NORTHERN TERRITORY GOVERNMENT

Centre for Disease Control

DISEASE CONTROL BULLETIN

Vol. 32 No. 1

March 2025

ISSN 1440-883X

In this issue we get a wrap up of notifiable enteric diseases and gastrointestinal outbreaks reported in the NT in 2024. Salmonellosis rates were higher than the prior 2 years and have been consistently higher than the rest of the nation. There were 2 *Salmonella* Muenchen outbreaks - one associated with wild-hunted kangaroo and the other at a remote aged care facility. While amoebiasis can be acquired in the north of Australia, the 5 cases reported in 2024 in the NT were all acquired overseas.

There were 2 NT Public Health Alerts issued in the first quarter of 2025. One focused on the ongoing syphilis outbreak and the other on an imported case of measles diagnosed in Darwin – the first case notified in the NT since 2019. Measles cases are currently reported in very large numbers in many neighbouring countries and already this year all Australian states and territories have notified cases. The message is to make sure you are measles immune. Measles vaccines in the NT are free for all those who are not immune.

In the abstracts generated from NT peer-reviewed published articles 4 feature melioidosis. From them we learn of details of new and old diagnostics for melioidosis, the fact that melioidosis 'is on-the-move' and that melioidosis, leptospirosis and rickettsiosis are 3 bacterial diseases considered to be in a cycle of neglect globally.

Vicki Krause, Editor

Editor: Vicki Krause

Assistant Editors: Anthony Draper, Ashish Yadav, Belinda Greenwood-Smith, Hayley Dyke, Manoji Gunathilake

Production Design: Jessica Jarrett-Wright

Contact: NT Public Health Division – Centre for Disease Control

p: 8922 4044 or 1800 008 002

e: cdcsurveillance.darwin@nt.gov.au

w: https://health.nt.gov.au/professionals/centre-for-disease-control

m: PO Box 40596, Casuarina, Northern Territory 0811

ePublication: DoH Digital Library: The Northern Territory Disease Control Bulletin 1991 - current

NORTHERN TERRITORY GOVERNMENT

Contents

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

***Anthony DK Draper*[1,2,3]**

[1] Centre for Disease Control, Public Health Division, NT Health, Darwin
[2] Global and Tropical Health Division, Menzies School of Health Research, Charles Darwin University, Darwin
[3] National Centre for Epidemiology and Population Health, Australian National University, Canberra

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

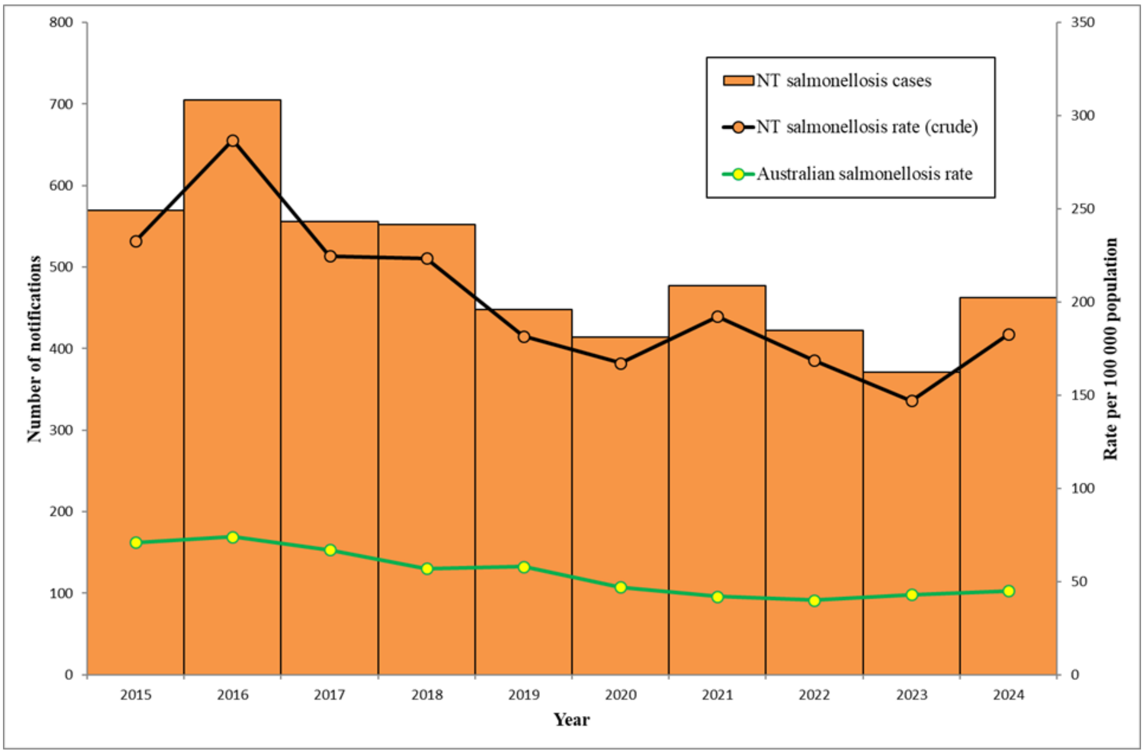
In 2024 there were 463 notifications of salmonellosis in the NT which was 9% greater than the previous 5YM (426 notifications) and 25% greater than the number of notifications in 2023 (371 notifications). The incidence rate of salmonellosis in the NT compared to the national incidence rate has been consistently 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

