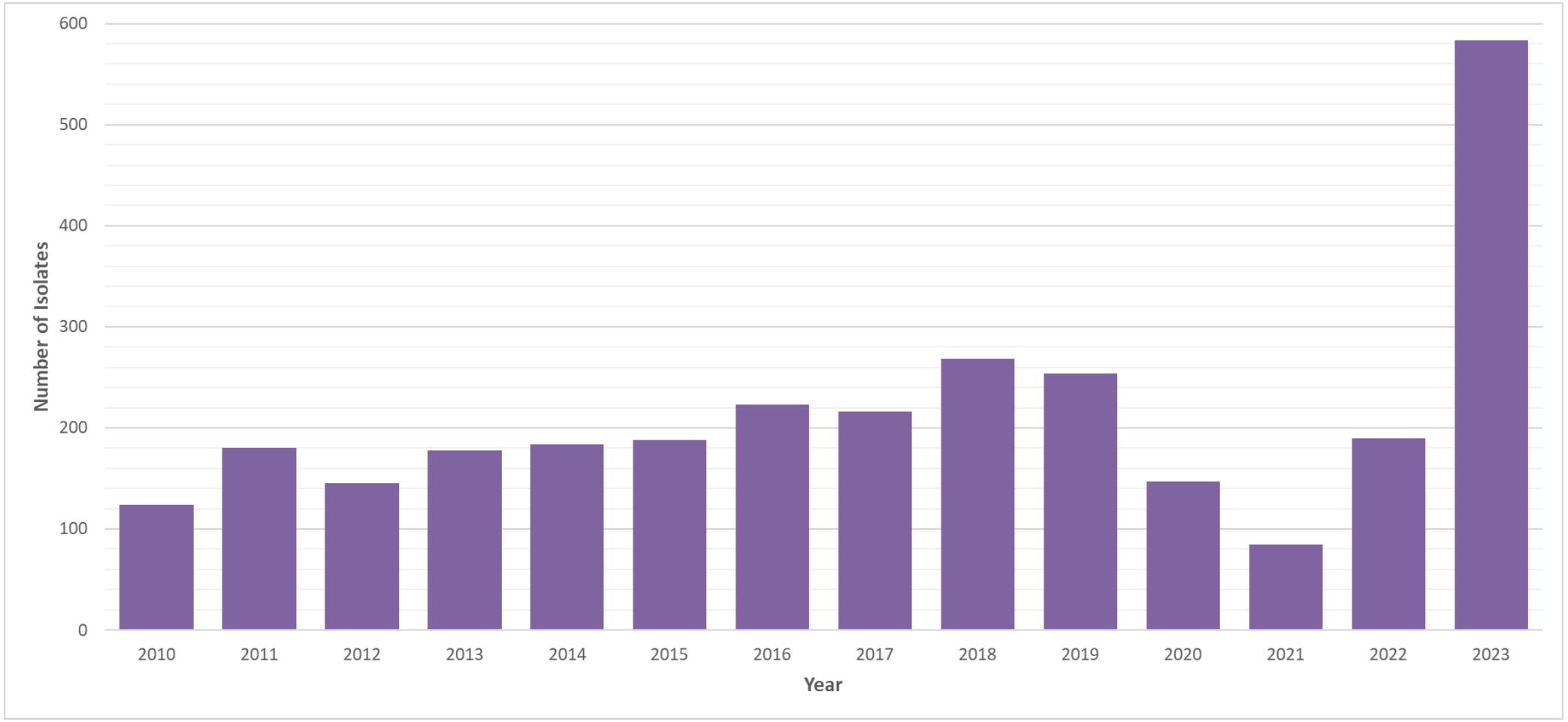
Annual iGAS in Canada



Year	Total
2010	838
2011	1257
2012	1346
2013	1528
2014	1705
2015	1759
2016	2108
2017	2475
2018	3207
2019	3236
2020	2866
2021	2179
2022	2630
2023	**4814**

Note: Preliminary 2023 data.

Annual iGAS in Canada – Children <15 years of age



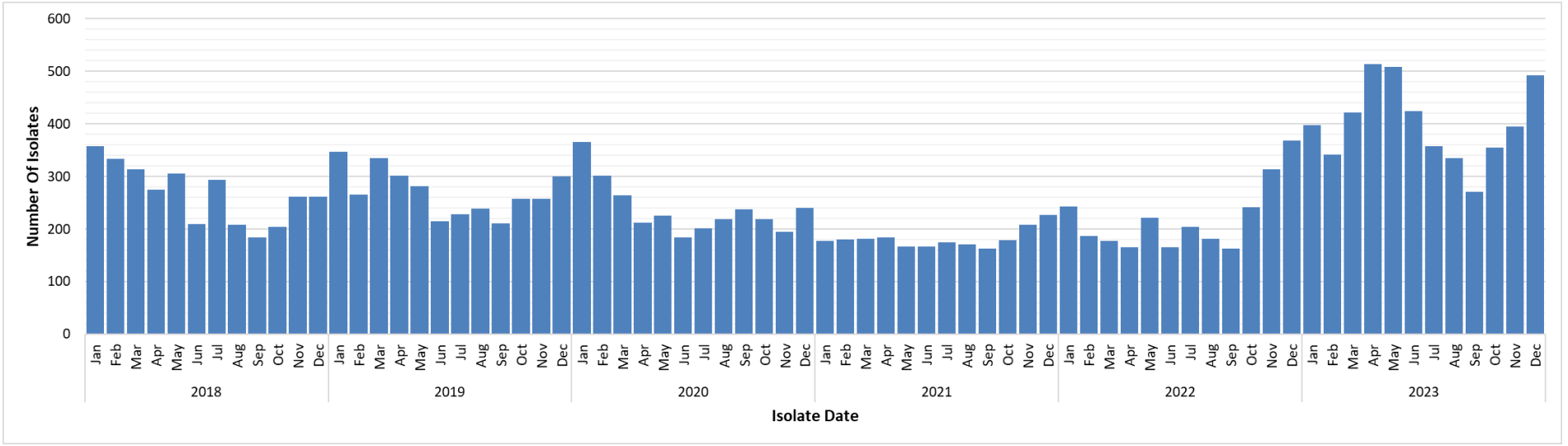
Year	Total
2010	124
2011	180
2012	145
2013	178
2014	184
2015	188
2016	223
2017	216
2018	268
2019	254
2020	147
2021	85
2022	190
2023	**583**

