The epidemiology of notifiable enteric diseases and gastrointestinal disease outbreaks in the Northern Territory in 2024

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ABSTRACT

In 2024, there were 896 notifications of foodborne disease in the Northern Territory (NT) which was 11% less than the previous 5-year mean (5YM) of 1,008 notifications per year and 4% less than the number of notifications in 2023 (933 notifications). The most commonly notified foodborne disease was salmonellosis which accounted for 52% of all foodborne disease notifications followed by campylobacteriosis (31%) and shigellosis (12%). There were 211 notifications of non-foodborne enteric disease which was 23% less than the 5YM (273 notifications per year) and almost half the number of notifications received in 2023 (398 notifications). There were 5 notifications of amoebiasis in 2024 which is also the most notified in a single year in the NT; all were related to overseas travel to endemic countries; 3 (60%) had hepatic abscesses. There were 14 outbreak investigations undertaken in the NT in 2024; 3 of these outbreaks were suspected foodborne outbreaks, with the remainder likely due to person-to-person spread of viral illnesses. There were 2 outbreaks of Salmonella Muenchen; 1 associated with consumption of contaminated kangaroo meat and 1 likely associated with a contaminated stick blender.

Key words: *OzFoodNet, amoebiasis, salmonellosis, typhoid, shigellosis, Salmonella Muenchen, campylobacteriosis, cryptosporidiosis, outbreak, orthern Territory, enteric disease.*

INTRODUCTION

The OzFoodNet (OFN) site in the Northern Territory (NT) has been funded by the Australian Government Department of Health and Aged Care since 2003. The funding employs a network of epidemiologists in every jurisdiction in Australia with a coordinating team in the Commonwealth. OzFoodNet's objectives are to enhance enteric and foodborne disease surveillance and to investigate suspected foodborne and non-foodborne gastrointestinal illness outbreaks across Australia. OzFoodNet conducts surveillance on the following notifiable conditions in the NT; salmonellosis, shigellosis, campylobacteriosis, cryptosporidiosis, hepatitis A, hepatitis E, typhoid and paratyphoid fever, shiga toxin-producing *Escherichia coli* (STEC), haemolytic uraemic syndrome (HUS), amoebiasis, botulism, brucellosis, cholera, yersiniosis, ciguatera, *Vibrio* food poisoning, and listeriosis. Rotavirus is also included in this brief summary despite not being a disease surveilled by OzFoodNet.

METHODS

Data were extracted from the NT Notifiable Diseases System (NTNDS) on 8 January 2025 and analysed from the data warehouse using SAP (*Systemanalyse* und *Programmentwicklung*) Business Intelligence software. Population figures were obtained from the NT Department of Health Statistics and Informatics Branch population data.[1] Australian incidence rates were obtained from the publicly available National Notifiable Disease Surveillance System (NNDSS) data as at 8 January

2025.[2] Foodborne or potentially foodborne diseases included amoebiasis, botulism, brucellosis, campylobacteriosis, cholera, salmonellosis, shigellosis, STEC, HUS, typhoid, paratyphoid, yersiniosis, ciguatera, *Vibrio* food poisoning, and listeriosis. Non-foodborne enteric diseases were defined as rotavirus, cryptosporidiosis, hepatitis A and hepatitis E. Notifications in 2023 were compared to the previous 5-year mean (5YM) number of notifications (2019-2023). Microsoft Excel 2016 was used to create graphs and Intercooled Stata 17.0 was used to calculate rate ratios (RR) with 95% confidence intervals (CI).

Outbreaks were detected from reports of suspected outbreaks from clinicians or members of the public routine, laboratory-based surveillance systems, and emergency department syndromic surveillance systems at Royal Darwin and Palmerston Regional Hospitals.

RESULTS AND DISCUSSION

There were 896 notifications of foodborne or potentially foodborne disease* reported in the NT which was 11% less than the 5YM of 1,008 notifications per year and 4% less than the number of notifications in 2023 (933 notifications). Salmonellosis accounted for 52% of all foodborne disease notifications, followed by campylobacteriosis (31%) and shigellosis (12%).

There were 211 notifications of non-foodborne enteric disease in the NT in 2024 which was 23% less than the 5YM (273 notifications) and 47% less than the previous year (398 notifications). Most non-foodborne enteric disease notifications (127, 60%) were due to rotavirus followed by cryptosporidiosis (84, 40%).

The number of notifications for each disease in 2024, 2023 and the previous 5YM are presented in Table 1.

* This includes total number of notifications for amoebiasis, botulism, brucellosis, campylobacteriosis, cholera, salmonellosis, shigellosis, STEC, HUS, typhoid, paratyphoid, yersiniosis, ciguatera, *Vibrio* food poisoning, and listeriosis. It does not include rotavirus, cryptosporidiosis, hepatitis A and hepatitis E.

