

ENHANCED EPIDEMIOLOGICAL SUMMARY

Invasive Group A Streptococcal (iGAS) Disease 2022-23 Season Summary

Published: August 2024

Purpose

This report is an epidemiologic overview of confirmed cases of invasive group A streptococcal disease reported in Ontario during the 2022-23 season (October 1, 2022 to September 30, 2023) compared to the five seasons prior to the COVID-19 pandemic (October 1, 2014 and September 30, 2019). The report includes the most current information available from Ontario's integrated Public Health Information System (iPHIS) as of **January 15, 2024**.

Invasive Group A Streptococcus (iGAS) is an invasive form of infection with Group A Streptococcus (GAS), which occurs when *Streptococcus pyogenes* bacteria enter a normally sterile part of the body (e.g., blood, deep tissue, lining of the brain). GAS is a common cause of milder infections but unlike iGAS, non-invasive GAS infections are not notifiable to public health in Ontario. Only cases meeting the [provincial confirmed iGAS case definition](#) are included in this report.¹ An iGAS season is defined as the period spanning October 1 of one year to September 30 of the following year.

Key Messages

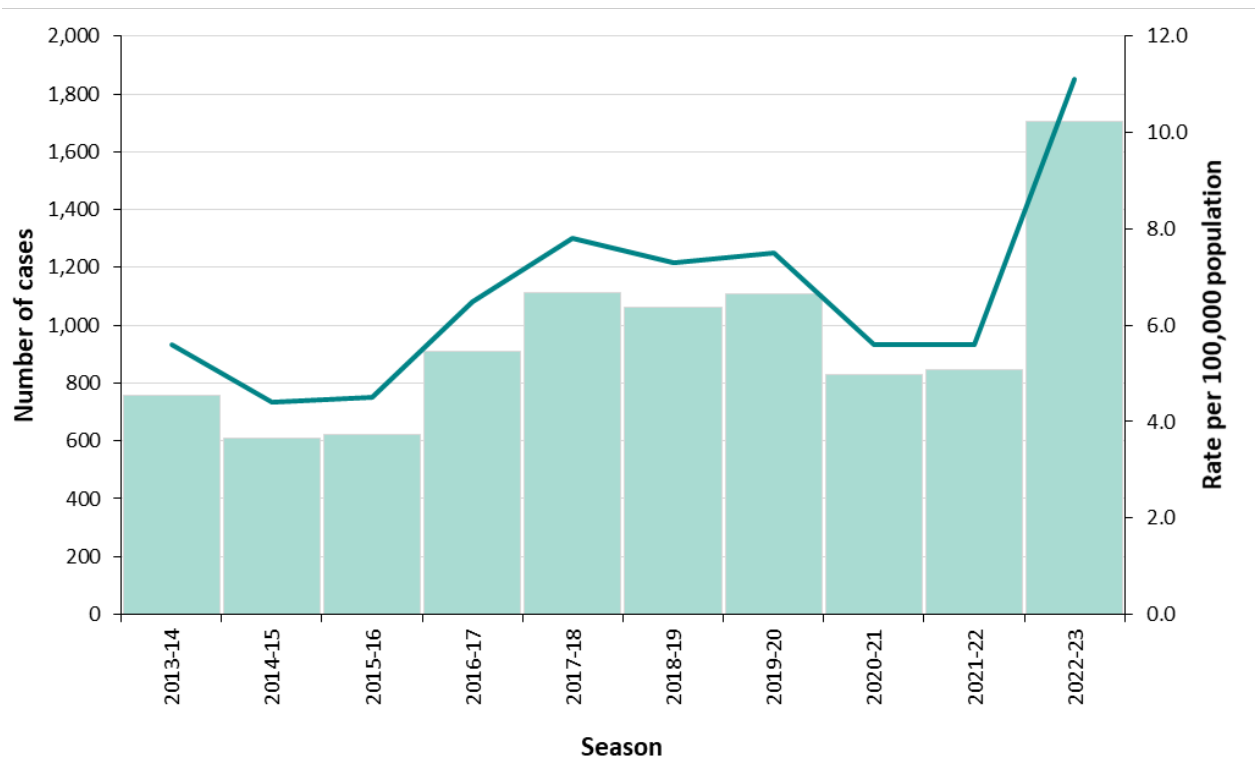
- The incidence of iGAS in Ontario in the 2022-23 season was the highest on record since iGAS became reportable in Ontario in 1995^{2,3}, with 1,707 reported cases and a rate of 11.1 cases per 100,000 population.
- The percentage of cases with a fatal outcome increased in the 2022-23 season compared to recent pre-pandemic seasons (12.0% vs 10.4% in 2014-2018). The overall number of deaths in 2022-23 (n=205, including 12 deaths in children under 18 years) also exceeded the average number of deaths reported in recent pre-pandemic seasons (n=90.0 overall, and 3.6 in children).
- Most public health units (31/34) had higher rates of iGAS in the 2022-23 season than in 2018-19, the previous peak season. iGAS incidence rates were double the provincial rate in multiple northern Ontario public health units (Northwestern health unit, Thunder Bay District Health Unit, Algoma Public Health and Public Health Sudbury & Districts).
- Pediatric iGAS cases with a fatal outcome (n=12) progressed rapidly from symptom onset to hospitalization (within two days, on average), and death (within four days, on average).
- The most commonly reported *emm* type was *emm1*, followed closely by *emm12*. Among commonly identified *emm* types, *emm1* had the highest proportions of severe cases among both adult and pediatric age groups.

- Increasing iGAS activity in Ontario, in the absence of a vaccine against GAS, underscores the importance of:
 - Continuing to strengthen surveillance of iGAS in children and adults;
 - Supporting local public health units' capacity to provide timely management of iGAS cases, contacts and outbreaks, including within equity-seeking populations and communities (e.g., in Northern Ontario);
 - Effective communication about iGAS with health care providers, as well as the public, in collaboration with key public health and clinical partners; and,
 - Staying up-to-date on available immunizations, as eligible, against viral infections that can occur before or at the same time as iGAS (e.g., influenza, chickenpox, COVID-19).

Trends

Since iGAS became reportable in Ontario in 1995, the 2022-23 season saw the highest number of iGAS cases reported in Ontario.^{2,3} Between the 2013-14 and 2022-23 seasons, the rate of cases per 100,000 population increased from 5.6 to 11.1, representing a 98.2% increase. Seasonal rates fluctuated during this period. There were sustained higher levels of iGAS activity during the 2017-18 to 2019-20 seasons compared to the preceding seasons, followed by a decrease in iGAS during the 2020-21 and 2021-22 seasons during the COVID-19 pandemic, and a subsequent sharp increase in 2022-23 ([Figure 1](#)).

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

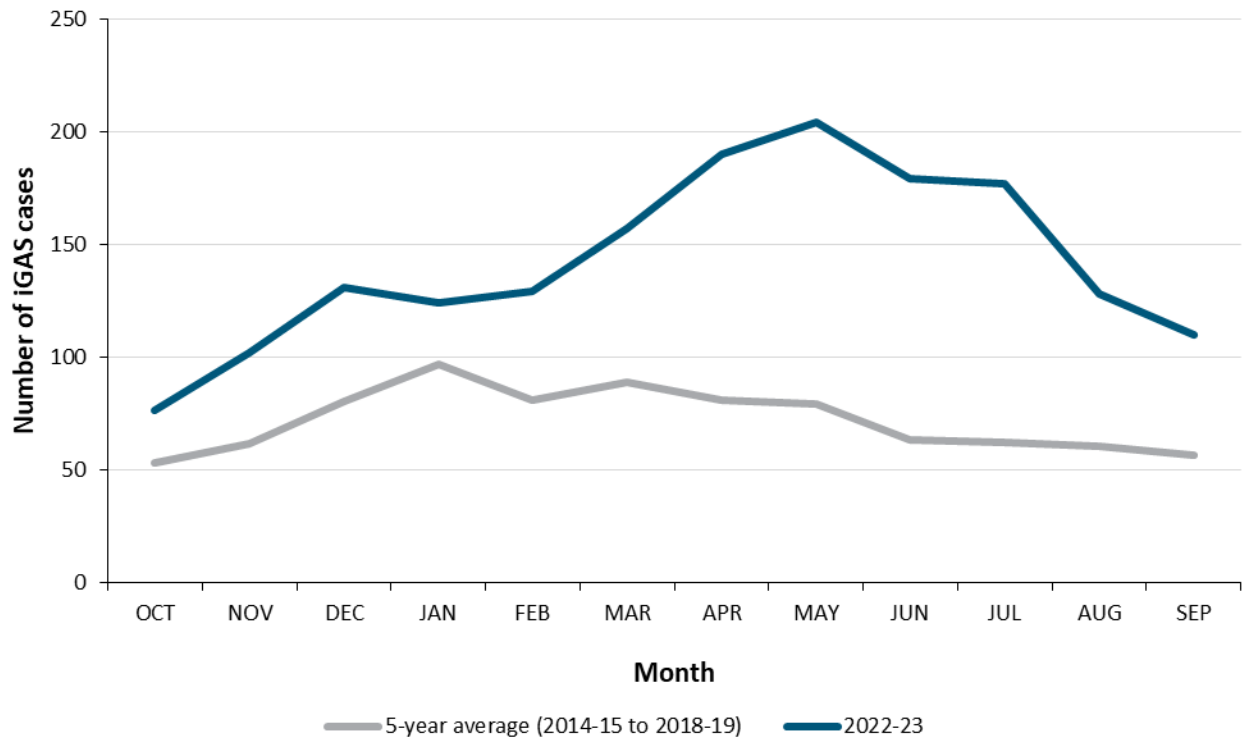


Data sources: Case data: Ontario. Ministry of Health;2024.⁴ Population data: Statistics Canada; 2022⁵, Population Reporting.⁶

The number of iGAS cases reported in each month of the 2022-23 season was higher than the corresponding monthly averages for the five pre-pandemic seasons. In Ontario, iGAS cases typically increase in October before peaking in the winter months and then decline through the spring and summer. Peak iGAS activity for the five pre-pandemic seasons occurred in January with a monthly average of 97 cases. However, in the 2022-23 season, this peak occurred much later into the season in May (n=204) before declining through the summer months (Figure 2).