Note: Preliminary 2023 data.

Monthly iGAS in Canada

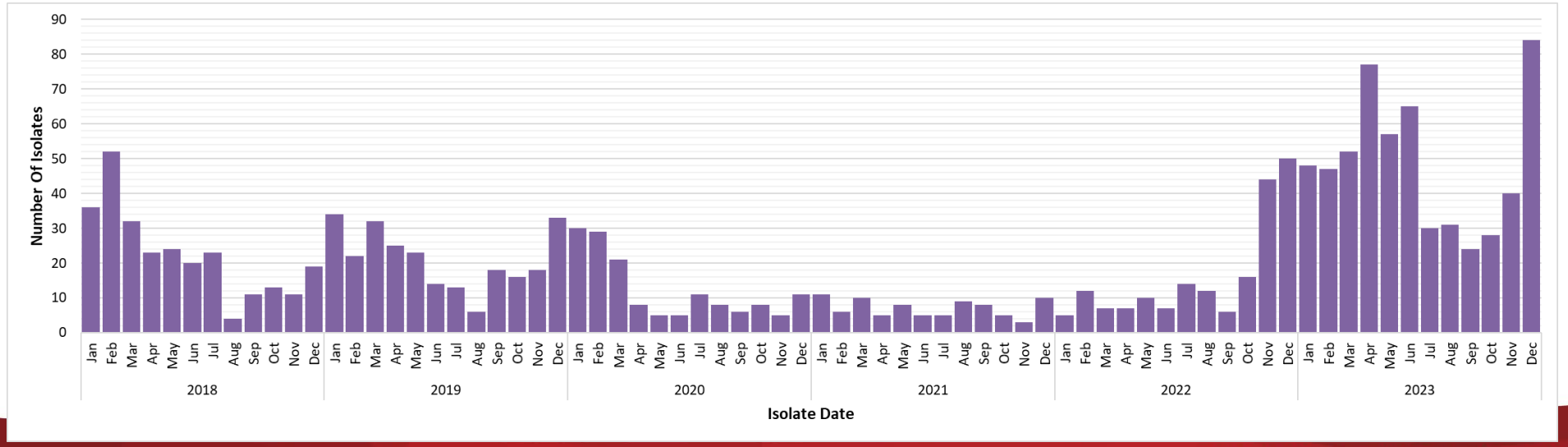
Note: Preliminary 2023 data.

A) All Ages



Month	2018	2023
Jan	358	398
Feb	333	341
Mar	314	422
Apr	275	514
May	305	508
Jun	210	426
Jul	293	357
Aug	208	335
Sep	184	271
Oct	204	354
Nov	262	395
Dec	261	493