Table 1. Notifications of enteric diseases under surveillance in the Northern Territory in 2024 compared to 2023 and the previous 5-year mean

Disease	2024	2023	2024 vs 2023 (ratio)	Previous 5-year mean	2024 vs previous 5-year mean (ratio)
Salmonellosis	463	371	1.25	426	1.09
Campylobacteriosis	281	326	0.86	353	0.80
Shigellosis	111	176	0.63	198	0.56
Rotavirus	127	210	0.60	145	0.88
Cryptosporidiosis	84	188	0.45	127	0.66
Yersiniosis	27	40	0.68	21	1.29
Amoebiasis	5	0	-	0.2	-
Typhoid	4	6	0.67	2.0	2.00
Vibrio food poisoning	3	3	1.00	1.8	1.67
Listeriosis	1	2	0.50	0.8	1.25
STEC‡	1	7	0.14	3.2	0.14
Paratyphoid	0	2	-	0.6	-
Hepatitis A	0	0	-	0.8	-
Hepatitis E	0	0	-	0.6	-
HUS†	0	1	-	0.2	-
Ciguatera food poisoning	0	0	-	0.0	-
Brucellosis	0	0	-	0.2	-

‡STEC: shiga-toxin producing *Escherichia* coli
† HUS: haemolytic uraemic syndrome

Notifiable conditions under surveillance by OzFoodNet in the NT

Salmonellosis

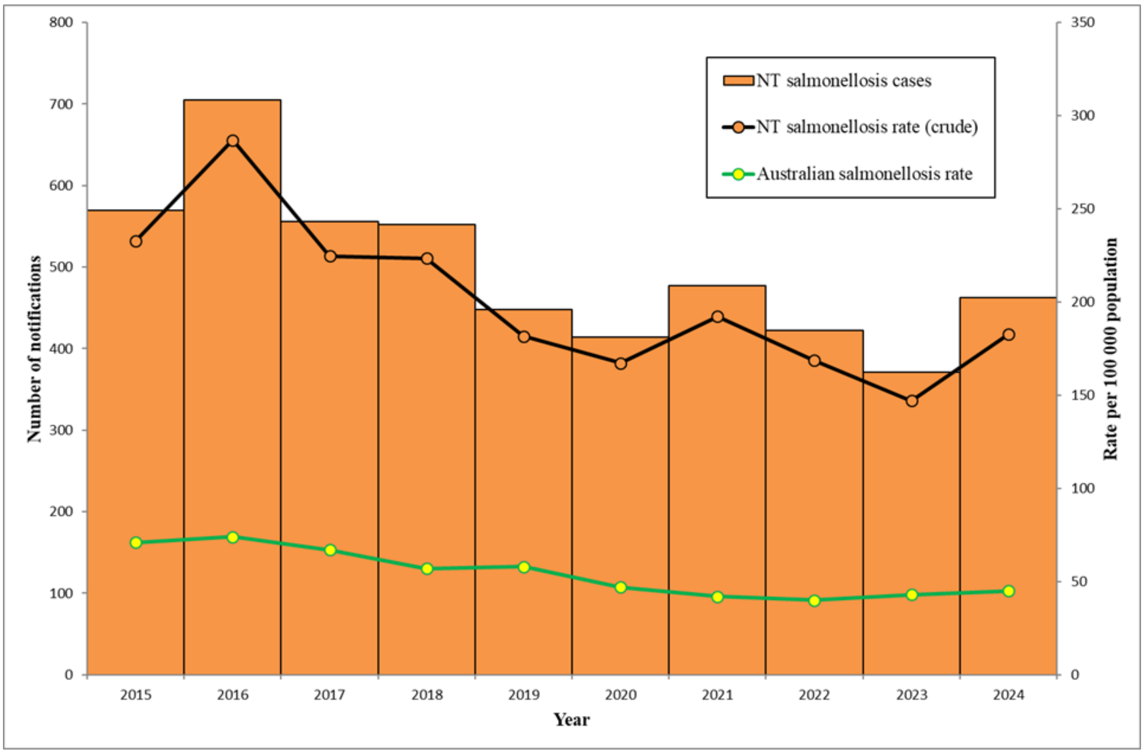
In 2024 there were 463 notifications of salmonellosis in the NT which was 9% greater than the previous 5YM (426 notifications) and 25% greater than the number of notifications in 2023 (371 notifications). The incidence rate of salmonellosis in the NT compared to the national incidence rate has been consistently higher as shown in Figure 1. The overall rate of salmonellosis in the NT was 183 notifications per 100,000 population in 2024 compared to approximately 45 per 100,000 for Australia. The median age of salmonellosis notifications was 10 years (range 0–94 years).

The rate of salmonellosis in the non-Aboriginal population was 183 notifications per 100,000 compared to 162 notifications per 100,000 in the Aboriginal population (RR=1.1, 95% CI 1.0-1.3, p=0.03). For the previous 10 years, the rates of salmonellosis in Aboriginal and non-Aboriginal Territorians were not statistically significantly different from each other, and prior to that the rate was higher in Aboriginal people compared to non-Aboriginal people.