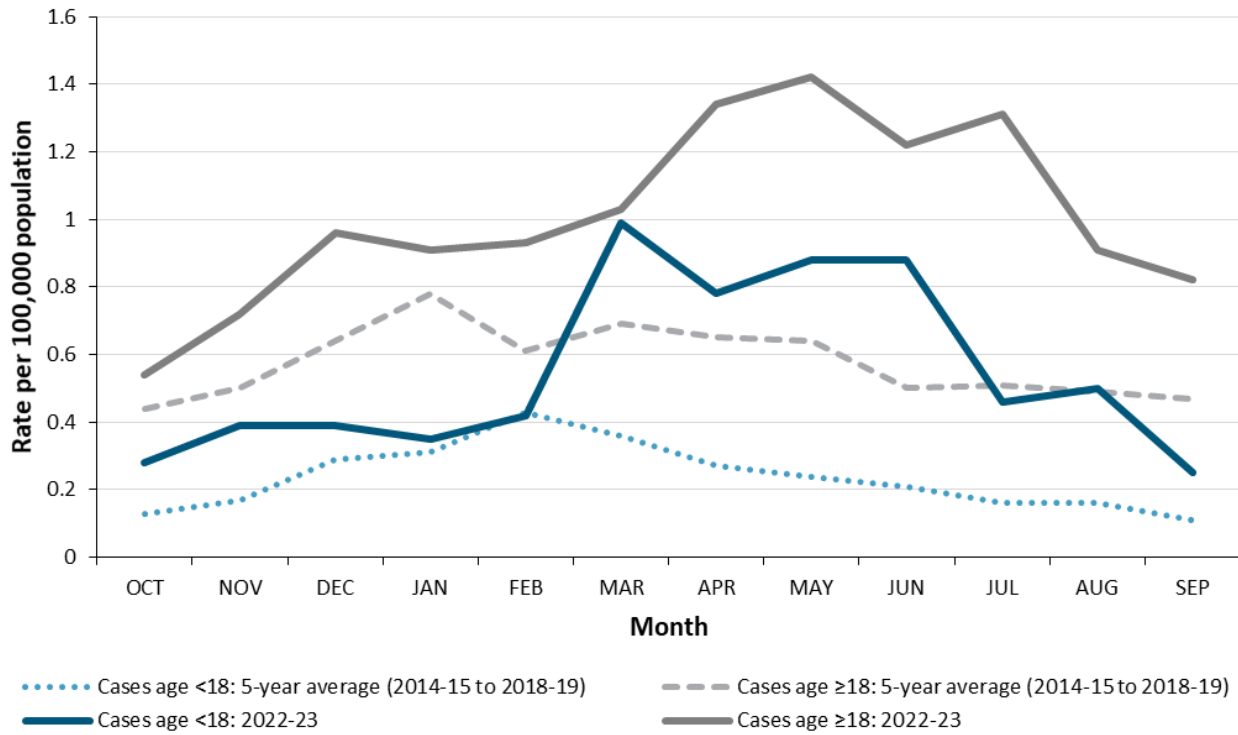
In the 2022-23 season, the rate (cases per 100,000 population) among adults peaked later in May (1.4; n=178) compared to January (0.79; n=88.4) for the five pre-pandemic seasons. The pediatric rate of cases peaked in March (1.0 case per 100,000 population; n=28) of the 2022-23 season and was elevated through to June before declining, but remained above expected compared to the five pre-pandemic seasons (Figure 3).

Figure 2. Confirmed iGAS case counts by month: 2022-23 season (October 1, 2022 – September 30, 2023) compared to five pre-pandemic seasons (October 1, 2014 – September 30, 2019)



Data source: Ontario. Ministry of Health; 2024.⁴

Figure 3. Rate (per 100,000 population) of confirmed iGAS cases by month and age group*: 2022-23 season (October 1, 2022 – September 30, 2023) compared to five pre-pandemic seasons (October 1, 2014 – September 30, 2019)



Data sources: Case data: Ontario. Ministry of Health; 2024.⁴ Population data: Population data: Statistics Canada; 2022⁵, Population Reporting.⁶

Note: *Excludes cases with unknown age

Age Group

During the 2022-23 iGAS season, cases age 65 years and over had the highest rate (cases per 100,000 population) followed by cases under one year of age and 1 to 4 years of age. The rates across all age groups were higher in the 2022-23 season compared to the age-specific average rates for the five pre-pandemic seasons, however, the largest percentage increases in rates occurred among cases age 5 to 9 years (180.6%) and 1 to 4 (165.1%) ([Table 1](#)).

Table 1. Confirmed iGAS cases and rate (per 100,000 population) by age group: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to the average for the five pre-pandemic seasons (October 1, 2014 – September 30, 2019)

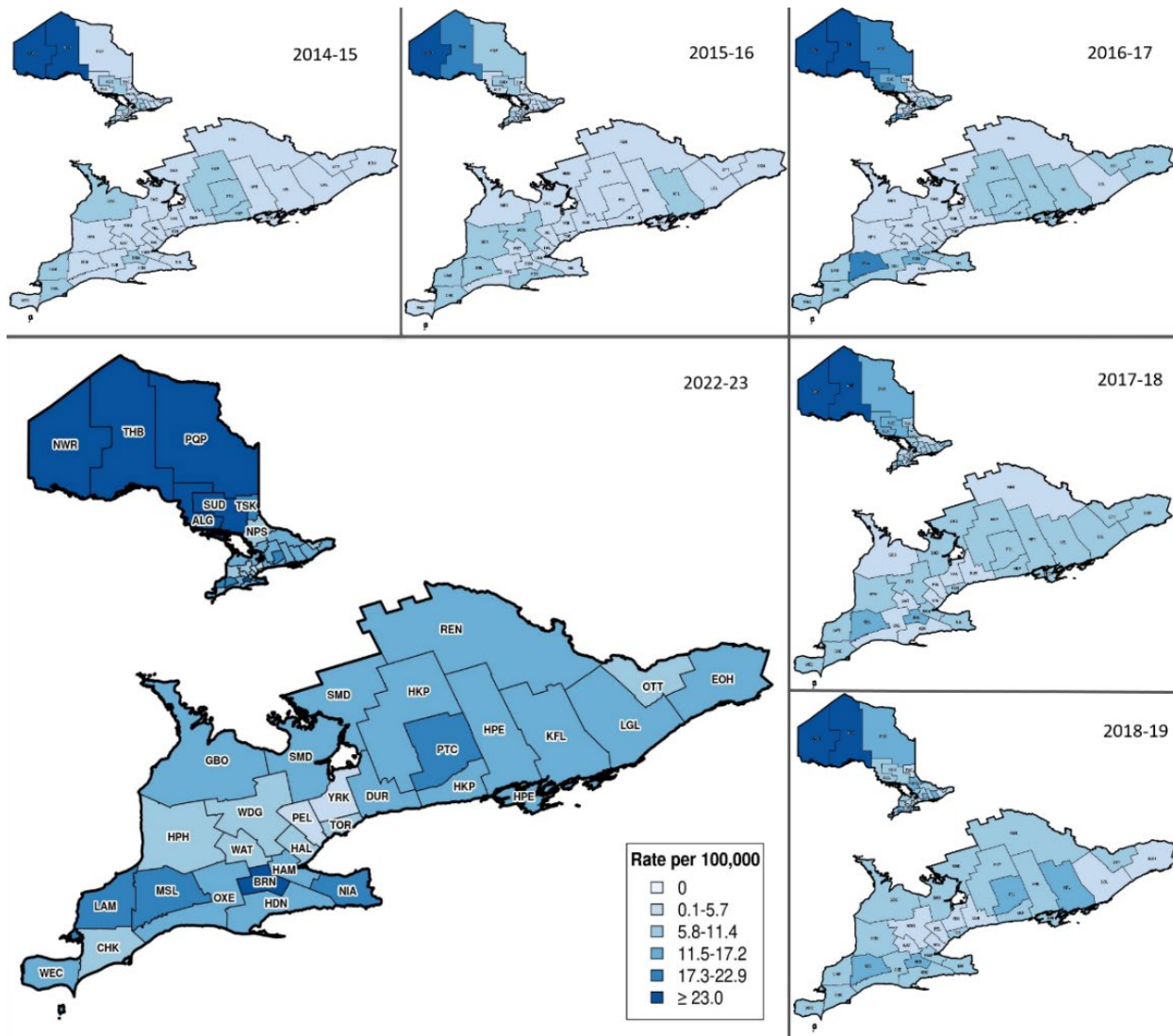
Age group (years)	2022-23 season: Total number of cases	2022-23 season: Rate per 100,000 population	Previous five seasons: Average number of cases	Previous five seasons: Average rate per 100,000 population	Percentage change in 2022-23 rate compared to previous five season average
< 1	20	13.4	12.8	9.1	47.3%
1 – 4	68	11.4	25.0	4.3	165.1%
5 – 9	67	8.7	23.6	3.1	180.6%
10 – 13	20	3.1	9.0	1.5	106.7%
14 – 17	11	1.6	7.6	1.2	33.3%
18 – 64	931	9.6	518.6	5.7	68.4%
≥ 65	588	20.5	267.0	11.4	79.8%
Unknown	2	N/A	0.4	N/A	N/A
Total	1,707	11.1	864	6.1	82.0%

Data sources: Case data: Ontario. Ministry of Health;2024.⁴ Population data: Population data: Statistics Canada; 2022⁵, Population Reporting.⁶

Geography

In the 2022-23 season, 73.5% (25/34) of public health units had rates above the Ontario rate of 11.1 cases per 100,000 population. The highest rates were consistently observed in northwestern Ontario. Northwestern Health Unit followed by Thunder Bay District Health Unit had the highest rates for the 2022-23 season and the five pre-pandemic seasons. Rates reported across public health units varied over time, however the majority of health units (31/34) had a higher rate in the 2022-23 season than in the 2018-19 season. The lowest rates in the 2022-23 season were reported by Peel Public Health followed by York Region Public Health ([Figure 4](#)).