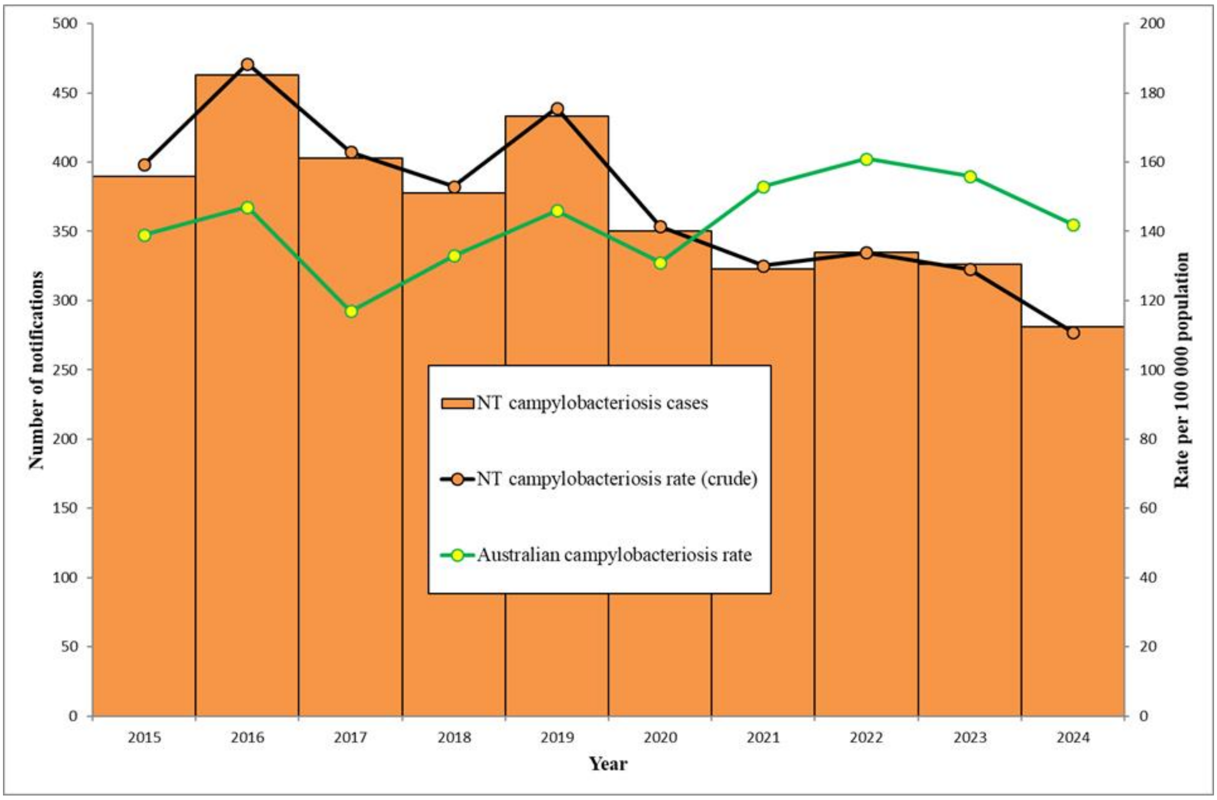