The NT consistently observes higher rates of salmonellosis than the rest of Australia largely due to the high number of children under 5 years old who contract salmonellosis. The highest rate of disease was seen in this age group with an incidence rate of 1,269 notifications per 100,000 (212 notifications). This age group represented 46% of all salmonellosis notifications in the NT. It is assumed that infection with *Salmonella* in this age group is not usually from food sources, but from the environment where it is ubiquitous in the NT.[3]

There are over 2,500 different *Salmonella* serovars.[4] Serovar identification assists in detection of outbreaks, tracking outbreaks to their causes and understanding the natural epidemiology of different *Salmonella* strains. In 2024, Territory Pathology began undertaking local whole genome sequencing (WGS) of *Salmonella* and *Shigella* isolates in order to infer serovar type and to assist in outbreak detection.

Figure 1. Salmonellosis notifications and rate of disease in the Northern Territory, 2015-2024



In 2024, 93% (429/463) of salmonellosis notifications were identified to the serovar level (Table 2). The widespread use of faecal multiplex polymerase chain reaction (PCR) assays has resulted in an increase in salmonellosis notifications detected by PCR but which have cultured negative for *Salmonella*. The 4 serovars with the highest number of notifications in 2024 were; *Salmonella* Virchow (n=72), followed by S. Saintpaul (n=38), S. Typhimurium (n=32) and S. Lansing (n=34). Except for S. Typhimurium, these are considered environmental serovars[3] and are consistently the most commonly notified serovars in the NT.

There were 2 salmonellosis outbreaks investigated in the NT in 2024 which were unrelated to each other, but both due to *S.* Muenchen. Both outbreaks are summarised in the outbreaks section of this report.

Table 2. Salmonella serovars reported in the Northern Territory in 2024

Serovar	Count	Serovar	Count	Serovar	Count
S. Virchow	72	*S.* Johannesburg	3	*S.* Eastbourne	1
S. Saintpaul	38	*S.* Ohlstedt	3	*S.* Emek	1
S. Typhimurium	32	*S.* Orion	3	*S.* Gaminara	1
S. Lansing	25	*S.* Rubislaw	3	*S.* Give	1
S. Ball	21	*S.* Welikade	3	*S.* Hadar	1
S. Newport	21	*S.* Zanzibar	3	*S.* Havana	1
S. Muenchen	17	*S.* Agona	2	*S.* Lexington	1
S. Enteritidis	15	*S.* Anatum var 15+	2	*S.* Muenster var 15+	1
S. Hvittingfoss	15	*S.* Heidelberg	2	*S.* Newlands	1
S. Para B bv Java	14	*S.* Kottbus	2	*S.* Oranienburg	1
S. Aberdeen	11	*S.* Litchfield	2	*S.* Sandiego	1
S. Chester	10	*S.* Montevideo	2	*S.* Schwarzengrund	1
S. Weltevreden	10	*S.* Rissen	2	*S.* subsp I	1
S. subsp I ser 16:l,v:-	9	*S.* Singapore	2	*S.* subsp I 6,7:k	1
S. Anatum	7	*S.* Stanley	2	*S.* subsp II 1,13,22:g,t:[1,	1
S. Poona	7	*S.* subsp I ser 1,4,5,12:i:-	2	*S.* subsp IIIb 61	1
S. Reading	7	*S.* subsp I ser 4,5:i:-	2	*S.* subsp IIIb 61:l,v:z35	1
S. Thompson	6	*S.* Wangata	2	*S.* subsp I ser 4,5,[5],12:b	1
S. Infantis	5	*S.* Ajiobo	1	*S.* Tennessee	1
S. Houten subsp IV	4	*S.* Bahrenfeld	1	*S.* Treforest	1
S. Javiana	4	*S.* Bispebjerg	1	*S.* Wandsworth	1
S. Mgulani	4	*S.* Bonn	1		
S. Breda	3	*S.* Brandenburg	1		
S. Chailey	3	*S.* Cerro	1	*Salmonella* (untyped)	34
					463

Campylobacteriosis

There were 281 notifications of campylobacteriosis which was 20% less than the previous 5YM (353 notifications per year) and 14% less than the number of notifications in 2023 (326 notifications). The median age of campylobacteriosis notifications was 36 years (range 0 – 86 years). The overall rate of campylobacteriosis was 111 notifications per 100,000 which was lower than the national rate of 142 notifications per 100,000 population (Figure 2).

The highest number of notifications and rate of disease was observed in those under 5 years of age with 55 notifications and a rate of 329 notifications per 100,000 population. For the second consecutive year, the rate of disease in this age group was not statistically different between the Aboriginal and non-Aboriginal populations. In the remaining population (≥5 years of age), the non-Aboriginal rate of campylobacteriosis (112 notifications per 100,000 population) was significantly higher than the Aboriginal rate (27 notifications per 100,000) with a rate ratio of 4.2 (95% CI 2.6 – 7.2, p<0.001). This is a consistent trend.