Figure 4. Rate of confirmed cases of iGAS reported in the 2022-23 season and five pre-pandemic seasons (October 1, 2014 – September 30, 2019) by public health unit: Ontario



Code / Code Name / Nom					
ALG	Algoma Public Health	KFL	Kingston, Frontenac and Lennox & Addington Public Health	REN	Renfrew County and District Health Unit
BRN	Brant County Health Unit	LAM	Lambton Public Health	SMD	Simcoe Muskoka District Health Unit
CHK	Chatham-Kent Public Health Unit	LGL	Leeds, Grenville & Lanark District Health Unit	SUD	Public Health Sudbury & Districts
DUR	Durham Region Health Department	MSL	Middlesex-London Health Unit	THB	Thunder Bay District Health Unit
EOH	Easter Ontario Health Unit	NIA	Niagara Region Public Health	TOR	Toronto Public Health
GBO	Grey Bruce Health Unit	NPS	North Bay Parry Sound District Health Unit	TSK	Timiskaming Health Unit
HAL	Halton Region Public Health	OTT	Ottawa Public Health Unit	WAT	Region of Waterloo Public Health and Emergency Services
HAM	City of Hamilton Public Health Services	WDG	Wellington-Dufferin-Guelph Public Health	WEC	Windsor-Essex County Health Unit
HDN	Haldimand-Norfolk Health Unit	OXE	Southwestern Public Health	YRK	York Region Public Health
HKP	Haliburton, Kawartha, Pine Ridge District Health Unit	PEL	Peel Public Health		
HPE	Hastings Prince Edward Public Health	PQP	Porcupine Health Unit		
HPH	Huron Perth Public Health	PTC	Peterborough Public Health		

Data sources: Case data: Ontario. Ministry of Health;2024.⁴ Population data: Population data: Statistics Canada; 2022⁵, Population Reporting.⁶

Note: Public health unit iGAS counts and rates are available in [Appendix A: Table A1 and Table A2](#)

Risk Factors

In the 2022-23 season, 82.8% (154/186) of iGAS cases under 18 years and 91.7% (1,393/1,519) of iGAS cases 18 years and over reported at least one risk factor in iPHIS. The most commonly reported medical risk factors in both pediatric and adult iGAS cases for the 2022-23 season and during the five pre-pandemic seasons were having a ‘chronic illness or underlying medical condition’ followed by ‘dermatological conditions’. Among adults, the most commonly reported behavioural risk factor was experiencing ‘homelessness or inadequate housing’, which also increased from 11.5% in the five pre-pandemic seasons to 15.9% in the 2022-23 season. Among pediatric cases, the most commonly reported behavioural risk factor was close contact with a GAS or iGAS case, which increased from 6.2% in the five pre-pandemic seasons to 10.4% in the 2022-23 season ([Table 2](#)).

Table 2. Risk factors for confirmed iGAS cases by age group and season among cases reporting at least one risk factor: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to the five pre-pandemic seasons (October 1, 2014 – September 30, 2019)

Risk factor	2022-23 season: Number (%) of cases age < 18	Previous five seasons: Number (%) of cases age < 18	2022-23 season: Number (%) of cases age ≥ 18	Previous five seasons: Number (%) of cases age ≥ 18
Alcohol use disorder	1/154 (0.6%)	1/337 (0.3%)	166/1,393 (11.9%)	427/3,702 (11.5%)
Chronic illness/underlying medical condition	39/154 (25.3%)	67/337 (19.9%)	891/1,393 (64.0%)	2164/3,702 (58.5%)
Close contact with a case	16/154 (10.4%)	21/337 (6.2%)	31/1,393 (2.2%)	96/3,702 (2.6%)
Dermatological conditions	36/154 (23.4%)	69/337 (20.5%)	598/1,393 (42.9%)	1521/3,702 (41.1%)
Diabetes	0/154 (0.0%)	6/337 (1.8%)	331/1,393 (23.8%)	836/3,702 (22.6%)
HIV status	0/154 (0.0%)	0/337 (0.0%)	1/1,393 (0.1%)	8/3,702 (0.2%)
Persons experiencing homelessness/inadequate housing	1/154 (0.6%)	1/337 (0.3%)	221/1,393 (15.9%)	426/3,702 (11.5%)
Immunocompromised	9/154 (5.8%)	24/337 (7.1%)	207/1,393 (14.9%)	678/3,702 (18.3%)
Injection drug use	0/154 (0.0%)	5/337 (1.5%)	190/1,393 (13.6%)	662/3,702 (17.9%)

Risk factor	2022-23 season: Number (%) of cases age < 18	Previous five seasons: Number (%) of cases age < 18	2022-23 season: Number (%) of cases age ≥ 18	Previous five seasons: Number (%) of cases age ≥ 18
Prenatal	0/154 (0.0%)	1/337 (0.3%)	13/1,393 (0.9%)	7/3,702 (0.2%)
Postpartum	0/154 (0.0%)	1/337 (0.3%)	28/1,393 (2.0%)	35/3,702 (0.9%)
Recent strep infection	12/154 (7.8%)	26/337 (7.7%)	43/1,393 (3.1%)	123/3,702 (3.3%)
Recent varicella infection	0/154 (0.0%)	3/337 (0.9%)	4/1,393 (0.3%)	11/3,702 (0.3%)
Other	33/154 (21.4%)	58/337 (17.2%)	304/1,393 (21.8%)	870/3,702 (23.5%)
At least one risk factor reported*	154	337	1,393	3,702

Data source: Case data: Ontario. Ministry of Health; 2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Excludes cases that only reported a risk factor of 'Unknown'. Refer to the [technical notes](#) for a list of medical and behavioural risk factors. Percentages may sum to more than 100% because cases may have more than one risk factor reported in iPHIS.

Clinical Manifestations

The proportion of adult cases with 'streptococcal toxic shock syndrome' (STSS) was similar in 2022-23 (5.5%) compared to the five pre-pandemic seasons (5.4%), but in pediatric cases it was higher at 11.3% compared to 4.6%. It is possible that STSS is underreported. Among adults, the proportion with 'possible STSS manifestations' reported was similar in the 2022-23 season (36.5%) and five pre-pandemic seasons (33.4%). Among pediatric cases, there was an overall increase in many clinical manifestations compared to the five pre-pandemic seasons including 'possible STSS manifestations' reported (31.2% vs 23.3%) ([Table 3](#)). The increase in the proportion of cases with 'possible STSS manifestations' reported is reflective of increased clinical severity amongst cases in the 2022-23 season, further outlined in [Table 4](#).

Among adult cases, 'fever or chills', 'cellulitis', 'headache or dizziness or confusion' and 'skin rash' were the most common clinical manifestations in the 2022-23 season; all were reported at similar proportions in the five pre-pandemic seasons.

Among pediatric cases, the most common clinical manifestations were 'fever or chills', 'vomiting or nausea', 'skin rash', 'sore throat', 'pneumonia' and 'cough'. With the exception of 'fever or chills', these clinical manifestations were reported at a higher proportion in the 2022-23 season compared to the five pre-pandemic seasons.

Table 3. Clinical manifestations* for confirmed iGAS cases by age group and season: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to the five pre-pandemic seasons (October 1, 2014 – September 30, 2019)

Symptoms/Complications*	2022-23 season: Percentage (n) of cases age < 18	Previous five seasons: Percentage (n) of cases age < 18	2022-23 season: Percentage (n) of cases age ≥ 18	Previous five seasons: Percentage (n) of cases age ≥ 18
Streptococcal toxic shock syndrome (STSS)	21/186 (11.3%)	18/390 (4.6%)	84/1,519 (5.5%)	214/3,928 (5.4%)
Possible STSS manifestation**	58/186 (31.2%)	91/390 (23.3%)	555/1,519 (36.5%)	1,311/3,928 (33.4%)
Septicemia	9/186 (4.8%)	19/390 (4.9%)	110/1,519 (7.2%)	321/3,928 (8.2%)
Hypotension	37/186 (19.9%)	46/390 (11.8%)	329/1,519 (21.7%)	794/3,928 (20.2%)
Renal impairment	13/186 (7.0%)	11/390 (2.8%)	216/1,519 (14.2%)	479/3,928 (12.2%)
Liver function abnormality	16/186 (8.6%)	21/390 (5.4%)	183/1,519 (12.0%)	360/3,928 (9.2%)
Acute respiratory distress syndrome (ARDS)	36/186 (19.4%)	48/390 (12.3%)	157/1,519 (10.3%)	380/3,928 (9.7%)
Disseminated intravascular coagulation (DIC)	18/186 (9.7%)	21/390 (5.4%)	79/1,519 (5.2%)	231/3,928 (5.9%)
Rash desquamation	4/186 (2.2%)	2/390 (0.5%)	16/1,519 (1.1%)	24/3,928 (0.6%)
Soft tissue necrosis	10/186 (5.4%)	20/390 (5.1%)	203/1,519 (13.4%)	496/3,928 (12.6%)
Meningitis	2/186 (1.1%)	11/390 (2.8%)	10/1,519 (0.7%)	24/3,928 (0.6%)
Pneumonia	39/186 (21.0%)	50/390 (12.8%)	120/1,519 (7.9%)	375/3,928 (9.5%)
Bacteremia	27/186 (14.5%)	50/390 (12.8%)	241/1,519 (15.9%)	505/3,928 (12.9%)