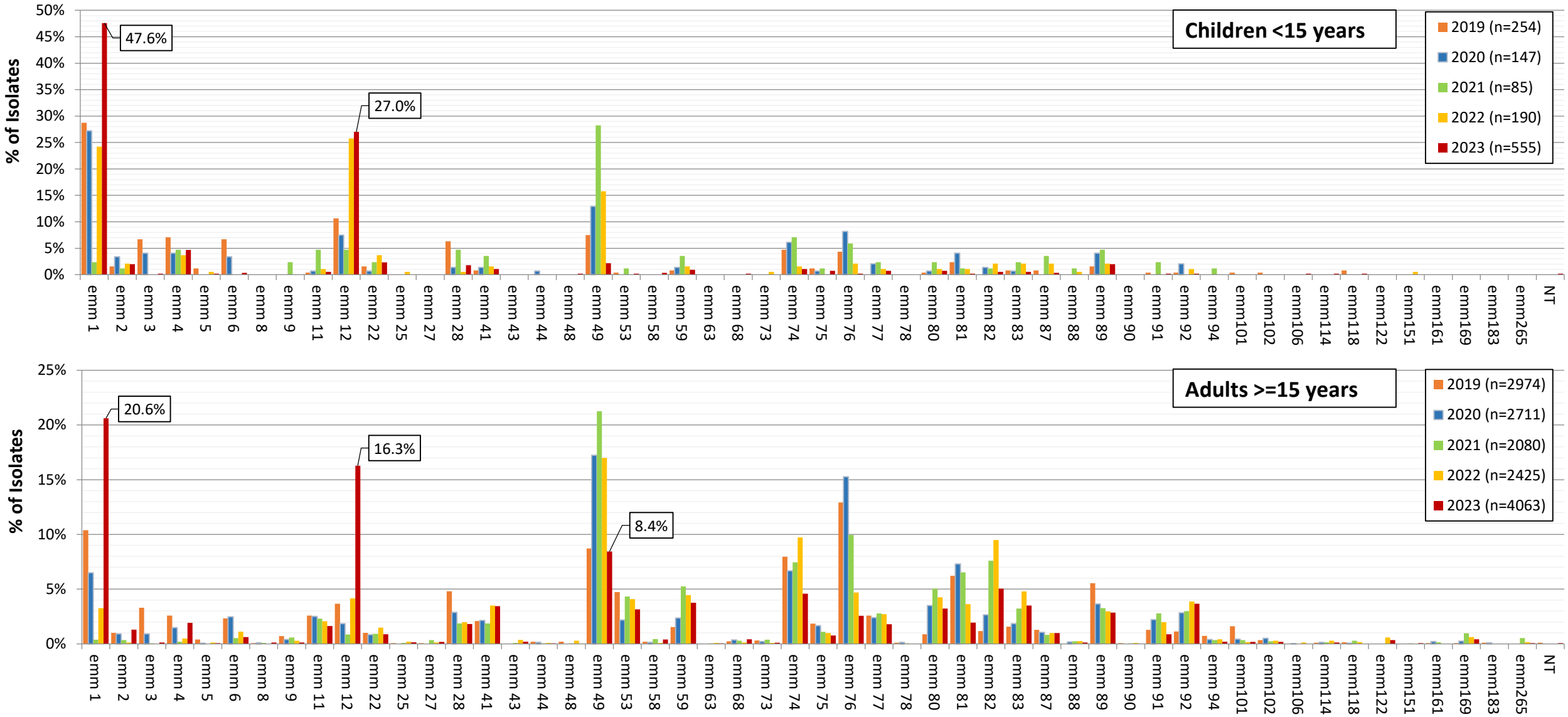
B) <15 years



Month	2018	2023
Jan	36	48
Feb	52	47
Mar	32	52
Apr	23	77
May	24	57
Jun	20	65
Jul	23	30
Aug	4	31
Sep	11	24
Oct	13	28
Nov	11	40
Dec	19	84

iGAS *emm* types 2019 – 2023, Canada

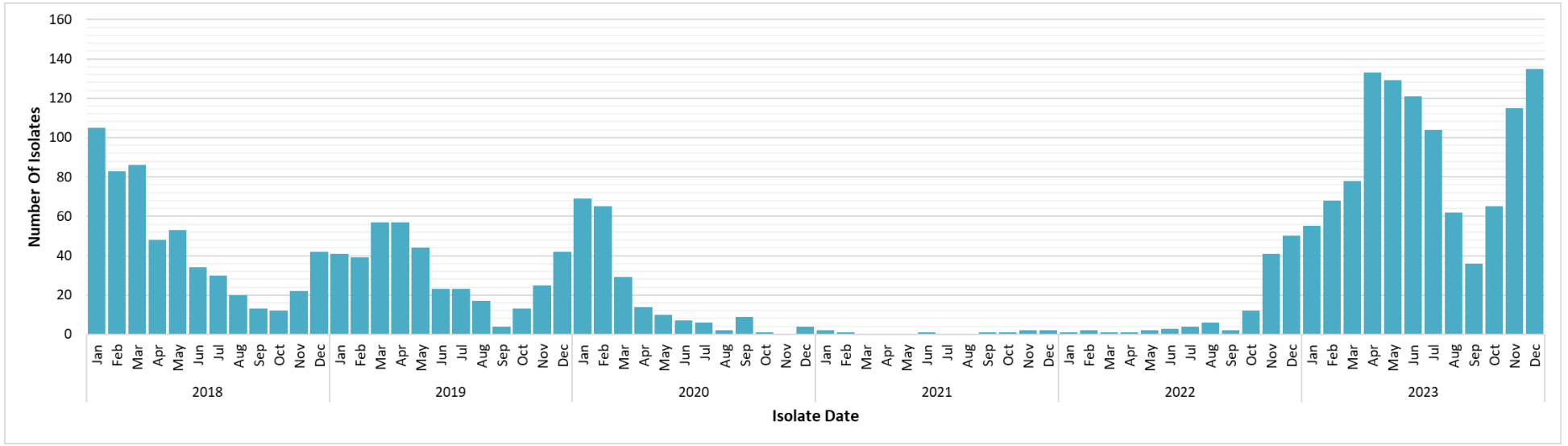
Note: Preliminary 2023 data.



Monthly iGAS *emm*1 and *emm*12

Note: Preliminary 2023 data.