Shigellosis

In 2024 there were 111 notifications of shigellosis which was 44% less than the previous 5YM of 198 notifications and 37% less than the number of notifications in 2023 (176 notifications). The overall rate of shigellosis was 44 notifications per 100,000 population which was 4 times the national rate (Figure 3). The majority of notifications (87, 78%) were in Aboriginal people. The median age of notifications was 29 years (range 0 – 81 years) with 33 (30%) of notifications occurring in the children aged under 10 years

Figure 2. Campylobacteriosis notifications and rate of disease in the Northern Territory, 2015-2024

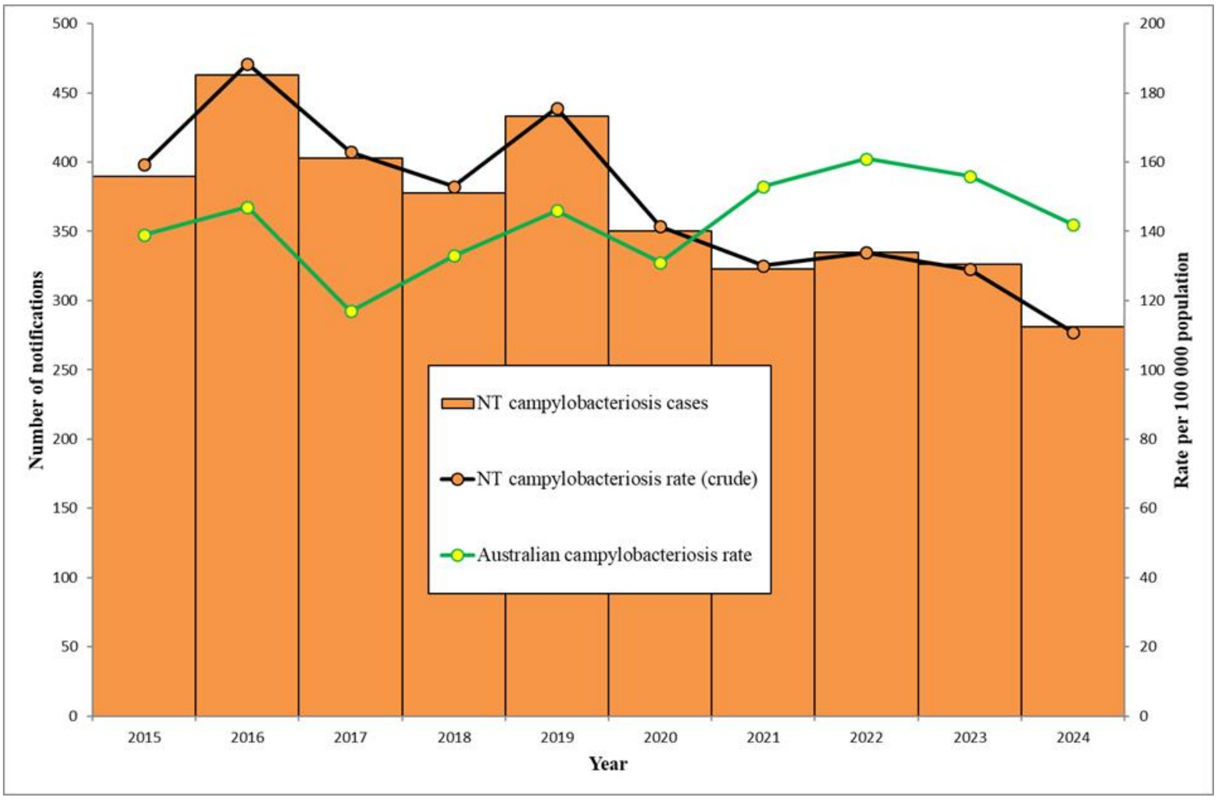
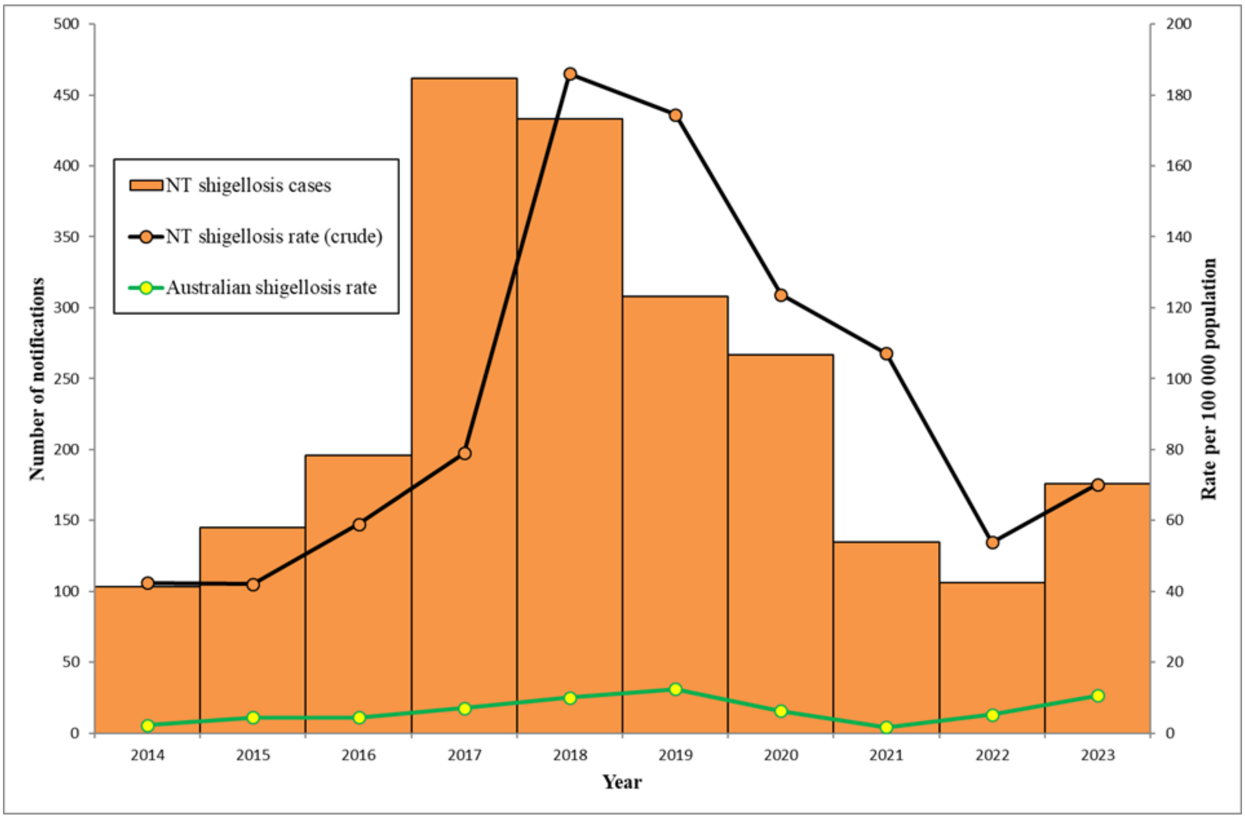