Symptoms/Complications*	2022-23 season: Percentage (n) of cases age < 18	Previous five seasons: Percentage (n) of cases age < 18	2022-23 season: Percentage (n) of cases age ≥ 18	Previous five seasons: Percentage (n) of cases age ≥ 18
Shock	20/186 (10.8%)	30/390 (7.7%)	155/1,519 (10.2%)	324/3,928 (8.2%)
Skin rash	60/186 (32.3%)	95/390 (24.4%)	375/1,519 (24.7%)	950/3,928 (24.2%)
Skin/muscle, extreme pain to touch	21/186 (11.3%)	28/390 (7.2%)	205/1,519 (13.5%)	563/3,928 (14.3%)
Osteomyelitis	1/186 (0.5%)	8/390 (2.1%)	11/1,519 (0.7%)	33/3,928 (0.8%)
Sore throat	47/186 (25.3%)	74/390 (19.0%)	147/1,519 (9.7%)	370/3,928 (9.4%)
Fever or chills	153/186 (82.3%)	332/390 (85.1%)	925/1,519 (60.9%)	2,579/3,928 (65.7%)
Vomiting or nausea	69/186 (37.1%)	112/390 (28.7%)	286/1,519 (18.8%)	700/3,928 (17.8%)
Diarrhea	14/186 (7.5%)	19/390 (4.9%)	85/1,519 (5.6%)	212/3,928 (5.4%)
Cough	39/186 (21.0%)	60/390 (15.4%)	101/1,519 (6.6%)	330/3,928 (8.4%)
Myositis	2/186 (1.1%)	2/390 (0.5%)	13/1,519 (0.9%)	34/3,928 (0.9%)
Cellulitis	28/186 (15.1%)	62/390 (15.9%)	501/1,519 (33.0%)	1,266/3,928 (32.2%)
Headache or dizziness or confusion	23/186 (12.4%)	49/390 (12.6%)	405/1,519 (26.7%)	926/3,928 (23.6%)
Kidney inflammation	8/186 (4.3%)	6/390 (1.5%)	51/1,519 (3.4%)	117/3,928 (3.0%)
Lymphadenopathy	10/186 (5.4%)	23/390 (5.9%)	37/1,519 (2.4%)	93/3,928 (2.4%)
Conjunctivitis	5/186 (2.7%)	5/390 (1.3%)	11/1,519 (0.7%)	18/3,928 (0.5%)

Symptoms/Complications*	2022-23 season: Percentage (n) of cases age < 18	Previous five seasons: Percentage (n) of cases age < 18	2022-23 season: Percentage (n) of cases age ≥ 18	Previous five seasons: Percentage (n) of cases age ≥ 18
Other symptoms [†]	113/186 (60.8%)	217/390 (55.6%)	779/1,519 (51.3%)	2,105/3,928 (53.6%)
No symptoms reported	8/186 (4.3%)	18/390 (4.6%)	114/1,519 (7.5%)	256/3,928 (6.5%)
No complications reported	47/186 (25.3%)	88/390 (22.6%)	393/1,519 (25.9%)	1,067/3,928 (27.2%)
Neither symptoms nor complications reported	5/186 (2.7%)	12/390 (3.1%)	92/1,519 (6.1%)	198/3,928 (5.0%)

Data source: Case data: Ontario. Ministry of Health;2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Includes symptoms and complications reported for iGAS cases in iPHIS, some of which are not typical of iGAS. Cases may not have any or multiple symptoms and/or complications entered.

**Possible STSS manifestations were based on the [provincial confirmed iGAS case definition](#). Due to potential incomplete data, this category was developed to identify cases where at least one manifestation of STSS was reported. The 'possible STSS manifestation' category may include cases with the 'STSS' complication reported explicitly in iPHIS. Refer to the [technical notes](#) for further details on how clinical manifestations including possible STSS manifestations were determined for cases.

[†]Other symptoms include over 230 other symptom options available in iPHIS. Some of the most frequently reported symptoms categorized under this category for the 2022-23 season include: other [specify]; weak; shortness of breath; malaise [general unwell feeling]; swelling, localized; abdominal pain; fatigue; lethargy; anorexia [loss of appetite]

Severity

Among pediatric cases, 54.8% (102/186) in the 2022-23 season and 63.3% (50/79) in the pre-pandemic seasons had severity information reported. Among adult cases, 58.3% (885/1,519) in the 2022-23 season and 61.7% (736/1,192) in the pre-pandemic seasons had severity information reported.

In the 2022-23 season, approximately 48.7% of adult cases and 55.9% of pediatric cases with data on severity were categorized as non-severe. A greater proportion of cases were categorized as non-severe in the prior seasons. Relative to the pre-pandemic seasons, the proportion of severe cases in the 2022-23 season increased for both adult (38.9% to 51.3%) and pediatric (32.0% to 44.1%) cases ([Table 4](#)).

Overall, the proportion of all cases hospitalized was similar in the 2022-23 season compared to the five pre-pandemic seasons. However, a higher proportion of cases age 1 to 4 and 10 to 13 were hospitalized in the 2022-23 season compared to the five pre-pandemic seasons. Similarly, the proportion of fatal cases was higher in the 2022-23 season for cases age 1 to 4 years and 5 to 9 years. Overall, the percentage of cases with a fatal outcome increased in the 2022-23 season compared to recent pre-pandemic seasons (12.0% vs 10.4%) ([Table 5](#)).

Table 4. Clinical severity among confirmed iGAS cases by age group and season: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to cases reported pre-pandemic (July 1, 2018 – September 30, 2019)

Clinical Severity	2022-23 season: cases age < 18	Pre-pandemic: cases age < 18	2022-23 season: cases age ≥ 18	Pre-pandemic: cases age ≥ 18
Non-severe complications*	57/102(55.9%)	34/50 (68.0%)	431/885 (48.7%)	450/736 (61.1%)
Severe complications**	45/102 (44.1%)	16/50 (32.0%)	454/885 (51.3%)	286/736 (38.9%)
Severity information unavailable	84/186 (45.2%)	29/79 (36.7%)	634/1,519 (41.7%)	456/1,192 (38.3%)

Data source: Case data: Ontario. Ministry of Health;2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Data available as of June 2018. Counts for the non-severe and severe complications are likely to be lower for the pre-pandemic seasons as these fields were not available for the majority of this time period. Therefore, the pre-pandemic columns in table 4 are restricted to cases reported between July 1, 2018 and September 30, 2019 and should be interpreted with caution.

** Clinical severity was calculated using the severity field, complications indicating a severe infection and the outcome field. For more details refer to the [technical notes](#).

Table 5. Hospitalizations and fatal outcomes for confirmed iGAS cases by age group and season: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to the five pre-pandemic seasons (October 1, 2014 – September 30, 2019)

Age group (years)	2022-23 season: Number (%) of cases hospitalized	Previous five seasons: Number (%) of cases hospitalized	2022-23 season: Number (%) of cases with a fatal outcome	Previous five seasons: Number (%) of cases with a fatal outcome
< 1	16/20 (80.0%)	51/64 (79.7%)	1/20 (5.0%)	4/64 (6.3%)
1 – 4	60/68 (88.2%)	98/125 (78.4%)	6/68 (8.8%)	6/125 (4.8%)
5 - 9	56/67 (83.6%)	102/118 (86.4%)	4/67 (6.0%)	4/118 (3.4%)
10 - 13	17/20 (85.0%)	36/45 (80.0%)	1/20 (5.0%)	4/45 (8.9%)
14 - 17	9/11 (81.8%)	33/38 (86.8%)	0/11 (0.0%)	0/38 (0.0%)
18 - 64	714/931 (76.7%)	2,011/2,593 (77.6%)	88/931 (9.5%)	203/2,593 (7.8%)
≥65	475/588 (80.8%)	1,067/1,335 (79.9%)	105/588 (17.9%)	227/1,335 (17.0%)
Unknown	2/2 (100%)	0/2 (0.0%)	0/2 (0.0%)	2/2 (100%)
Total	1,349/1,707 (79.0%)	3,398/4,320 (78.7%)	205/1,707 (12.0%)	450/4,320 (10.4%)

Data source: Case data: Ontario. Ministry of Health; 2024.⁴

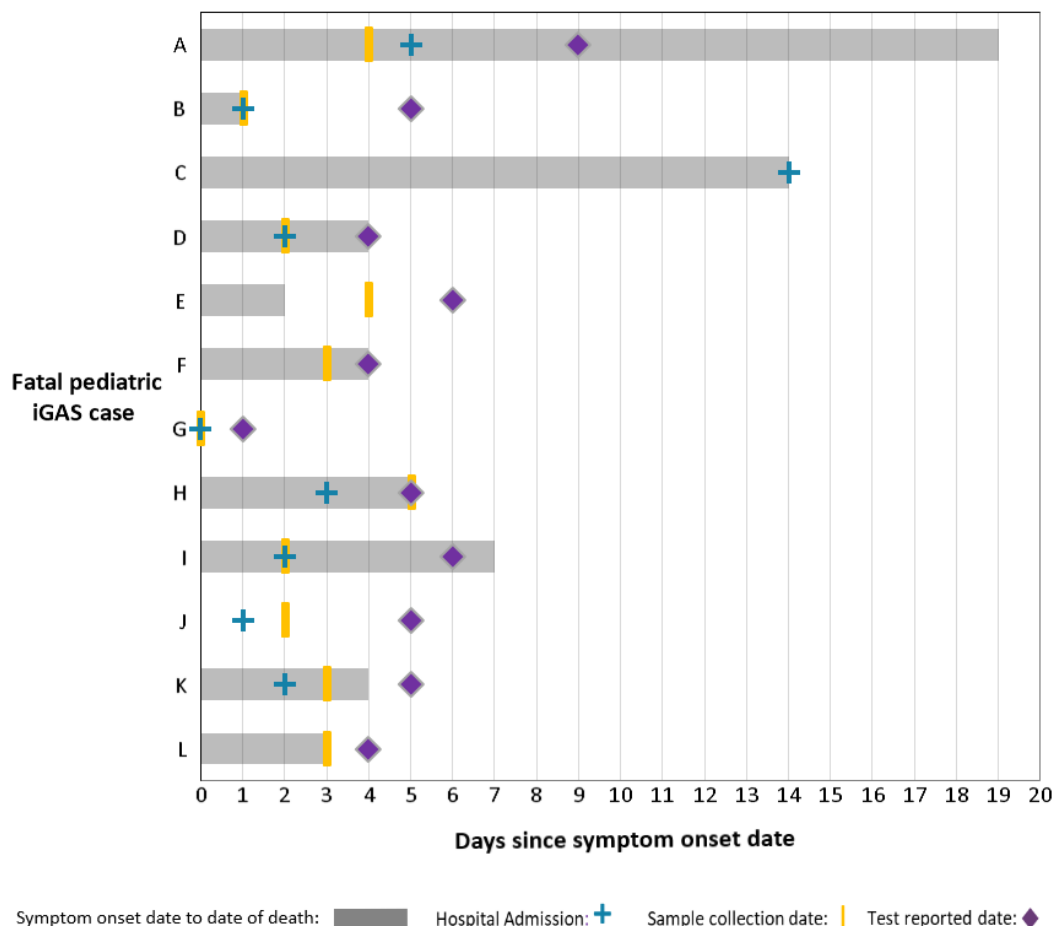
Pediatric Deaths – Analyses of Progression, Risk Factors and emm Types

Among the 186 pediatric cases reported in the 2022-23 season, 12 (6.5%) had a fatal outcome, 11 of which were under 10 years of age. Of the nine cases that were hospitalized prior to death, the median time between episode date (i.e., symptom onset) and hospitalization was two days (IQR 1-4 days). The median time between symptom onset and death was four days (IQR 2-7 days) (Figure 5). Lab confirmation (i.e., positive test reported date) of iGAS occurred on or after the date of death for most cases.