A) *emm*1



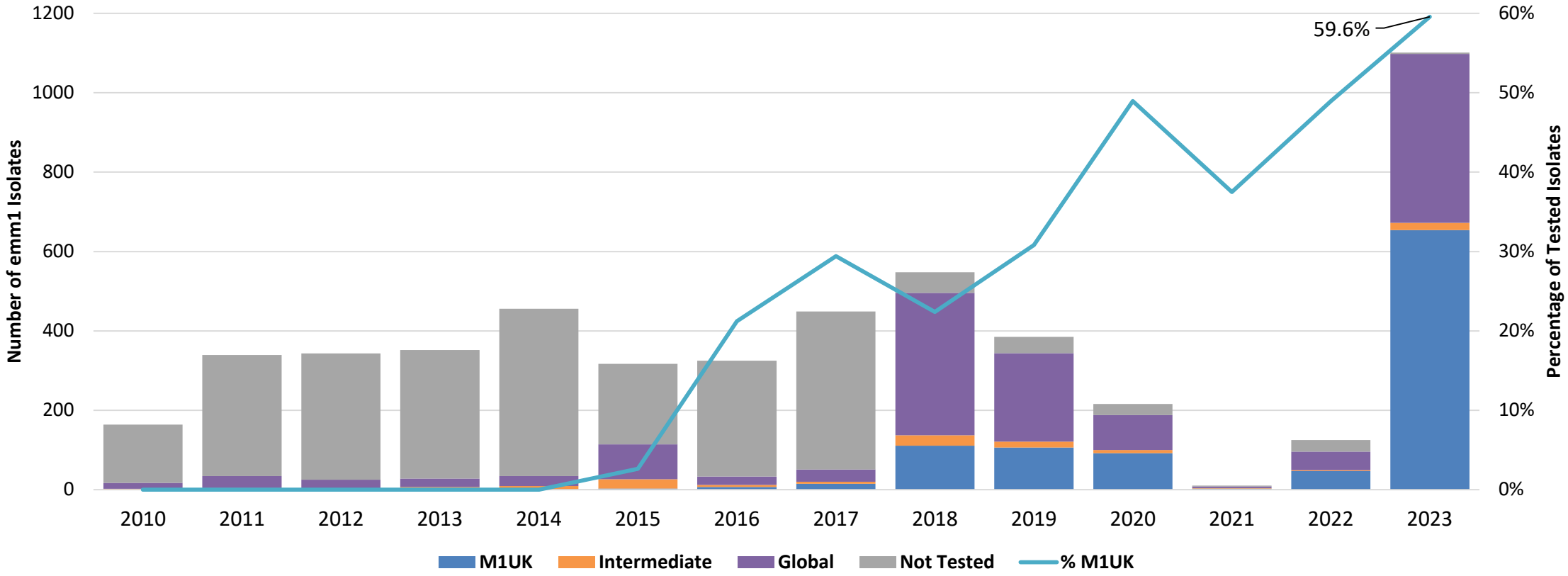
Month	2018	2023
Jan	105	55
Feb	83	68
Mar	85	78
Apr	48	133
May	53	129
Jun	34	121
Jul	30	104
Aug	20	62
Sep	13	36
Oct	12	65
Nov	22	115
Dec	42	135

B) *emm*12

Month	2018	2023
Jan	19	87
Feb	21	61
Mar	18	109
Apr	16	116
May	20	108
Jun	5	86
Jul	13	70
Aug	7	47
Sep	6	38
Oct	3	31
Nov	7	35
Dec	10	25

iGAS M1UK Clone in Canada

Note: Preliminary 2023 data.



Notes: Prior to 2018, WGS was not routinely performed for iGAS. All *emm*1 received at NML from 2018 onward have been sequenced for an upcoming manuscript.

"M1UK" refers to the hypervirulent *emm*1 genotype originally described by Lynskey et al. (Lancet Infect Dis. 2019;19(11):1209-1218). M1UK differs from other *emm*1 isolates by 27 key single nucleotide variants (SNVs).
M1UK = all 27 SNVs present. Intermediate = 1-26 SNVs. Global = 0 SNVs. Not tested = WGS not performed.

Summary

- NML performs routine *emm* typing using whole genome sequencing
  - Added benefits: M1UK typing, outbreak analysis
  - Urgent requests for Sanger sequencing are still possible, for faster TAT

- 2023 has seen the highest annual count of isolates submitted to NML
  - Particularly large increase in children <15 years of age
  - Didn’t always follow predicted seasonal trends

- *emm*1 and *emm*12 were particularly common nationally
  - *emm*1 back with a vengeance after COVID-19; ~60% M1UK clone
  - *emm*12 came out of obscurity

- Establishment of a national enhanced surveillance system for iGAS will help determine whether common *emm* types/virulent clones are associated with increased severity/poor outcomes

Acknowledgements

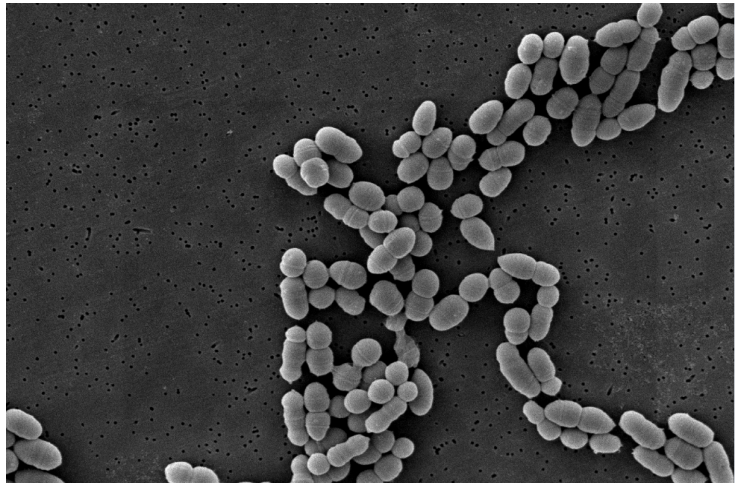
Questions?
alyssa.golden@phac-aspc.gc.ca