Figure 3. Shigellosis notifications and rate of disease in the Northern Territory, 2015-2024



In 2024, 49% of shigellosis notifications were identified to the species level. The most frequently reported biotype was *Shigella flexneri* 2a (36 notifications), followed by *Shigella flexneri* 2b (6 notifications); 57 (51%) of shigellosis notifications were untyped. There were no notifications of multi-drug resistant (MDR) shigellosis in 2024.

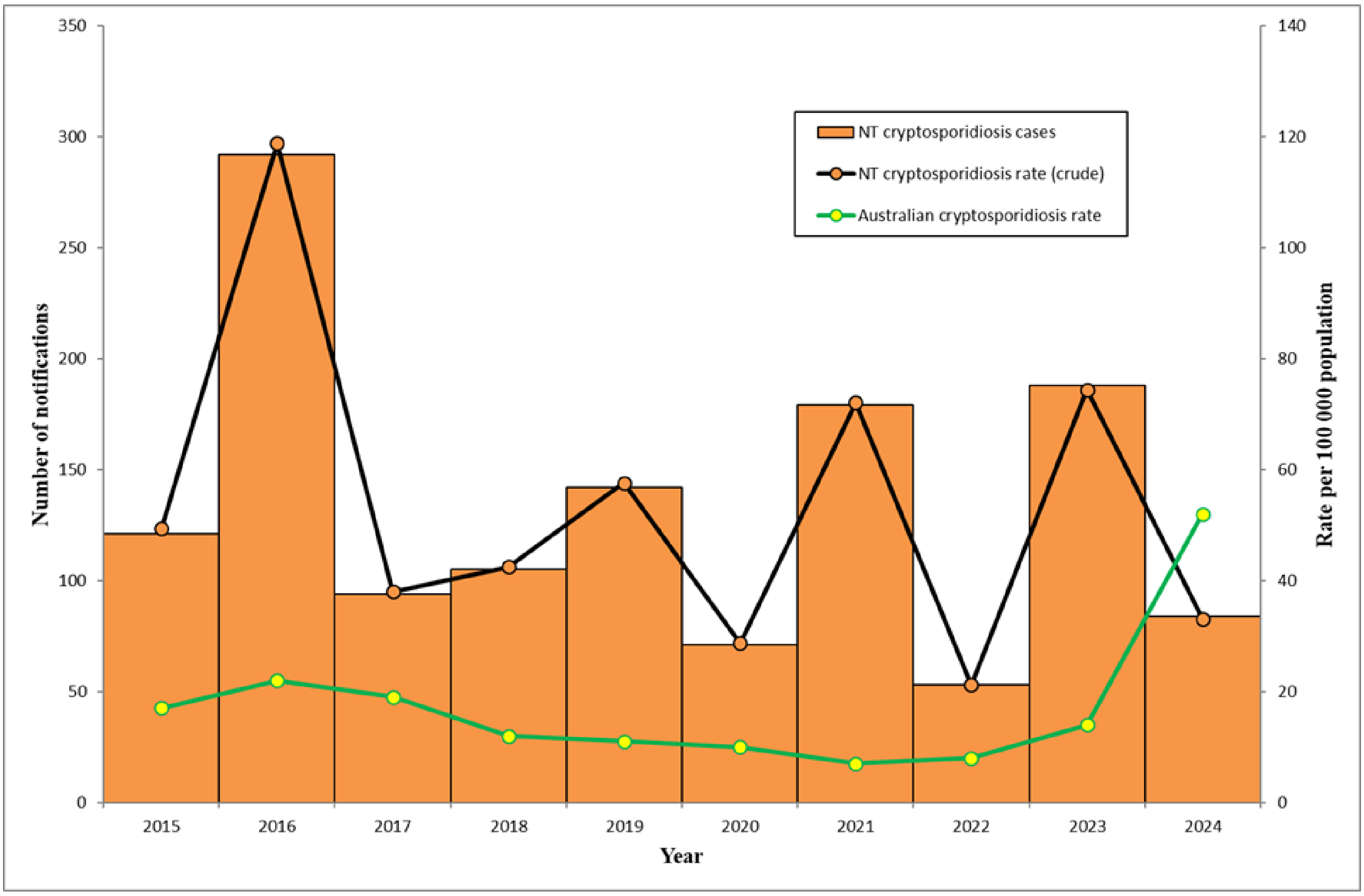
Shigellosis is historically more commonly reported in the Aboriginal population. The rate of shigellosis in the Aboriginal population was 112 notifications per 100,000 population compared to 13 notifications per 100,000 population in the non-Aboriginal population; a rate ratio of 8.9 (95% CI 5.5 – 14.9, p<0.001).