The most common clinical manifestations preceding or on the sample collection date for the twelve cases were vomiting (9/12), sore throat (5/12) and cough (4/12). Subsequent onset of sepsis (7/12), ARDS (6/12) and hypotension (6/12) were the most commonly reported clinical manifestations. ‘Chronic illness or underlying medical condition’ (5/12) and ‘recent strep infection’ (3/12) were the most commonly reported risk factors overall.

Five of the 12 cases were *emm1*, three were *emm12*, and four did not have *emm* type data available, which is proportionally similar to the distribution of *emm* types in pediatric cases overall.

Figure 5. Duration (days) between symptom onset date and hospital admission and death for pediatric cases with a fatal outcome (n=12): Ontario, October 1, 2022 – September 30, 2023



Data source: Case data: Ontario. Ministry of Health;2024.⁴ **Note:** Case C is missing lab information. Case G has the same episode date and date of death. Case J is missing a date of death.

Emm Types

In the 2022-23 season, 75.2% (1,283/1,707) of iGAS cases had *emm* type data reported in iPHIS. [Table 6](#) lists the top 12 *emm* types reported in the 2022-23 season, sorted by descending frequency. The most commonly reported *emm* types in the 2022-23 season were *emm1* (19.5%), followed closely by *emm12* (18.1%). Both of these *emm* types were also the most frequently reported among pediatric (*emm1*: 42.0%; *emm12*: 35.7%) and adult cases (*emm1*: 16.7%; *emm12*: 15.9%), although cases in adults were caused by a greater variety of *emm* types in general than in pediatric cases. The proportion of cases caused by *emm12* tripled in 2022-23 compared to the five pre-pandemic seasons. *Emm74* had the second highest proportion of cases in the five pre-pandemic seasons (following *emm1*), however has shifted to sixth place in the 2022-23 season.

Among adult cases, having a ‘chronic illness or underlying medical condition’ was the most commonly reported risk factor among cases with the top five *emm* types in the 2022-23 season (Appendix B; [Table B1](#)). ‘Dermatological conditions’ and ‘diabetes’ were also common risk factors. Experiencing ‘homelessness or inadequate housing’ was reported by over 20% of adult cases for each of the following subtypes: *emm49*, *emm82* and *emm80*. ‘Injection drug use’ was reported by almost 30% of adult *emm82* cases.

Among pediatric cases, ‘chronic illness or underlying medical condition’ and ‘dermatological conditions’ were the most commonly reported risk factors among cases that were *emm* typed (Appendix B; [Table B2](#)). ‘Recent strep infection’ was reported by 11.6% of *emm12* cases.

‘Fever or chills’ was one of the most commonly reported clinical manifestations among adult cases with the top five *emm* types reported in the 2022-23 season. Approximately half of all adult *emm1* cases had at least one ‘possible STSS manifestation’ reported. The proportion of adult cases reporting ‘STSS’ and ‘shock’ was higher among *emm1* cases than the other *emm* types in the top five (Appendix B; [Table B3](#)).

Among pediatric cases, over three-quarters of cases reported ‘fever or chills’ among the following subtypes: *emm1*, *emm12* and *emm49*. ‘Skin rash’ as well as ‘vomiting or nausea’ were also commonly reported among pediatric cases typed as *emm1* and *emm12*. Across *emm* types, the greatest proportion of ‘possible STSS manifestation’ was reported among *emm1* cases. Among *emm1* cases reporting at least one possible STSS manifestation, 35% reported ‘ARDS’ and 30% reported ‘hypotension’ (Appendix B; [Table B4](#)). Across *emm* types, ‘STSS’ and ‘pneumonia’ were both reported in a higher proportion of *emm1* cases.

Among the top five *emm* types, *emm1* accounted for the highest proportion of iGAS cases categorized as severe in the 2022-23 season. This trend remained unchanged for both adult and pediatric cases (Appendix B; [Table B5](#)).

Appendix B [Table B6](#) outlines the proportion of hospitalizations and fatal outcomes by cases of the top five *emm* types in the 2022-23 season. *Emm80* and *emm1* had the highest proportion of hospitalization among adults, while the highest proportion of fatal cases was reported for *emm49*, followed closely by *emm1*. Among pediatric cases, 95% of those that were *emm1* were hospitalized and 8.3% had a fatal outcome.

Table 6. Number (%*) of most commonly reported *emm* types among confirmed iGAS cases by age group **: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to the five pre-pandemic seasons (October 1, 2014 – September 30, 2019)

Most commonly reported <i>emm</i> type by rank	2022-23 season: All cases	Previous five seasons: All cases	2022-23 season: cases age ≥ 18	Previous five seasons: cases age ≥ 18	2022-23 season: cases age < 18	Previous five seasons: cases age < 18
<i>emm</i> 1	250 (19.5%)	480 (16.6%)	190 (16.7%)	395 (15.0%)	60 (42.0%)	85 (33.9%)
<i>emm</i> 12	232 (18.1%)	172 (5.9%)	181 (15.9%)	155 (5.9%)	51 (35.7%)	17 (6.8%)
<i>emm</i> 49	114 (8.9%)	82 (2.8%)	109 (9.6%)	77 (2.9%)	5 (3.5%)	5 (2.0%)
<i>emm</i> 82	102 (8.0%)	34 (1.2%)	102 (9.0%)	28 (1.1%)	0 (0.0%)	6 (2.4%)
<i>emm</i> 80	70 (5.5%)	19 (0.7%)	69 (6.1%)	19 (0.7%)	1 (0.7%)	0 (0.0%)
<i>emm</i> 74	53 (4.1%)	237 (8.2%)	53 (4.7%)	231 (8.7%)	0 (0.0%)	5 (2.0%)
<i>emm</i> 83	38 (3.0%)	35 (1.2%)	37 (3.2%)	35 (1.3%)	1 (0.7%)	0 (0.0%)
<i>emm</i> 41	37 (2.9%)	20 (0.7%)	36 (3.2%)	20 (0.8%)	1 (0.7%)	0 (0.0%)
<i>emm</i> 89	34 (2.7%)	164 (5.7%)	34 (3.0%)	157 (5.9%)	0 (0.0%)	7 (2.8%)
<i>emm</i> 92	33 (2.6%)	9 (0.3%)	33 (2.9%)	9 (0.3%)	0 (0.0%)	0 (0.0%)
<i>emm</i> 53	27 (2.1%)	142 (4.9%)	27 (2.4%)	142 (5.4%)	0 (0.0%)	0 (0.0%)
<i>emm</i> 77	27 (2.1%)	59 (2.0%)	26 (2.3%)	59 (2.2%)	1 (0.7%)	0 (0.0%)
Other	266 (20.7%)	1,441 (49.8%)	242 (21.2%)	1,315 (49.8%)	23 (16.1%)	126 (50.2%)
Total with <i>emm</i> type	1,283 (75.2%)	2,894 (67.0%)	1,139 (75.0%)	2,642 (67.3%)	143 (76.9%)	251 (64.4%)
Total without <i>emm</i> type	424 (24.8%)	1,426 (33.0%)	380 (25.0%)	1,286 (32.7%)	43 (23.1%)	139 (35.6%)
Total	1,707 (100%)	4,320 (100%)	1,519 (100%)	3,928 (100%)	186 (100%)	390 (100%)

Data source: Case data: Ontario. Ministry of Health;2024.⁴

Note: **Emm* type percentages are among cases with *emm* type information available.

**Cases with an unknown age are excluded from the age-related columns in this table.

Technical Notes

Data Sources

CASE DATA

- The data for this report were based on information entered in the Ontario Ministry of Health (MOH) integrated Public Health Information System (iPHIS) database as of **9 a.m., January 15, 2024**.⁴

ONTARIO POPULATION DATA

- Ontario population estimates were sourced from Statistics Canada. Population estimates 2001-2021: table 1 - annual population estimates by age and sex for July 1, 2001 to 2021, health regions, Ontario [unpublished data table]. Ottawa, ON: Government of Canada; 2022 [received 2022 Mar 25]⁵
- Ontario population projections were sourced from Population Reporting. Population projections public health unit, 2021-2046 [data file]. Toronto, ON: Ministry of Finance [producer]; Toronto, ON: Ontario. Ministry of Health, IntelliHealth Ontario [distributor]; [data extracted 2022 Jan 13]⁶

Data Caveats

- iPHIS is a dynamic disease reporting system that allows ongoing updates to previously entered data. As a result, data extracted from iPHIS represent a snapshot at the time of extraction and may differ from previous or subsequent reports.
- These data only represent laboratory-confirmed cases of iGAS reported to public health and recorded in iPHIS. As a result, all case counts are subject to varying degrees of underreporting due to a variety of factors, such as disease awareness and medical care seeking behaviours, which may depend on severity of illness, clinical practices, and changes in laboratory testing and reporting behaviours.
- Population estimates used to calculate rates for total cases, total hospital admissions and total deaths were calculated using the Ontario 2014, 2015, 2016, 2017, 2018, and 2019 population estimates⁵, sourced from Statistics Canada, and the Ontario 2023 population projections⁶, sourced from the Ontario Ministry of Finance.
- Only iGAS cases meeting the [confirmed case classification](#) as listed in the Ontario Ministry of Health (MOH) surveillance case definitions are included in the reported case counts.¹
 - Provincial surveillance case definitions available online under the Infectious Diseases Protocol are the most current.
 - Changes to provincial surveillance case definitions and disease classifications have occurred over the years and thus may impact the analysis of trends over time. Cases are classified in iPHIS based on the Ontario MOH surveillance case definitions in use at the time the case was identified.
 - PHO's technical report "Factors Affecting Reporting Diseases in Ontario: Case Definition Changes and Associated Trends 1991-2016" and its associated appendix provide more detailed information on this topic.²
- Cases are reported based on the Episode Date, which is an estimate of the onset date of disease for a case. In order to determine this date, the following hierarchy exists in iPHIS: Onset Date > Specimen Collection Date > Lab Test Date > Reported Date.