Canadian Provincial Public Health Laboratories

- British Columbia Centre for Disease Control
- Provincial Laboratory of Public Health Alberta
- Saskatchewan Disease Control Laboratory
- Cadham Provincial Laboratory, Manitoba
- Public Health Laboratories, Public Health Ontario
- Laboratoire de santé publique du Québec
- Queen Elizabeth II Health Science Centre, Nova Scotia
- New Brunswick Regional Hospitals
- Newfoundland Public Health Laboratory
- Queen Elizabeth Hospital, P.E.I.
- Stanton Territorial Hospital, Northwest Territories
- Toronto Invasive Bacterial Disease Network

Streptococcus and STI Unit

- Irene Martin, Head
- Anastasia Anistratov
- Alyssa Golden
- Rachel Hink
- Nick Nordal-Budinsky
- Caitlin Sarna
- Robyn Thorington
- Norman Barairo
- Averil Griffith
- Gary Liu
- Shelley Peterson
- Giulia Severini
- Angela Yuen



Group A Streptococcus image provided by Dan Beniac, National Microbiology Laboratory

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Direction régionale de santé publique de Montréal

Recurrent *emm*89 invasive group A streptococcal disease (iGAS) outbreak in a multi-level elder care facility in Montreal, 2019 & 2022

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January 31st, 2024

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Conflict of interest

- None

Acknowledgements

- Direction régionale de santé publique de Montréal
- CIUSSS de l'Ouest-de-l'Île-de-Montréal
- Concerned multi-level elder care facility (unnamed to maintain confidentiality)
- Jewish General Hospital Laboratory
- McGill University Health Centre – Glen site laboratory
- Laboratoire national de santé publique du Québec
- National Microbiology Laboratory, in particular Irene Martin & Alyssa Golden
- Canadian Field Epidemiology Program, Public Health Agency of Canada
- Ministère de la santé et des services sociaux du Québec
- CIUSSS du Centre-Sud-de-l'Île-de-Montréal
- CIUSSS du Nord-de-l'Île-de-Montréal
- CIUSSS du Centre-Ouest-de-l'Île-de-Montréal
- Dr Allison McGeer, Mount Sinai Hospital & University of Toronto
- Dr Irene Armstrong, Toronto Public Health

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Outline

1. **Description of the 2018-2019 and 2022 outbreaks**
2. **Contribution of laboratory analyses to outbreak management**
3. **Outbreak detection & management: barriers & facilitators**

Quick review: Guidelines for iGAS outbreak management in a LTCF

1. Confirming the existence of an outbreak in a LTCF
    - ≥200+ beds: iGAS incidence >1/100 in a 30-day period
    - <200 beds: 2 iGAS cases in a 30-day period
    - iGAS/GAS incidence >4/100 in a 30-day period, including probable cases that are not laboratory-confirmed
    - No mention of emm typing or whole genome sequencing (WGS)
2. Implementing interventions to control the outbreak
    - Enhancement of IPC measures, especially hand hygiene
    - Mass screening of all asymptomatic healthcare providers (throat, nose, non-intact skin swab for culture)
    - Mass screening of residents (throat, nose, non-intact skin swab for culture)
        - <100 beds: screen all residents
        - ≥100 beds: screen outbreak unit residents; if evidence of staff/resident mobility or spread to other units: expand screening
    - Antibiotic prophylaxis to residents and healthcare providers who screen positive
    - Prospective surveillance / case finding and treatment for invasive and non-invasive GAS disease among residents, healthcare providers and other staff x30 days
    - Resident isolation / staff exclusion from work until 24h of effective antibiotic treatment
    - Check GAS/iGAS case relatedness to outbreak based on laboratory analyses
    - No mention of mass antibiotic prophylaxis; no further guidance if these measures don't control the outbreak

Guide d'intervention - Les infections invasives à streptocoque du groupe A (mise à jour 2007) - Publications du ministère de la Santé et des Services sociaux (gouv.qc.ca)

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1 Description of the 2018-2019 and 2022 outbreaks

Outbreak setting

Building

- Two 6-story towers joined by a shared lobby
  - Tower A : LTC on floor 1 ; IC on floors 2-3 ; RH on floors 3-6, including locked unit floor 5
  - Tower B : LTC on floors 1-2 ; RH on floors 3-6
- Rooms
  - Mostly single, except a few doubles
  - All have toilet + sink
- Common areas
  - One shower/bathing area per floor
  - One dining room per floor
  - One large cafeteria on the ground floor

People

- Residents
  - About 250 residents (125 per tower)
    - 45 (18%) LTC
    - 25 (10%) IC
    - 180 (72%) RH
  - Level of autonomy
    - 20% with neurocognitive disorder
    - 70% semi-autonomous
    - 10% autonomous
- Employees
  - Most staff were employed by the private facility
  - Some healthcare staff employed by 5 different subregional health authorities (CIUSSS/CISSS)
  - Some highly-mobile private agency staff hired by the CIUSSS/CISSS and the private facility

LTC: long-term care, IC: intermediate care, RH: retirement home

CIUSSS: *Centre intégré universitaire de santé et de services sociaux*, CISSS: *Centre intégré de santé et de services sociaux*