Since an outbreak of *S. flexneri* 2b in 2017,[5] the CDC has continued to recommend that all clinicians in the NT treat cases of shigellosis, even if symptoms have resolved in order to reduce the duration of transmissibility.

Cryptosporidiosis

There were 84 notifications of cryptosporidiosis in 2024 which was 34% less than the previous 5YM (127 notifications) and less than half the number of notifications in 2023 (188 notifications). The median age of notifications was 3 years (range 0 - 70 years). Cryptosporidiosis is predominantly a disease reported in children, with the majority of notifications (55/84, 65%) occurring in children aged <10 years. The rate of disease was higher in the non-Aboriginal population with 53 notifications per 100,000 compared to 23 notifications per 100,000 in the Aboriginal population (RR = 2.3, 95% CI 1.4-3.6, p<0.001). The national incidence rate in 2024 was 52 notifications per 100,000 compared to 33 notifications per 100,000 in the NT (Figure 4). The NT did not experience outbreaks of cryptosporidiosis like other jurisdictions did in 2024.

Figure 4. Cryptosporidiosis notifications and rate of disease in the Northern Territory, 2015-2024



Typhoid

There were 4 notifications of typhoid in 2024; 3 notifications were imported from India and 1 from Bangladesh. The previous 5YM was 2.0 notifications of typhoid per year with a record 6 notifications in 2023. Since 2007, almost all notifications (28/30, 93%) acquired their infection after visiting their birth countries or visiting family members in typhoid endemic countries. These travellers require pre-travel health advice and are recommended to seek vaccination for typhoid.[6]

Paratyphoid

There were no notifications of paratyphoid fever in 2024 compared to the previous 5YM of 0.6 notifications. The last 2 notifications of paratyphoid fever were in 2023.

Rotavirus

Rotavirus is a vaccine preventable disease. In 2024, there were 127 notifications of rotavirus which was 12% less than the previous 5YM (145 notifications per year) and 40% less than 2023 (210 notifications). The NT experiences annual outbreaks, typically in the cooler months. However, the peak incidence in 2024 occurred in March and April with 19 notifications in each of those months.

Hepatitis A

There were no notifications of hepatitis A notified in the NT in 2024. The last notification was in 2022 and was acquired in India (5YM = 0.8). Hepatitis A is a vaccine preventable disease. Since the introduction of the funded vaccine for all

Aboriginal children under 5 years of age in the NT in 2005, there have only been 7 locally acquired notifications of hepatitis A in the NT with the rest acquiring their infection overseas.

Hepatitis E

There were no notifications of hepatitis E reported in the NT in 2024. There were 3 notifications in the previous 5 years, all in 2019 (5YM = 0.6 notifications per year).

Shiga toxin-producing *Escherichia coli* (STEC)/haemolytic uraemic syndrome (HUS)

There was 1 notification of shiga toxin-producing *Escherichia coli* (STEC) in 2024 which was 69% less than the prevous 5YM of 3.2 notifications per year.

Haemolytic uraemic syndrome (HUS) is a severe sequelae that can sometimes follow an STEC infection. There were no notifications of HUS in 2024. There was 1 notification of HUS in the NT in the previous 5 years, in 2023.