- For example: If an Onset Date exists, it will be used as the Episode Date. If Onset Date is not available, then the next available date in the hierarchy (i.e., Specimen Collection Date) will be used, and so on.
- Clinical manifestation data includes records where the clinical manifestation was reported as either a symptom or complication in iPHIS. Not all cases have a symptom and/or complication reported in iPHIS. Not all clinical manifestations listed may be typical symptoms of iGAS disease. “Other” symptoms include over 230 other symptom options available in iPHIS. For information on common iGAS clinical manifestations and symptoms preceding onset of iGAS disease please refer to the [provincial confirmed iGAS case definition](#).¹
- ‘Possible STSS manifestations’ were based on the [provincial confirmed iGAS case definition](#).¹ Cases may have one or more possible STSS manifestations recorded in iPHIS. While some cases reported as having STSS have one or more of these signs entered in iPHIS there are also some cases reported as having STSS that do not have any of the listed signs of STSS recorded specifically in iPHIS. Therefore, due to potential incomplete data, this category was developed to identify cases where at least one manifestation of STSS was reported. The ‘possible STSS manifestation’ category may include cases with the ‘STSS’ complication reported explicitly in iPHIS.
- Cases may have more than one risk factor reported in iPHIS. Data entry for risk factors may not be complete due to reporting and/or data entry lags.
- Cases that reported “Yes” to each of the included risk factors in iPHIS were included. The definitions for the included risk factors are detailed below.
- iPHIS - Medical risk factors:
 - Chronic Illness/Underlying medical condition: Any self-reported secondary chronic medical condition that puts the individual at greater risk of acquiring the disease or having a more severe outcome due to their infection. Many underlying medical conditions may also be considered co-morbidities. Cases may have this risk factor selected in addition to the risk factors for ‘diabetes’, ‘dermatological conditions’ and ‘immunocompromised’.
 - Dermatological conditions: Include dermatological condition / chronic dermatitis / wound causing break in skin integrity. Self-reported dermatological conditions involving inflammation of the skin. Cases may have this risk factor selected in addition to the risk factor for ‘chronic illness/underlying medical condition’.
 - Diabetes: An individual who self-reports they have been diagnosed with diabetes. Cases may have this risk factor selected in addition to the risk factor for ‘chronic illness/underlying medical condition’.
 - HIV status: Users select values corresponding to case’s HIV status: Negative, Positive, Test Not Offered, Test Refused, and Unknown. This report only includes cases where HIV Status is reported as Positive.
 - Immunocompromised: Person is less capable of battling infections because of an immune response that is not properly functioning. This can be brought about by illness/disease or medication/treatment. Cases may have this risk factor selected in addition to the risk factor for ‘chronic illness/underlying medical condition’.
 - Prenatal: Covers any period in time during pregnancy up to and including the day/date of delivery, with reference to the mother.

- Postpartum: Covers any period in time after the date of delivery up to 30 days after the date of delivery, with reference to the mother. For example, if date of delivery is 01 January 2018 the postpartum period will start on 02 January 2018.
- Recent non-invasive strep infection: The individual has been infected with a non-invasive form of strep within the past 30 days.
- Recent varicella infection (<1 month): The individual has been infected with the varicella virus less than one month before their invasive group A streptococcal infection.
- iPHIS - Behavioural risk factors:
 - Alcohol abuse (presented as Alcohol Use Disorder): A pattern of drinking or dependency on alcohol that results in harm to one's health, interpersonal relationships or ability to work.
 - Close contact with a case: An individual who has been in close contact for a period of time with a confirmed case of a communicable disease. This may include contact with a person with a group A streptococcal infection that was not invasive.
 - Experiencing homelessness/Inadequate housing: Lacks a fixed regular and adequate night-time residence and has a night-time residence that is: A supervised publicly or privately operated shelter designed to provide temporary living accommodations; An institution that provides a temporary residence for individuals intended to be institutionalized; A public or private place not designed for, or ordinarily used as, a regular sleeping accommodation for human beings
 - Injection Drug Use: Recreational/illicit drug use or steroids administered using a needle or syringe pierced through the skin into the body.
 - Other: A risk factor of interest that is not currently specified on the Risks screen in iPHIS for the case/episode/encounter under investigation.
 - Unknown: No known factor which could have caused the infection or the reportable disease/event could be identified by the client or the health unit was unable to collect any risk factor information from the client. Excluded from analyses of cases with at least one risk factor.
- Severity was determined using data reported in iPHIS for the outcome (fatal), symptom and complications fields. A case is categorized as severe if Complication: Severe = Yes or Complication: STSS= Yes or Complication: Necrotizing Fasciitis= Yes or Symptom: Soft tissue necrosis/necrotizing fasciitis/necrotizing myositis/gangrene = Yes or Complication/Symptom: Meningitis=Yes or Outcome= FATAL and Cause of death is not 'unrelated'.
- Hospitalized iGAS cases were determined based on a reported intervention type description of "Hospitalization" or "ICU" and a reported intervention start date on or after the case's episode date.
- Fatal iGAS cases were determined based on a case outcome description of "Fatal" and the type of death not being reported as "Reportable disease was unrelated to cause of death."
- Case counts by geography are based on the diagnosing health unit (DHU). DHU refers to the case's public health unit of residence at the time of illness onset or report to public health.
- Cases for which the Diagnosing Health Unit (DHU) was reported as MOHLTC (to signify a case that is not a resident of Ontario) or MUSKOKA-PARRY SOUND (a public health unit that no longer exists) were excluded from this analysis.

References

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6. Population Reporting. Population projections public health unit, 2021-2046 [data file]. Toronto, ON: Ministry of Finance [producer]; Toronto, ON: Ontario. Ministry of Health, IntelliHealth Ontario [distributor]; n.d. [data extracted 2022 Jan 13]

Appendix A

Table A1. Number of confirmed iGAS cases by public health unit and season: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to the five pre-pandemic seasons (October 1, 2014 – September 30, 2019)

Diagnosing health unit	2014-15 season	2015-16 season	2016-17 season	2017-18 season	2018-19 season	2022-23 season
Algoma Public Health	6	3	21	18	8	32
Brant County Health Unit	11	3	17	25	24	39
Chatham-Kent Public Health	7	7	12	8	8	12
City of Hamilton Public Health Services	28	24	34	49	50	89
Durham Region Health Department	13	33	23	32	36	85
Eastern Ontario Health Unit	5	4	13	24	10	33
Grey Bruce Health Unit	11	4	8	8	14	28
Haldimand-Norfolk Health Unit	3	8	5	6	10	20
Haliburton, Kawartha, Pine Ridge District Health Unit	11	8	14	14	20	32
Halton Region Public Health	24	17	15	25	19	44
Hastings Prince Edward Public Health	8	5	10	18	14	30
Huron Perth Public Health	3	10	8	14	13	15
Kingston, Frontenac and Lennox & Addington Public Health	10	19	14	14	31	29
Lambton Public Health	10	9	9	13	9	25
Leeds, Grenville & Lanark District Health Unit	6	6	4	12	9	29
Middlesex-London Health Unit	18	38	95	68	67	98
Niagara Region Public Health	20	25	41	51	50	91

Diagnosing health unit	2014-15 season	2015-16 season	2016-17 season	2017-18 season	2018-19 season	2022-23 season
North Bay Parry Sound District Health Unit	7	6	7	13	19	12
Northwestern Health Unit	31	38	52	57	48	45
Ottawa Public Health	41	34	67	67	68	107
Peel Public Health	44	31	39	55	52	79
Peterborough Public Health	9	2	9	16	21	35
Porcupine Health Unit	2	7	16	11	12	20
Public Health Sudbury & Districts	14	15	25	28	21	53
Region of Waterloo Public Health and Emergency Services	22	22	27	30	34	57
Renfrew County and District Health Unit	3	3	4	3	9	15
Simcoe Muskoka District Health Unit	27	26	31	63	51	90
Southwestern Public Health	9	5	17	11	18	27
Thunder Bay District Health Unit	44	30	62	76	42	45
Timiskaming Health Unit	1	1	1	3	1	6
Toronto Public Health	98	115	138	188	183	246
Wellington-Dufferin-Guelph Public Health	16	18	15	20	10	19
Windsor-Essex County Health Unit	10	16	28	27	37	53
York Region Public Health	37	29	31	47	46	67
Ontario	609	621	912	1,114	1,064	1,707

Data source: Case data: Ontario. Ministry of Health; 2024.⁴ Population data: Population data: Statistics Canada; 2022⁵, Population Reporting.⁶

Table A2. Rate of confirmed iGAS cases by public health unit and season: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023) compared to the five pre-pandemic seasons (October 1, 2014 – September 30, 2019)

Diagnosing health unit	2014-15 season	2015-16 season	2016-17 season	2017-18 season	2018-19 season	2022-23 season
Algoma Public Health	5.1	2.6	18.1	15.5	6.8	26.9
Brant County Health Unit	7.6	2.1	11.5	16.8	15.8	24.5
Chatham-Kent Public Health	6.7	6.7	11.4	7.6	7.5	11.2
City of Hamilton Public Health Services	5.1	4.3	6.1	8.7	8.7	14.8
Durham Region Health Department	2.0	5.0	3.4	4.7	5.2	11.5
Eastern Ontario Health Unit	2.4	1.9	6.2	11.4	4.7	14.9
Grey Bruce Health Unit	6.7	2.4	4.7	4.7	8.1	15.3
Haldimand-Norfolk Health Unit	2.7	7.1	4.4	5.1	8.4	15.9
Haliburton, Kawartha, Pine Ridge District Health Unit	6.1	4.4	7.5	7.4	10.6	16.2
Halton Region Public Health	4.3	3.0	2.6	4.3	3.2	6.8
Hastings Prince Edward Public Health	4.9	3.0	6.0	10.6	8.2	16.8
Huron Perth Public Health	2.2	7.2	5.7	9.8	9.0	9.9
Kingston, Frontenac and Lennox & Addington Public Health	5.1	9.6	6.9	6.8	14.9	13.4
Lambton Public Health	7.7	7.0	6.9	9.9	6.8	18.5
Leeds, Grenville & Lanark District Health Unit	3.5	3.5	2.3	6.8	5.1	15.6
Middlesex-London Health Unit	3.9	8.1	19.7	13.8	13.3	18.2
Niagara Region Public Health	4.4	5.4	8.8	10.8	10.5	18.2