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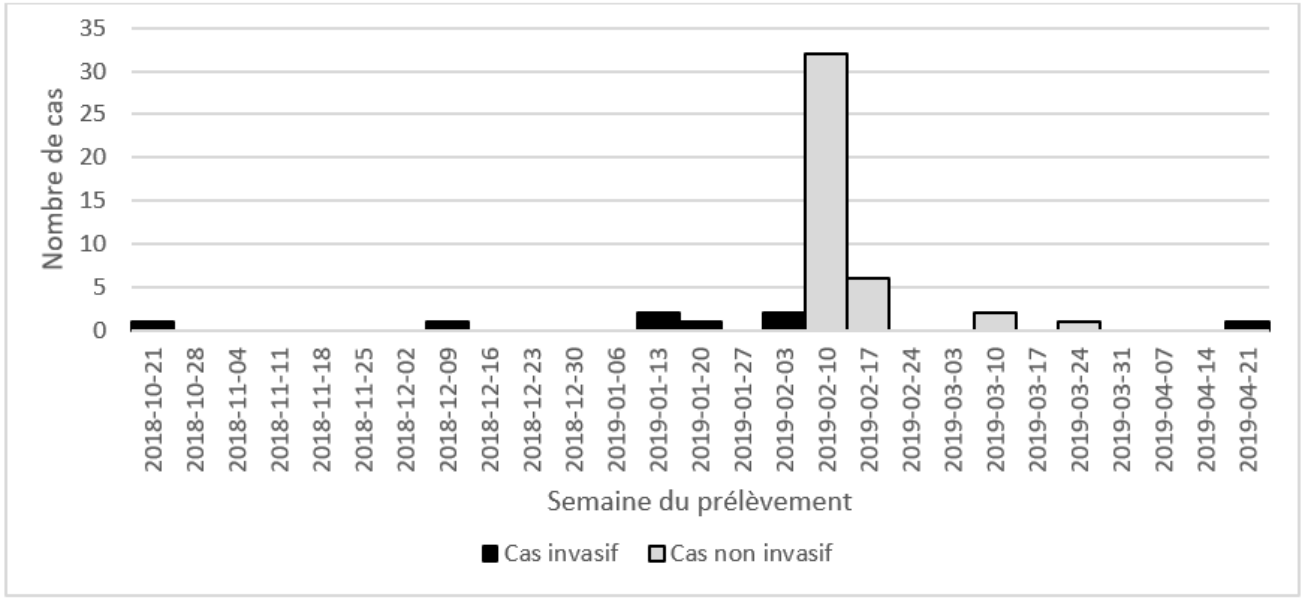
Outbreak summary: number of cases

	2018-2019 outbreak	2022 outbreak
Number of iGAS cases (all among residents)	8	6
Clinically severe* (%)	7 (88%)	5 (83%)
Fatal (%)	6 (63%)	4 (67%)
Number of non-invasive GAS cases/carriers	41	17
Among residents	32	10
Among staff	9	7

*As per provincial iGAS management guidelines, clinically severe cases include those with : meningitis or pneumonia or soft tissue necrosis (including myositis, fasciitis, and gangrene) or streptococcal toxic shock syndrome or death.

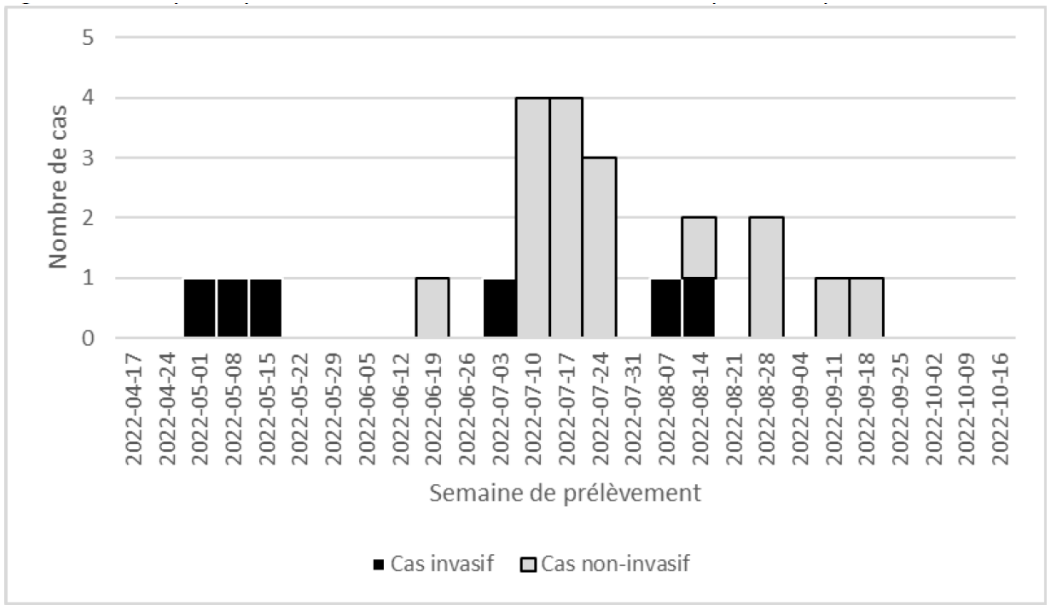
Epidemic curve of emm89 iGAS cases and GAS carriers, by specimen collection date*

2018-2019 outbreak



6 months between the first and last iGAS cases

2022 outbreak



3.5 months between the first and last iGAS cases

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*Date of symptom onset was challenging to obtain for several iGAS cases and does not apply to GAS carriers detected through screening

Location of iGAS cases in the facility

2018-2019 Outbreak

- iGAS cases
  - 7/8 in Tower A
    - Floors 3, 4, 5, 6
    - IC and RH (no LTC)
  - 1/8 in Tower B (RH)

2022 Outbreak

- iGAS cases
  - Limited to Tower A
    - Floors 2, 3, 4, 5
    - IC and RH (no LTC)

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IC: intermediate care, LTC: long-term care, RH: retirement home