Yersiniosis

There were 27 notifications of yersiniosis in 2024 compared to the previous 5YM of 21 notifications per year. No outbreaks were detected. Notifications of yersiniosis have increased nationally since the introduction of culture independent testing in 2013.

Listeriosis

There was 1 notification of listeriosis in the NT in 2024 compared to the previous 5YM of 0.8 notifications per year. The person had no obvious high risk food exposures and was pregnant. The case was not linked to any national multijurisdictional outbreaks. There were also single notifications of listeriosis in 2021 and 2022. Listeriosis, while uncommon can cause serious illness particularly for pregant women, newborns and people with weakened immune systems.

Amoebiasis

There were 5 notifications of amoebiasis notified in 2024 with all acquiring their infection overseas; 2 from Indonesia, 2 from India and 1 from Thailand. Most (3/5, 60%) had extra-intestinal spread in the form of hepatic abscesses. In the previous 5 years there was only 1 notification, in 2019. Amoebiasis is found in Northern Australia but is rare.

Ciguatera

There were no notifications of ciguatera fish poisoning in 2024. Since ciguatera fish poisoning was made a notifiable condition in the NT in 2010 there have only been 2 notifications, 1 in 2013 aquired in Vanuatu and 1 in 2016 from Nhulunbuy.

***Vibrio* food poisoning**

There were 3 notifications of *Vibrio* food poisoning notified in the NT in 2024 compared to the previous 5YM of 1.8 notifications per year. Infection is often associated with consumption of shellfish and molluscs. All 3 notifications were *Vibrio cholerae* (non-cholera strains):

- the first was an Aboriginal adult who had consumed locally caught 'longbum' (*Telescopium telescopium*) molluscs during their incubation period.
- a second was a non-Aboriginal infant on a remote cattle station with no obvious travel or high-risk food exposures.
- a third person acquired their infection in Bali, Indonesia.

Since 1 January 2025, *Vibrio parahaemolyticus* infection is now a nationally notifiable condition.[7] This was largely in response to a large multijurisdictional outbreak of *V. parahaemolyticus* food poisoning across Australia in 2021-2022 which was associated with consumption of contaminated oysters.[8]

Botulism

There were no notifications of botulism reported in 2024. The only notification of botulism in the NT was a single notification in the year 2000.

Brucellosis

There were no notifications of brucellosis in 2024. The previous 5YM was 0.2 notifications per year. The last brucellosis notification in the NT was in 2021.

Outbreak Investigations

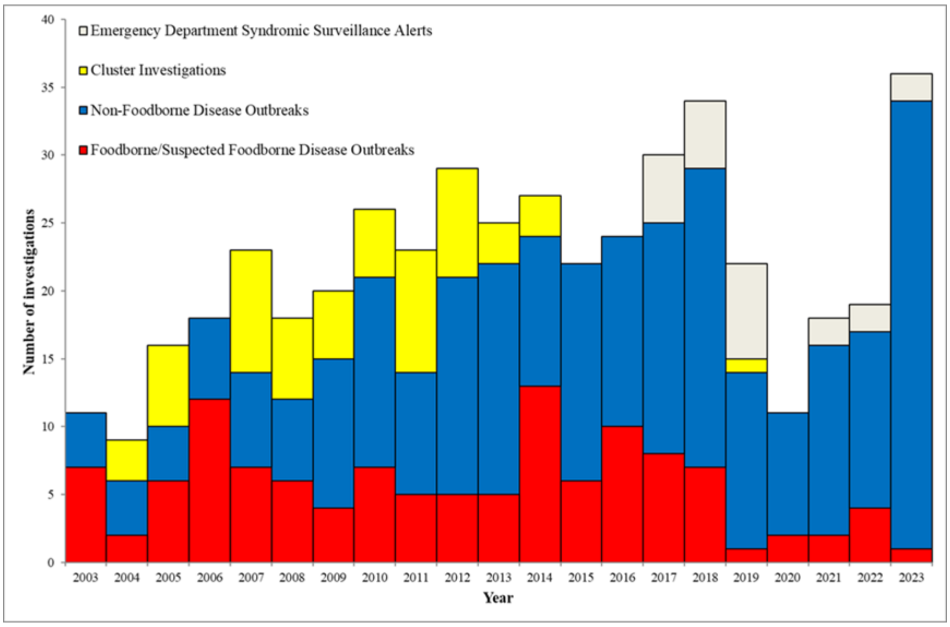
There were 14 outbreaks of gastrointestinal disease investigated in 2024; 3 suspected foodborne outbreaks; 11 non-foodborne outbreaks and no alerts triggered by emergency department syndromic surveillance systems (Figure 5). Of the 11 non-foodborne outbreaks, 10 were likely due to person-to-person spread of viral illnesses. The most common settings for outbreaks were childcare centres (9 outbreaks).

Salmonella was confirmed as the aetiological agent in 2 outbreaks (both due to *S*. Muenchen), with the remainder of outbreaks of unconfirmed aetiology. The 2 salmonellosis outbreak investigations are briefly summarised below.