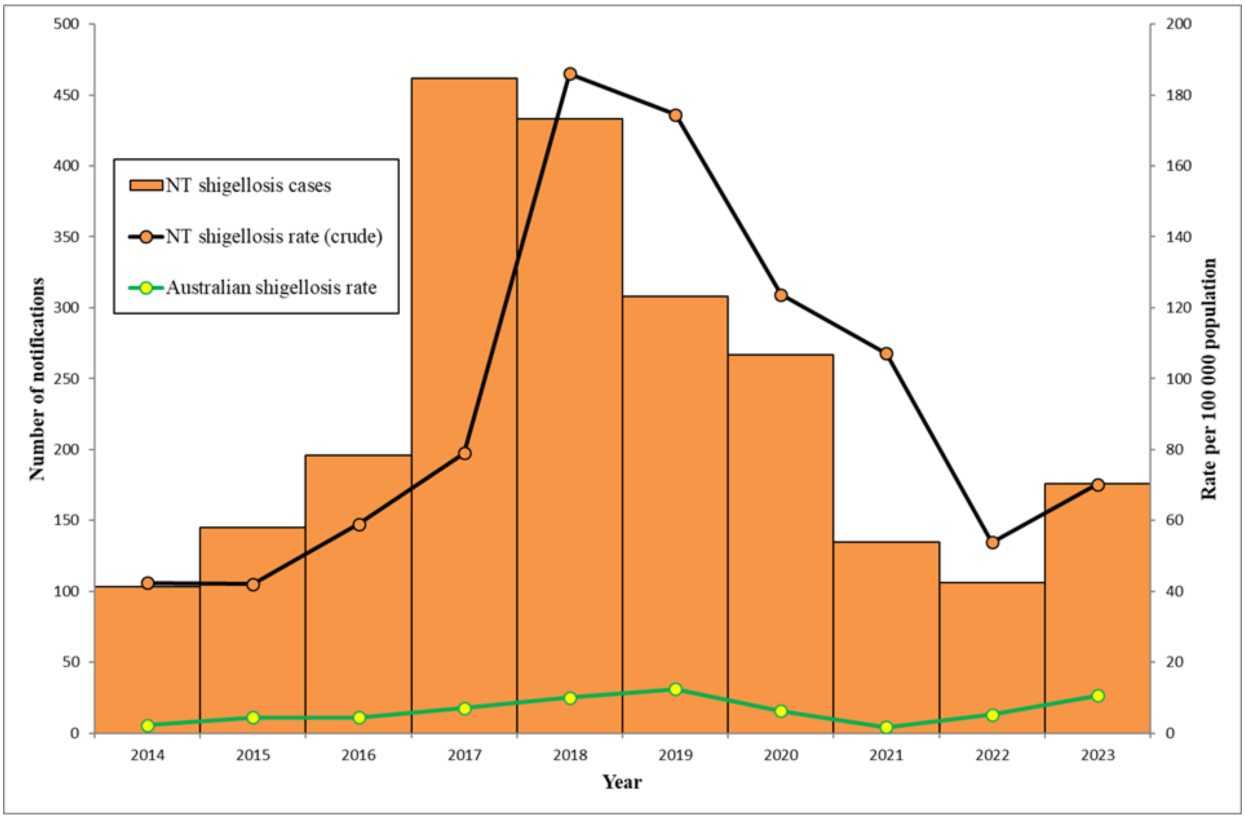