Risk factors among iGAS cases

2018-2019 Outbreak

- 8/8 iGAS cases had wounds
- 5/8 had diabetes

2022 Outbreak

- 5/6 iGAS cases had wounds
- Other iGAS case had recent non-penetrating trauma (due to a fall), but no wound

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Site of iGAS infections

2018-2019 Outbreak

- 5/8 pneumonia
  - 2 also had septic arthritis
  - 1 also had cellulitis
- 3/8 cellulitis only

2022 Outbreak

- 4/6 cellulitis
  - 1 also had bursitis
  - 1 also had pneumonia
- 1/6 osteitis
- 1/6 septicemia of unknown origin

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Contribution of laboratory analyses to outbreak management

Contributions of laboratory analyses to outbreak management

- Confirmed outbreak recurrence
- Helped define the scope of each outbreak
  - Used to determine which cases/carriers were related to the outbreak
  - Used to determine if the 2022 outbreak spread to another facility
    - In August 2022, an iGAS outbreak was detected at Facility B
      - Owned/operated by the same private company as Facility A
      - Located <10km away
      - Some shared staff
      - The only other facility with an iGAS outbreak in Montreal at the time

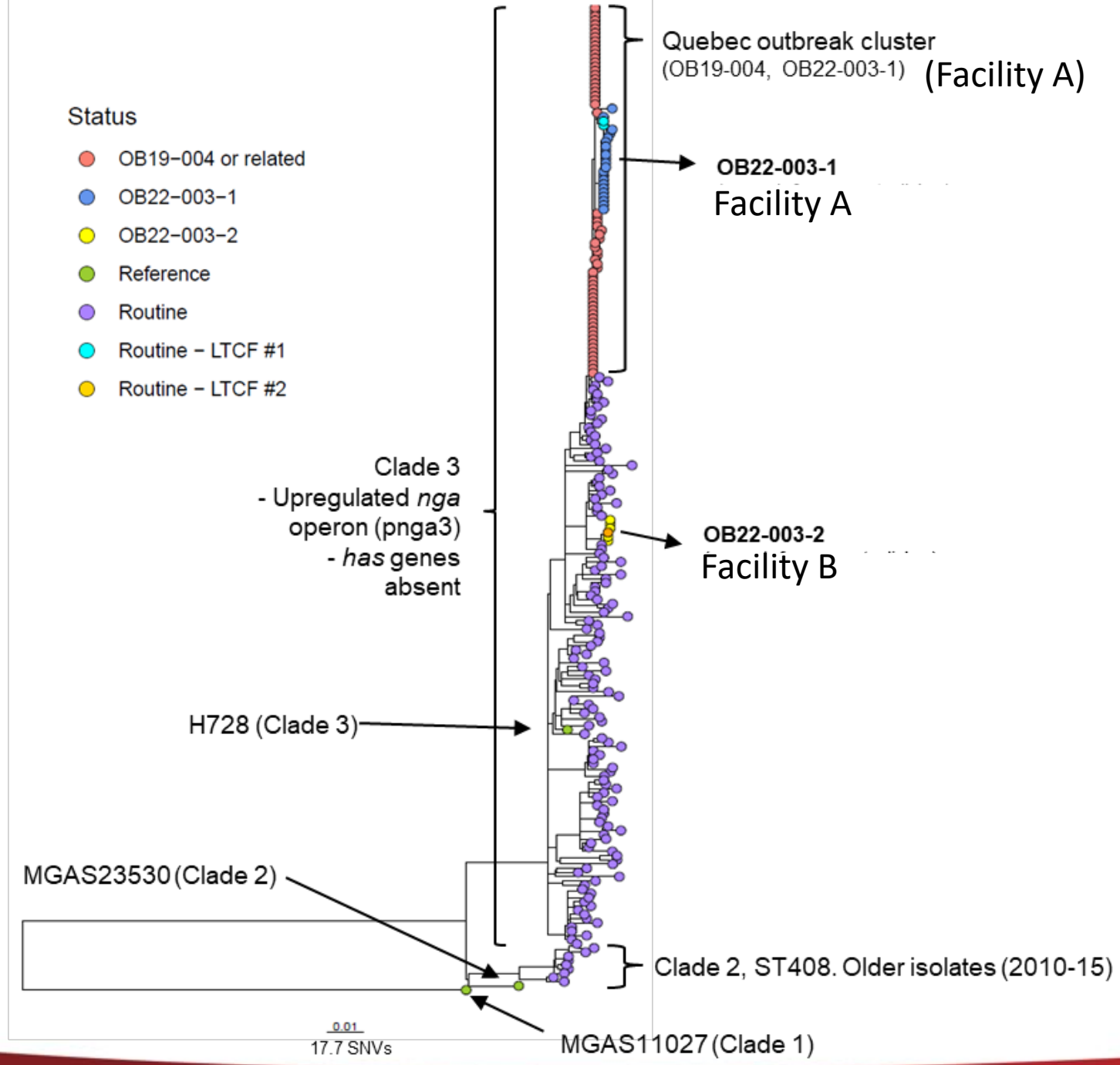
Emm typing

- Rapid, preliminary detection of a potential outbreak recurrence of the 2018-2019 outbreak at Facility A in 2022
  - Helped raise the alert level internally and with external partners
- Used to exclude a few non-invasive GAS cases and carriers from the outbreak because their emm types were different
- However, was misleading and initially led to a more extensive and resource-intensive intervention at Facility B than if the WGS results had been available