An outbreak of *Salmonella* Muenchen associated with wild hunted kangaroo

An outbreak of salmonellosis due to *Salmonella* Muenchen occurred among a group of people who ate wild hunted kangaroo. There were 7 people who became ill with diarrhoea; 3 were confirmed with *S*. Muenchen from stool samples. Isolates clustered closely on whole genome WGS with <3 single nucleotide polymorphisms (SNPs) difference. All 7 cases consumed the same meal – a single, locally hunted and butchered kangaroo. Contamination occurred because of unsafe butchering of the animal, storage and transport of the meat at ambient period overnight (at temperatures ranging between 18° - 32.9° Celcius) and insufficient cooking of the meat which was cooked rare in an earth oven. When preparing hunted meat washing hands and knives regularly while butchering an animal to avoid contamination is required. Butchered meat needs to be stored below 5° Celsius to avoid bacterial growth and cookeed thoroughly to kill microbes. This outbreak was the first salmonellosis outbreak in the NT where Territory Pathology used whole genome sequencing typing methods (which inferred *S*. Muenchen).

Figure 5. Number of outbreaks investigated in the Northern Territory since an OzFoodNet site was established in 2003



A detailed report of this outbreak is published in the journal, [Communicable Disease Intelligence](#).[9]

An outbreak of *Salmonella* Muenchen at a remote aged care facility

An outbreak of *S.* Muenchen was reported from a remote aged care facility, with 2 residents ill from a total population of 23 residents and 29 staff. The 2 *S.* Muenchen isolates clustered closely on WGS with <3 SNPs difference, and were genetically unrelated to the previously mentioned outbreak associated with kangaroo meat. There were no other reports of illness among other staff or residents from the aged care facility. Both residents were on a mince and moist food diet and suffered from dementia. The hand mixer used to mince their food was discarded as a preventative measure and was assumed to be contaminated. No further cases occurred after this.

CONCLUSION

There was a decrease in the number of gastroenteritis outbreaks investigated in 2024 with most outbreaks determined to be of unknown aetiology and presumed to be due to person-to-person transmission. Most of these outbreaks occurred in childcare. There were 2 *Salmonella* outbreaks in 2024; 1 associated with the consumption of contaminated kangaroo meat and 1 associated with a presumed contaminated stick blender. It is important to butcher, store and cook meat safely to avoid food poisoning. Likewise, maintaining hand hygiene and sanitising knives and equipment can minimise the risk of food contamination.

There was a record number of amoebiasis notifications in 2024, all in returning travellers. It is important for clinicians to consider a diagnosis of amoebiasis in returned travellers, particularly those with abdominal abscesses. The introduction of local WGS on *Salmonella* and *Shigella* isolates in the NT by Territory Pathology was used to confirm the existence of 2 salmonellosis outbreaks and is likely to have an important role in foodborne disease surveillance in coming years.

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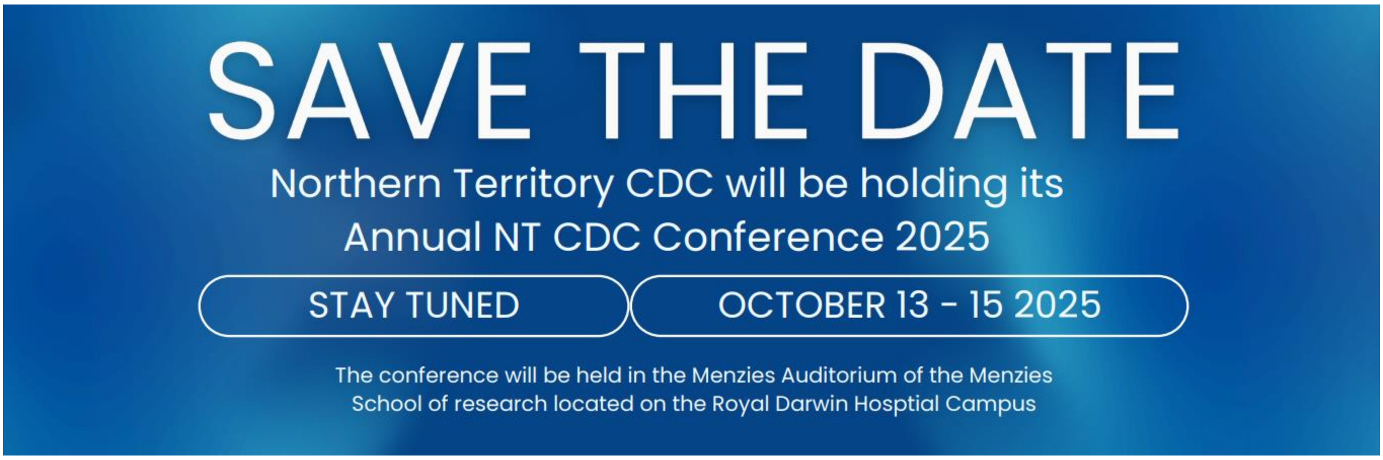

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