Figure 3. Shigellosis notifications and rate of disease in the Northern Territory, 2015-2024



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.

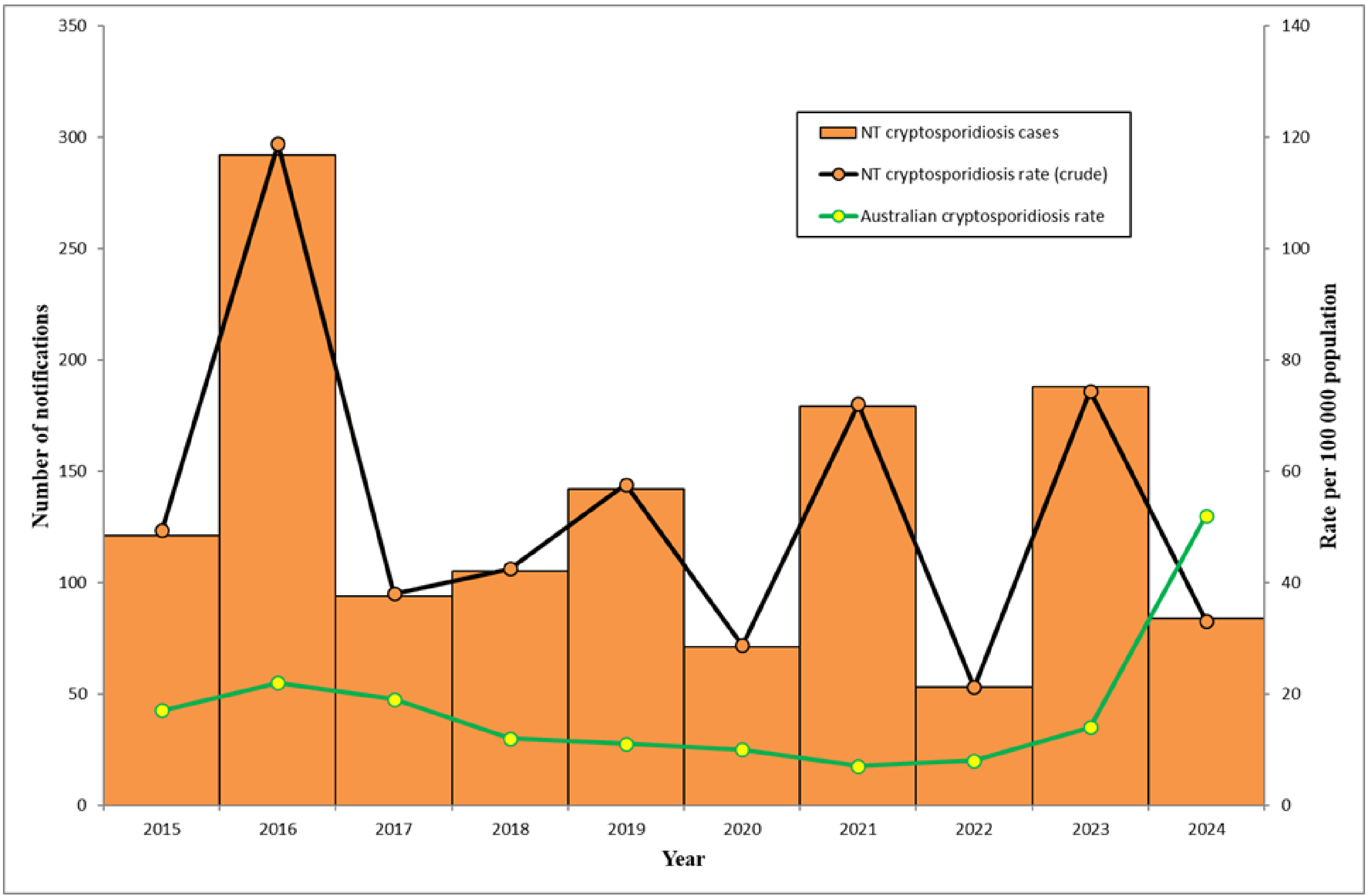
Shigellosis is historically more commonly reported in the Aboriginal population. The rate of shigellosis in the Aboriginal population was 112 notifications per 100,000 population compared to 13 notifications per 100,000 population in the non-Aboriginal population; a rate ratio of 8.9 (95% CI 5.5 – 14.9,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