Whole genome sequencing (WGS)

- Confirmed outbreak recurrence at Facility A
  - 5-6 SNVs difference between 2018-2019 and 2022 outbreak isolates at Facility A
  - Comparing the SNV difference to the presumed rate of genetic drift (~1.7 SNVs per year) suggests that **the 2022 outbreak was likely a resurgence of the same clone that caused the 2019 outbreak**
- Ruled out spread of the 2022 outbreak from Facility A to Facility B
  - ~39 SNVs difference between Facility A and Facility B outbreak isolates

*emm*89.0, Quebec (n=231)
2010-2022



- QC outbreak cluster (88 samples from 2018, 2019, 2020 and 2022) has an average of 3.2 SNVs difference (range 0-16 SNVs)
  - Only includes OB22-003 samples collected from LTCF #1.
  - OB22-003-1 samples in this cluster differ from the rest of the OB clade by an average of 5.9 SNVs (range 3-12 SNVs)
- OB22-003-2 isolates are:
  - ~39 SNVs different (range 38-43 SNVs) from OB22-003-1
  - ~36 SNVs different (range 33-43 SNVs) from the greater OB cluster
- Removing the distantly related MGAS11027, average SNVs difference in tree = 40.1, range 0-136

Core = 86.5%
Sites used = 1774
Mapping reference = SC10-0717-A
SNV density filter = 5/500
Tree rooted on MGAS11027

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Outbreak detection & management: barriers & facilitators

Barriers to outbreak detection

- Failure of treating physicians and hospital laboratories to report iGAS cases to public health (in 2022)
  - Public health was only notified of the third iGAS case when the LNM reported the emm typing result
  - Two more iGAS cases were not reported; they were discovered fortuitously when a recent death and hospital transfer were reviewed during an outbreak management meeting
- Failure to recognize the prior occurrence of other iGAS cases in the same setting
  - In 2018-2019, the lookback procedure was limited to the last 30 days (as per provincial guidelines), so the outbreak was only detected when the 4th case occurred
- Failure to reassess the possibility of a link between cases when emm typing results became available
  - In 2022, the case investigator concluded to no epi link between the first and second cases; this was not reassessed in light of identical emm typing results

Key barriers to outbreak management

- Unclear governance
  - Between Montreal Public Health and the subregional health authority (CIUSSS)
  - Between the five subregional health authorities (CIUSSS/CISSS)
- Deficient management of private care facility
  - Administrative & clinical leadership issues
  - Staffing issues, including: high turnover, high proportion of part-time and temporary staff, multiple employers (see governance)
  - Quality of care issues, including resident mistreatment
  - Failure to effectively implement outbreak control measures

Barriers to implementing outbreak control measures

- Mass screening of residents and staff:
  - Inability to obtain a reliable list of staff working in the facility
  - Low uptake of screening among staff in 2022
    - Pandemic-related screening fatigue
  - Unscreened staff continued to work in the facility
- Mass prophylaxis of residents (2022 only):
  - Several residents who were prescribed prophylaxis were not provided it
    - Discovered because of further iGAS cases among non-prophylaxed residents
- IPC practices:
  - Compliance with hand hygiene recommendations below 20% initially
  - Inadequate environmental cleaning and disinfection, clutter
  - No wound registry, deficiencies with wound care

Key facilitators for controlling the 2022 outbreak

- Independent inquiry into resident mistreatment launched at the request of the Ministry of Health (2022), which led to:
- Take-over of the management of the private facility by the CIUSSS
  - Temporary transfer of staff from the CIUSSS to the private facility, including key admin and clinical leadership positions
  - Transfer of several residents to other facilities
  - Improved human resources management
    - Staff lists became available to effectively implement staff screening
    - Unscreened staff were prevented from working at the facility
  - Development & effective implementation of an IPC action plan, including :
    - Mandatory IPC training and testing; test failure led to immediate unpaid leave of absence
    - Creation of a wound registry, review and improvement of wound care practices
    - Resident skin decolonisation with chlorhexidine “baths”
    - Hand hygiene audits with feedback (compliance rates went from below 20% to above 80%)
    - Review and improvement of environmental cleaning & disinfection practices and products
    - Training of IPC champions

Summary

- Collaboration among regional public health and subregional health authorities (CIUSSS/CISSS) was necessary to control these outbreaks, but was impeded by unclear governance
- Several factors at Facility A impeded outbreak control and likely contributed to its recurrence, including:
  - Deficient management
  - High turnover and mobility of staff, multiple employers
  - Inadequate IPC practices
  - Suboptimal quality of care, including wound care
- Timely access to WGS was instrumental in understanding:
  - The recurrence of the 2018-2019 outbreak in 2022
  - The scope of the 2022 outbreak
- iGAS outbreak management guidelines need to be updated

THANK YOU

For more information, please contact Dr Geneviève Cadieux at: genevieve.cadieux.med1@ssss.gouv.qc.ca

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Epilogue

- Independent inquiries into allegations of mistreatment and the 2022 iGAS outbreak were completed and recommendations made
- The facility was eventually shut down after all remaining patients were transferred to other facilities; management was never transferred back to the private company
- The Ministry of Health is taking steps to ensure public oversight of all LTCFs in Quebec
- Montreal's regional governance with respect to IPC is being clarified; the 5 CIUSSS, Montreal Public Health, and the Ministry of Health are involved in these ongoing efforts
- A review of provincial governance with respect to IPC was initiated, but is currently paused due to ongoing healthcare reform