Diagnosing health unit	2014-15 season	2015-16 season	2016-17 season	2017-18 season	2018-19 season	2022-23 season
North Bay Parry Sound District Health Unit	5.5	4.7	5.5	10.1	14.7	9.1
Northwestern Health Unit	38.4	47.0	64.1	70.1	59.0	55.1
Ottawa Public Health	4.3	3.5	6.8	6.7	6.6	9.7
Peel Public Health	3.1	2.2	2.7	3.7	3.4	4.8
Peterborough Public Health	6.4	1.4	6.3	10.9	14.3	22.8
Porcupine Health Unit	2.3	8.1	18.7	12.9	14.1	23.7
Public Health Sudbury & Districts	7.0	7.4	12.4	13.7	10.3	25.4
Region of Waterloo Public Health and Emergency Services	4.1	4.0	4.8	5.2	5.7	8.8
Renfrew County and District Health Unit	2.8	2.8	3.7	2.8	8.3	13.6
Simcoe Muskoka District Health Unit	4.9	4.7	5.4	10.8	8.6	14.1
Southwestern Public Health	4.4	2.4	8.2	5.2	8.4	11.8
Thunder Bay District Health Unit	28.3	19.2	39.6	48.4	26.6	28.2
Timiskaming Health Unit	2.9	3.0	3.0	8.9	2.9	17.7
Toronto Public Health	3.5	4.1	4.8	6.4	6.2	7.9
Wellington-Dufferin-Guelph Public Health	5.6	6.1	5.0	6.6	3.2	5.8
Windsor-Essex County Health Unit	2.5	3.9	6.7	6.4	8.7	11.9
York Region Public Health	3.3	2.5	2.7	4.0	3.9	5.4
Ontario	4.4	4.5	6.5	7.8	7.3	11.1

Data source: Case data: Ontario. Ministry of Health; 2024⁴ Population data: Population data: Statistics Canada; 2022⁵, Population Reporting.⁶

Appendix B

Top Five *Emm* Types (2022-23 Season)

RISK FACTORS BY EMM TYPE

Table B1. Risk factors for confirmed iGAS cases age 18 and over by top five *emm* types* among cases reporting at least one risk factor: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023)

Risk factor	<i>emm</i> 1: n (%)	<i>emm</i> 12: n (%)	<i>emm</i> 49: n (%)	<i>emm</i> 82: n (%)	<i>emm</i> 80: n (%)
Alcohol use disorder	16/180 (8.9%)	14/167 (8.4%)	19/102 (18.6%)	10/96 (10.4%)	11/66 (16.7%)
Chronic illness/underlying medical condition	122/180 (67.8%)	113/167 (67.7%)	61/102 (59.8%)	56/96 (58.3%)	51/66 (77.3%)
Close contact with a case	8/180 (4.4%)	6/167 (3.6%)	1/102 (1.0%)	0/96 (0.0%)	0/66 (0.0%)
Dermatological conditions	63/180 (35.0%)	66/167 (39.5%)	46/102 (45.1%)	53/96 (55.2%)	34/66 (51.5%)
Diabetes	34/180 (18.9%)	51/167 (30.5%)	18/102 (17.6%)	22/96 (22.9%)	16/66 (24.2%)
HIV status	0/180 (0.0%)	0/167 (0.0%)	0/102 (0.0%)	0/96 (0.0%)	0/66 (0.0%)
Persons experiencing homelessness/inadequate housing	2/180 (1.1%)	3/167 (1.8%)	26/102 (25.5%)	27/96 (28.1%)	15/66 (22.7%)
Immunocompromised	32/180 (17.8%)	26/167 (15.6%)	12/102 (11.8%)	11/96 (11.5%)	9/66 (13.6%)
Injection drug use	2/180 (1.1%)	6/167 (3.6%)	12/102 (11.8%)	28/96 (29.2%)	10/66 (15.2%)
Prenatal	1/180 (0.6%)	1/167 (0.6%)	1/102 (1.0%)	1/96 (1.0%)	0/66 (0.0%)
Postpartum	3/180 (1.7%)	4/167 (2.4%)	2/102 (2.0%)	2/96 (2.1%)	1/66 (1.5%)
Recent strep infection	10/180 (5.6%)	3/167 (1.8%)	2/102 (2.0%)	3/96 (3.1%)	2/66 (3.0%)

Risk factor	<i>emm</i> 1: n (%)	<i>emm</i> 12: n (%)	<i>emm</i> 49: n (%)	<i>emm</i> 82: n (%)	<i>emm</i> 80: n (%)
Recent varicella infection	1/180 (0.6%)	2/167 (1.2%)	1/102 (1.0%)	0/96 (0.0%)	0/66 (0.0%)
Other	27/180 (15.0%)	25/167 (15.0%)	25/102 (24.5%)	16/96 (16.7%)	17/66 (25.8%)
At least one risk factor reported**	180	167	102	96	66

Data source: Case data: Ontario. Ministry of Health; 2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Top five *emm* types reported among all cases in the 2022-23 season.

**Excludes cases that reported a risk factor of 'Unknown'. Refer to the [technical notes](#) for a list of medical and behavioural risk factors.

Table B2. Risk factors for confirmed iGAS cases age under 18 by top five *emm* types* among cases reporting at least one risk factor: Ontario, 2022-23 season (October 1, 2022 – September 30, 2023)

Risk factor	<i>emm</i> 1: n (%)	<i>emm</i> 12: n (%)	<i>emm</i> 49: n (%)	<i>emm</i> 82: n (%)	<i>emm</i> 80: n (%)
Chronic Illness/underlying medical condition	14/52 (26.9%)	13/43 (30.2%)	0/2 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Close contact with a case	2/52 (3.8%)	3/43 (7.0%)	2/2 (100%)	0/0 (0.0%)	0/1 (0.0%)
Dermatological conditions	8/52 (15.4%)	11/43 (25.6%)	0/2 (0.0%)	0/0 (0.0%)	1/1 (100.0%)
Experiencing homelessness/inadequate housing	1/52 (1.9%)	0/43 (0.0%)	0/2 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Immunocompromised	3/52 (5.8%)	3/43 (7.0%)	0/2 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Recent strep infection	2/52 (3.8%)	5/43 (11.6%)	0/2 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Recent varicella infection	0/52 (0.0%)	0/43 (0.0%)	0/2 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Other	11/52 (21.2%)	5/43 (11.6%)	0/2 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
At least one risk factor reported**	52	43	2	0	1

Data source: Case data: Ontario. Ministry of Health; 2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Top five *emm* types reported among all cases in the 2022-23 season.

**Excludes cases that reported a risk factor of 'Unknown'. Refer to the [technical notes](#) for a list of medical and behavioural risk factors. Listed risk factors include those most relevant for pediatric cases.

CLINICAL MANIFESTATIONS BY EMM TYPE

Table B3. Clinical manifestations (%) for confirmed iGAS cases age 18 and over by top five *emm* types* : Ontario, 2022-23 season (October 1, 2022 – September 30, 2023)

Symptoms/Complications **	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
STSS	26/190 (13.7%)	16/181 (8.8%)	5/109 (4.6%)	4/102 (3.9%)	1/69 (1.4%)
Possible STSS manifestation†	98/190 (51.6%)	78/181 (43.1%)	41/109 (37.6%)	37/102 (36.3%)	24/69 (34.8%)
Septicemia	21/190 (11.1%)	24/181 (13.3%)	8/109 (7.3%)	8/102 (7.8%)	6/69 (8.7%)
Hypotension	64/190 (33.7%)	47/181 (26.0%)	28/109 (25.7%)	22/102 (21.6%)	11/69 (15.9%)
Renal impairment	39/190 (20.5%)	27/181 (14.9%)	17/109 (15.6%)	19/102 (18.6%)	11/69 (15.9%)
Liver function abnormality	39/190 (20.5%)	16/181 (8.8%)	12/109 (11.0%)	17/102 (16.7%)	6/69 (8.7%)
Acute respiratory distress syndrome (ARDS)	33/190 (17.4%)	27/181 (14.9%)	10/109 (9.2%)	11/102 (10.8%)	6/69 (8.7%)
Disseminated intravascular coagulation (DIC)	20/190 (10.5%)	15/181 (8.3%)	9/109 (8.3%)	3/102 (2.9%)	2/69 (2.9%)
Rash desquamation	2/190 (1.1%)	1/181 (0.6%)	0/109 (0.0%)	1/102 (1.0%)	2/69 (2.9%)
Soft tissue necrosis	32/190 (16.8%)	25/181 (13.8%)	7/109 (6.4%)	18/102 (17.6%)	16/69 (23.2%)
Meningitis	6/190 (3.2%)	1/181 (0.6%)	0/109 (0.0%)	0/102 (0.0%)	0/69 (0.0%)
Pneumonia	14/190 (7.4%)	17/181 (9.4%)	10/109 (9.2%)	5/102 (4.9%)	8/69 (11.6%)