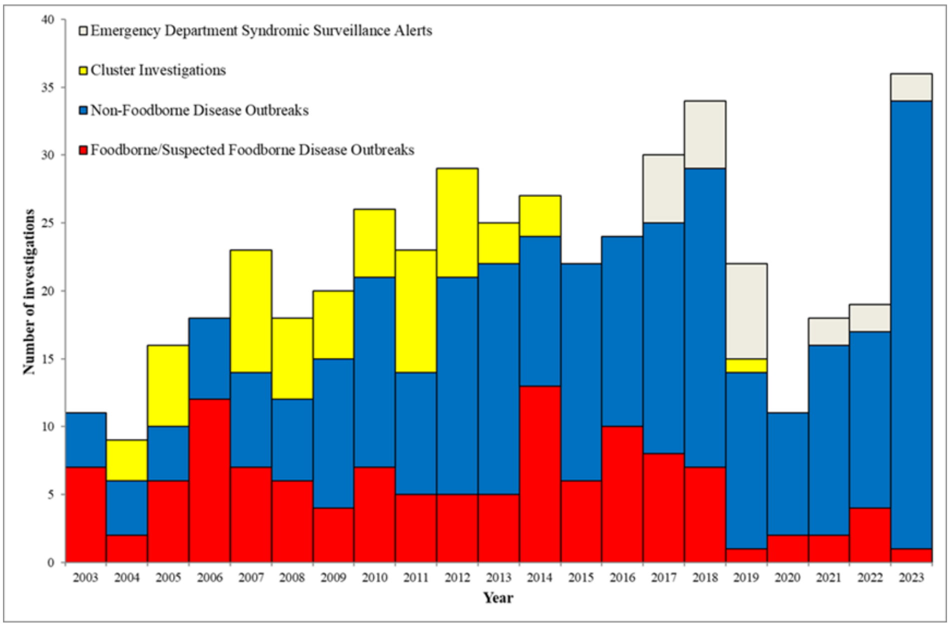
There were 14 outbreaks of gastrointestinal disease investigated in 2024; 3 suspected foodborne outbreaks; 11 non-foodborne outbreaks and no alerts triggered by emergency department syndromic surveillance systems (Figure 5). Of the 11 non-foodborne outbreaks, 10 were likely due to person-to-person spread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

ACKNOWLEDGMENTS

I would like to thank Kelly Lomas, Astrid Stark, Thalia Hewitt, Sandhaya Sen Thapa, Jerry Chen, Dr Hayley Dyke, Dr Vicki Krause and the staff at the NT CDC Public Health Units around the NT.

Helen Hocking and the team from SA Pathology.

The team from the Microbiology Diagnostic Unit at Melbourne University (MDU).

Damien Bradford and the team at Pathwest.

Northern Territory Government Environmental Health Officers.

Staff from the Territory Pathology, Western Diagnostic Pathology, Sullivan and Nicolaides Pathology, and Australian Clinical Labs.

REFERENCES

1. Northern Territory Department of Health, Staff Intranet. *Health Research, Data & Analytics.* (2023) Health Statistics and Informatics Branch.

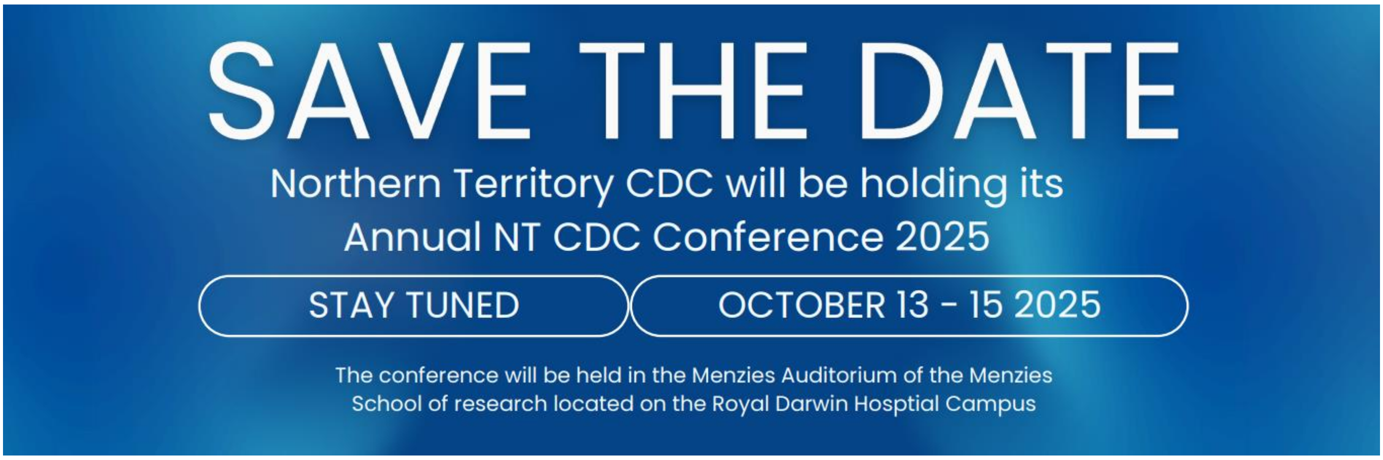
2. Australian Government Department of Health and Aged Care. National Notifiable Disease Surveillance System (NNDSS) data visualisation tool. Available at https://www.health.gov.au/resources/apps-and-tools/national-notifiable-diseases-surveillance-system-nndss-data-visualisation-tool

1. Williams S, Patel M, Markey P, Muller R, Benedict S, Ross I, Heuzenroeder M, Davos D, Cameron S & Krause V. *Salmonella* in the tropical household environment – Everyday, everywhere. *Journal of Infection*. 2015;71(6):642-648. Available at https://www.journalofinfection.com/article/S0163-4453(15)00289-3/abstract

3. World Health Organization & Insitut Pasteur. WHO Collaborating Centre for Reference and

Research on Salmonella. Antigenic formulae of the Salmonella serovars, 2007 (9th Ed). Available from: https://www.pasteur.fr/sites/default/files/veng_0.pdf

4. Draper ADK & Markey PG. *Shigella flexneri* 2b in the Northern Territory in 2017. *The Northern Territory Disease Control Bulletin*. 2017;24(4):1-6. Available at: https://digitallibrary.health.nt.gov.au/prodjspui/bitstream/10137/506/557/Vol%2024%20no%204%20December%202017.pdf
5. Balzat L. Typhoid notifications and the public health response in the Northern Territory: a case series. *The Northern Territory Disease Control Bulletin*. 2012;19(4):4-10. Available at https://digitallibrary.health.nt.gov.au/prodjspui/bitstream/10137/506/417/Vol.%2019%20no%204%20December%202012.pdf
6. Australian Government Department of Health and Aged Care. Communicable Disease Network of Australia. List of nationally notifiable diseases. 2025. Available from: https://www.health.gov.au/topics/communicable-diseases/nationally-notifiable-diseases/list
7. Fearnley E, Leong LEX, Centofanti A, Dowsett P, Hocking H, Coombs B, Draper ADK, Howden B, Horan K, Wilmot M, Levy A, Cooley L, Kennedy K, Wang Q, Arnott A, Graham RMA, Sinchenko V, Jennison A, Kane S, Wright R. An outbreak of *Vibrio parahaemolyticus* food poisoning associated with consumption of oysters, Australia, 2021-2022. *EID*. 2024 Nov. https://doi.org/10.3201/eid3011.240172
8. Draper ADK, Gerrell J, McKay S, Forrester J, Ordonez A, Meumann E, Baird R, Menouhos D, Basnet M, Creeper T, Cummins M, Krause V. An outbreak of *Salmonella* Muenchen gastroenteritis after consuming wild hunted kangaroo, Northern Territory, Australia. 2024. *Communicable Disease Intelligence*. (2018) 2025;49. https://doi.org/10.33321/cdi.2025.49.010



Top of the Document

An update on the Tennant Creek dengue mosquito elimination program, March 2025

Benjamin Smitheram and Nina Kurucz
Medical Entomology, Centre for Disease Control, Public Health Division, NT Health

BACKGROUND

The dengue mosquito, *Aedes aegypti*, which also can transmit other flaviviruses, was detected in Tennant Creek in February 2021, with a dedicated elimination program established immediately. The number of properties with detections of *Ae. aegypti* remained relatively low until December 2022. However, the program experienced a setback during the 6th round of property inspections and treatments in January and February 2023, with *Ae. aegypti* detected on 112 properties. The extensive breeding and subsequent dispersal of the dengue mosquito was most likely due to the extensive rainfall between October 2022 and March 2023.[1]

Aedes aegypti surveillance and control in Tennant Creek, January 2023 to March 2025

To reduce the number of *Ae. aegypti* positive properties and ultimately work towards *Ae. aegypti* elimination, the Tennant Creek based program team received extensive weekly assistance from within NT Health and the National Critical Care and Trauma Response Centre, with additional weekly support in late 2023 from Australian Defence Force members. Between November 2024 and February 2025, Queensland Health staff provided further and much appreciated assistance on the ground. The additional human resources enabled property inspections and treatment rounds to be carried out within shorter timeframes, which resulted in lower *Ae. aegypti* detections during the 8th round of property inspections and treatments which occurred from May 2023 onwards (see Table).