Symptoms/Complications**	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
Bacteremia	35/190 (18.4%)	36/181 (19.9%)	27/109 (24.8%)	16/102 (15.7%)	11/69 (15.9%)
Shock	40/190 (21.1%)	15/181 (8.3%)	9/109 (8.3%)	14/102 (13.7%)	3/69 (4.3%)
Skin rash or redness	54/190 (28.4%)	48/181 (26.5%)	25/109 (22.9%)	32/102 (31.4%)	19/69 (27.5%)
Skin/muscle, extreme pain to touch	25/190 (13.2%)	25/181 (13.8%)	22/109 (20.2%)	18/102 (17.6%)	11/69 (15.9%)
Osteomyelitis	1/190 (0.5%)	1/181 (0.6%)	0/109 (0.0%)	0/102 (0.0%)	1/69 (1.4%)
Sore throat	36/190 (18.9%)	25/181 (13.8%)	12/109 (11.0%)	3/102 (2.9%)	6/69 (8.7%)
Fever or Chills	136/190 (71.6%)	122/181 (67.4%)	74/109 (67.9%)	51/102 (50.0%)	33/69 (47.8%)
Vomiting or nausea	57/190 (30.0%)	42/181 (23.2%)	26/109 (23.9%)	10/102 (9.8%)	8/69 (11.6%)
Diarrhea	23/190 (12.1%)	10/181 (5.5%)	11/109 (10.1%)	4/102 (3.9%)	1/69 (1.4%)
Cough	14/190 (7.4%)	12/181 (6.6%)	11/109 (10.1%)	5/102 (4.9%)	2/69 (2.9%)
Myositis	1/190 (0.5%)	2/181 (1.1%)	0/109 (0.0%)	2/102 (2.0%)	2/69 (2.9%)
Cellulitis	52/190 (27.4%)	57/181 (31.5%)	35/109 (32.1%)	44/102 (43.1%)	30/69 (43.5%)
Headache or dizziness or confusion	59/190 (31.1%)	42/181 (23.2%)	36/109 (33.0%)	30/102 (29.4%)	23/69 (33.3%)
Kidney inflammation	8/190 (4.2%)	8/181 (4.4%)	5/109 (4.6%)	1/102 (1.0%)	5/69 (7.2%)
Lymphadenopathy	9/190 (4.7%)	3/181 (1.7%)	4/109 (3.7%)	0/102 (0.0%)	3/69 (4.3%)
Conjunctivitis	2/190 (1.1%)	3/181 (1.7%)	1/109 (0.9%)	0/102 (0.0%)	1/69 (1.4%)

Symptoms/Complications**	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
Other symptom‡	101/190 (53.2%)	89/181 (49.2%)	55/109 (50.5%)	55/102 (53.9%)	39/69 (56.5%)
No symptoms reported	5/190 (2.6%)	11/181 (6.1%)	9/109 (8.3%)	6/102 (5.9%)	2/69 (2.9%)
No complications reported	29/190 (15.3%)	43/181 (23.8%)	23/109 (21.1%)	21/102 (20.6%)	21/69 (30.4%)
Neither symptoms nor complications reported	3/190 (1.6%)	8/181 (4.4%)	9/109 (8.3%)	6/102 (5.9%)	2/69 (2.9%)

Data source: Case data: Ontario. Ministry of Health; 2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Top five *emm* types reported among all cases in the 2022-23 season.

** Includes symptoms and complications reported for iGAS cases in iPHIS, some of which are not typical of iGAS. Cases may not have any or multiple symptoms and/or complications entered. Refer to the [technical notes](#) for further details on how clinical manifestations including possible STSS manifestations were determined for cases.

†Possible STSS manifestations were based on the [provincial confirmed iGAS case definition](#). Due to potential incomplete data, this category was developed to identify cases where at least one manifestation of STSS was reported. The 'possible STSS manifestation' category may include cases with the 'STSS' complication reported explicitly in iPHIS. Refer to the [technical notes](#) for further details on how clinical manifestations including possible STSS manifestations were determined for cases.

‡Other symptoms include over 230 other symptom options available in iPHIS. Some of the most frequently reported symptoms categorized under this category for the 2022-23 season include: other [specify]; weak; shortness of breath; malaise [general unwell feeling]; swelling, localized; abdominal pain; fatigue; lethargy; anorexia [loss of appetite].

Table B4. Clinical manifestations (%) for confirmed iGAS cases age under 18 by top five *emm* types* : Ontario, 2022-23 season (October 1, 2022 – September 30, 2023)

Symptoms/Complications**	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
Possible STSS manifestation†	28/60 (46.7%)	13/51 (25.5%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Septicemia	6/60 (10.0%)	2/51 (3.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Hypotension	18/60 (30.0%)	5/51 (9.8%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Renal impairment	5/60 (8.3%)	2/51 (3.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Liver function abnormality	10/60 (16.7%)	1/51 (2.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)

Symptoms/Complications**	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
Acute respiratory distress syndrome (ARDS)	21/60 (35%)	6/51 (11.8%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Disseminated intravascular coagulation (DIC)	9/60 (15%)	3/51 (5.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Rash desquamation	2/60 (3.3%)	0/51 (0.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
STSS	11/60 (18.3%)	2/51 (3.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Soft tissue necrosis	5/60 (8.3%)	2/51 (3.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Meningitis	2/60 (3.3%)	0/51 (0.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Pneumonia	19/60 (31.7%)	9/51 (17.6%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Bacteremia	11/60 (18.3%)	9/51 (17.6%)	2/5 (40.0%)	0/0 (0.0%)	0/1 (0.0%)
Shock	10/60 (16.7%)	2/51 (3.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Skin rash or redness	25/60 (41.7%)	16/51 (31.4%)	3/5 (60.0%)	0/0 (0.0%)	0/1 (0.0%)
Skin/muscle, extreme pain to touch	10/60 (16.7%)	6/51 (11.8%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Osteomyelitis	0/60 (0%)	0/51 (0.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Sore throat	14/60 (23.3%)	12/51 (23.5%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Fever or chills	46/60 (76.7%)	43/51 (84.3%)	4/5 (80.0%)	0/0 (0.0%)	1/1 (100.0%)
Vomiting or nausea	24/60 (40.0%)	20/51 (39.2%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Diarrhea	3/60 (5.0%)	3/51 (5.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)

Symptoms/Complications**	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
Cough	17/60 (28.3%)	11/51 (21.6%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Myositis	1/60 (1.7%)	1/51 (2.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Cellulitis	11/60 (18.3%)	7/51 (13.7%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Headache or dizziness or confusion	9/60 (15.0%)	3/51 (5.9%)	1/5 (20.0%)	0/0 (0.0%)	0/1 (0.0%)
Kidney inflammation	4/60 (6.7%)	0/51 (0.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Lymphadenopathy	4/60 (6.7%)	2/51 (3.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Conjunctivitis	3/60 (5.0%)	0/51 (0.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Other symptom‡	41/60 (68.3%)	28/51 (54.9%)	4/5 (80.0%)	0/0 (0.0%)	1/1 (100.0%)
No symptoms reported	3/60 (5.0%)	2/51 (3.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
No complications reported	14/60 (23.3%)	10/51 (19.6%)	1/5 (20.0%)	0/0 (0.0%)	1/1 (100.0%)
Neither symptom nor complication reported	2/60 (3.3%)	1/51 (2.0%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)

Data source: Case data: Ontario. Ministry of Health;2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Top five *emm* types reported among all cases in the 2022-23 season.

**Includes symptoms and complications reported for iGAS cases in iPHIS, some of which are not typical of iGAS. Cases may not have any or multiple symptoms and/or complications entered.

†Possible STSS manifestations were based on the [provincial confirmed iGAS case definition](#). Due to potential incomplete data, this category was developed to identify cases where at least one manifestation of STSS was reported. The 'possible STSS manifestation' category may include cases with the 'STSS' complication reported explicitly in iPHIS. Refer to the [technical notes](#) for further details on how clinical manifestations including possible STSS manifestations were determined for cases.

‡Other symptoms include over 230 other symptom options available in iPHIS. Some of the most frequently reported symptoms categorized under this category for the 2022-23 season include: other [specify]; weak; shortness of breath; malaise [general unwell feeling]; swelling, localized; abdominal pain; fatigue; lethargy; anorexia [loss of appetite].

SEVERITY BY EMM TYPE

Table B5. Clinical severity among confirmed iGAS cases where severity is known by top five *emm* types* : Ontario, 2022-23 season (October 1, 2022 – September 30, 2023)

Clinical Severity	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
Non-severe complications among cases under 18 years of age	17/35 (48.6%)	15/25 (60.0%)	3/3 (100.0%)	0/0 (0.0%)	0/1 (0.0%)
Severe complications** among cases under 18 years of age	18/35 (51.4%)	10/25 (40.0%)	0/3 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Non-severe complications among cases 18 years of age and over	41/118 (34.7%)	52/107 (48.6%)	41/71 (57.7%)	35/68 (51.5%)	19/37 (51.4%)
Severe complications** among cases 18 years of age and over	77/118 (65.3%)	55/107 (51.4%)	30/71 (42.3%)	33/68 (48.5%)	18/37 (48.6%)
Severity information unavailable (all age groups)	97/250 (38.8%)	100/232 (43.1%)	40/114 (35.1%)	34/102 (33.3%)	33/70 (47.1%)

Data source: Case data: Ontario. Ministry of Health; 2024.⁴

Note: Cases with an unknown age are excluded from this table.

*Top five *emm* types reported among all cases in the 2022-23 season.

**Clinical severity field was calculated using the severity field, complications indicating a severe infection and the outcome field. For more details refer to the [technical notes](#).

Table B6. Hospitalization and fatal outcomes for confirmed iGAS cases by age group and top five *emm* types* : Ontario, 2022-23 season (October 1, 2022 – September 30, 2023)

Severe outcome	<i>emm1</i>	<i>emm12</i>	<i>emm49</i>	<i>emm82</i>	<i>emm80</i>
Hospitalizations among cases under 18	57/60 (95.0%)	43/51 (84.3%)	5/5 (100.0%)	0/0 (0.0%)	1/1 (100.0%)
Hospitalizations among cases 18 and over	162/190 (85.3%)	146/181 (80.7%)	87/109 (79.8%)	77/102 (75.5%)	59/69 (85.5%)
Fatal cases among cases under 18	5/60 (8.3%)	3/51 (5.9%)	0/5 (0.0%)	0/0 (0.0%)	0/1 (0.0%)
Fatal cases among cases 18 and over	28/190 (14.7%)	24/181 (13.3%)	17/109 (15.6%)	14/102 (13.7%)	3/69 (4.3%)

Data source: Case data: Ontario. Ministry of Health;2024⁴

Note: Cases with an unknown age are excluded from this table.

*Top five *emm* types reported among all cases in the 2022-23 season.

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