The low detection rates are promising, considering the extensive rainfall which occurred between January and March 2024, and additional rain in late May and early July 2024. A total of 1,721 adult mosquito traps were set (431 Sentinel Biogents traps (BG) and 1,290 Gravid *Aedes* traps (GAT)) between 1 May 2024 and 31 March 2025, with a single female *Ae. aegypti* only detected on 4 and 16 October 2024 and 11 December 2024. The female detected on 11 December 2024 was collected at the same property as larval *Ae. aegypti* which were found in an unused spa.

The program's messaging campaign, delivered via local newspaper, radio, and social media posts (Figure) has also resulted in improved property sanitation, with containers removed, reducing the number of potential breeding sites in the town. Program staff further liaised with local Indigenous corporations and land councils, who in return assisted with promoting access to property backyards.

Outlook

The program is currently in its 18th round of property inspections and treatments, and with the current low detection rates, we are cautiously optimistic that the program will achieve *Ae. aegypti* elimination. While it appears that *Ae. aegypti* has decreased to very low numbers, viable eggs, which can survive in dry receptacles up to 12 months, might still be present. Thus, it is important to continue property inspections and treatments throughout the coming wet season, with inspections and treatments critical following the next extensive rain, which has the potential to trigger egg hatches. However, with additional NT Health funding to continue the program until April 2026, we are hopeful that with concentrated efforts the dengue mosquito elimination program will be successful.

Table. Summary of properties inspections and treatments, and numbers of properties positive for *Aedes aegypti* larvae

Property rounds	Time period	No. of properties positive for *Ae. aegypti* larvae	No. of receptacles positive for *Ae. aegypti* larvae	No. of properties visited
Preliminary round	9/3/2021 to 14/5/2021	6 (2.1%)	10	284
1st round	9/8/2021 to 1/10/2021	0 (0.0%)	0	630
2nd round	8/11/2021 to 25/2/2022	2 (0.3%)	2	652
3rd round	28/2/2022 to 27/5/2022	18 (2.2%)	24	837
4th round	30/5/2022 to 5/8/2022	6 (0.7%)	6	871
5th round	8/8/2022 to 23/12/2022	8 (0.9%)	8	869
6th round	3/1/2023 to 24/2/2023	112 (13.2%)	142	847
7th round	27/2/2023 to 28/4/2023	87 (10.4%)	106	838
8th round	1/5/2023 to 29/6/2023	8 (1.1%)	8	730
9th round	3/7/2023 to 1/9/2023	10 (1.3%)	10	745
10th round	4/9/2023 to 10/11/2023	2 (0.2%)	2	810
11th round	13/11/2023 to 25/1/2024	1 (0.2%)	1	621
12th round	29/1/2024 to 5/4/2024	7 (1%)	7	717
13th round	8/4/2024 to 17/5/2024	3 (0.4%)	3	857
14th round	20/5/2024 to 26/7/2024	0 (0.0%)	0	740
15th round	29/7/2024 to 18/10/2024	0 (0.0%)*	0	605
16th round	21/10/2024 to 20/12/2024	1 (0.13%)**	1	800
17th round	6/1/2025 to 14/3/2025	0 (0.0%)	0	758
18th round	17/3/2025 to 31/3/2025^	0 (0.0%)	0	186
Totals			**330**	**13,397**

*BG trap found positive for *Ae. aegypti* on 4 and 16 October 2024.
**BG trap found positive for *Ae. aegypti* on 11 December 2024.
^Round 18 is ongoing.

Figure. NT Health social media post to promote reduction of mosquito breeding receptacles in backyards, 2024

Reference

1. Kurucz, N and Smitheram, B. The dengue mosquito has returned to Tennant Creek. *NT Dis Control Bull.* 2023; 30(2):17-19.

A single imported case of measles and the subsequent outbreak response, Darwin, Northern Territory, January 2025

Sarah Sim[1,2,3], Anthony DK Draper[1,2,4], Hayley Dyke[1], Jerry Chen[1], Dhanya Kachapilly Louis[6], Rob Baird[5], Kevin Freeman[5], Kimberly McMahon[1], Gina Majid[1], Amy Parry[2], Alyson Wright[2,3], Vicki Krause[1]

1. *Centre for Disease Control, Public Health Division, NT Health, Darwin*
2. *National Centre for Epidemiology and Population Health, College of Law, Governance and Policy, Australian National University, Canberra*
3. *Health Statistics and Informatics, NT Health, Darwin*
4. *Global and Tropical Health Division, Menzies School of Health Research, Charles Darwin University, Darwin*
5. *Territory Pathology, NT Health, Darwin*
6. *Infection Prevention and Control Unit, Royal Darwin Hospital and Palmerston regional Hospital, NT Health, Darwin*

Abstract

Measles is a highly contagious viral airborne disease, typically presenting with high fever, cough, conjunctivitis, and a maculopapular rash. No longer endemic in Australia, imported cases of measles do occur with a single case regarded as a public health emergency.

In January 2025, a returned traveller with measles was notified to the Centre for Disease Control (CDC) in Darwin, Northern Territory (NT); the first case in the NT since 2019 to be notified. An outbreak team followed national public health response guidelines. We interviewed the case to determine travel history, infectious period, potential contacts, and provided isolation advice. The electronic database, Research Electronic Data Capture (REDCap), was used for contact tracing to record contact details, vaccination status, and past infection history.

A total of 162 contacts were identified. We successfully contacted and completed follow up for 94% (153/162) of contacts. Of the total 162 contacts, 84% (136/162) were considered to be immune to measles. Of those immune, 90% (123/136) had received 2 doses of the measles-containing vaccine; 7% (9/136) were born before 1966; and 3% (4/136) reported a previous measles infection as a child. During the response, 90% (146/162) of contacts were provided advice only with no further action required, and 2% (4/162) were provided the measles-mumps-rubella (MMR) containing vaccine. Only 1 contact received normal human immunoglobulin (NHIG). The contact tracing was completed by 8 staff over a total of 12 hours on a weekend. We calculated the human resource cost for this outbreak response to be approximately $7,300. No further cases of measles were reported in the NT in the 2 months following this case notification.

This outbreak response highlights how high immunisation rates and a rapid, co-ordinated response using familiar electronic management systems, and staff preparedness training are crucial in preventing the onward transmission of measles.

Keywords: *measles, outbreaks, contact tracing, REDCap, Northern Territory, vaccination.*

Background

Measles is caused by a paramyxovirus from the Morbillivirus genus. It is a highly contagious viral, airborne disease that can lead to severe complications and death.[1] Measles virus infects the respiratory tract, and typical symptoms of patients include high fever, coryza, cough, conjunctivitis and a widespread maculopapular rash. Populations most vulnerable to serious complications of measles infection include those who are pregnant, those under 5 years of age or those who are immunocompromised.[2] Before the global introduction of the measles-containing vaccine in 1963, and subsequent mass vaccination programs, more than 2 million people died from the measles virus annually.[3] With the introduction of the Expanded Programme on Immunisation (EPI) implemented by the World Health Organization (WHO) in 1974, there has been a dramatic reduction of measles cases with increased vaccine uptake.[3] However, despite the availability of a safe and cost-effective vaccine, measles still remains a leading cause of death among young children in developing countries, with an estimated 107,500 children under 5 years of age dying from measles in 2023.[2]

Measles is a notifiable disease across all states and territories in Australia, with a single case regarded as an outbreak, requiring urgent public health response and surveillance.[4] In 2014, the World Health Organization declared measles eliminated in Australia because it had not been endemic for several years.[5] The Communicable Disease Network Australia (CDNA) has developed a Series of National Guidelines (SoNG) to provide best practice and nationally consistent guidance for notifiable disease events. The CDNA Measles SoNG provides the public health response and management required during an outbreak involving; isolating infectious people, identifying their contacts, providing post-exposure prophylaxis and implementing appropriate education and exclusions as required.[4]

The measles-containing vaccines used in Australia are; measles-mumps-rubella (MMR) which is a live attenuated vaccine recommended for children at 12 months of age; and the measles-mumps-rubella-varicella (MMRV) recommended at 18 months of age.[5] People born before 1966 are generally considered to be immune to measles due to the likelihood of a measles infection as a child.[4] Vaccine immunogenicity and effectiveness of measles-containing vaccines is high; an overall vaccine effectiveness of 96% for 1 dose, and 99% for 2 doses.[6] Therefore people are considered to be 'measles immune' if they were born before 1966, have had documented measles in the past or have received 2 doses of a measles-containing vaccine. However, 95% vaccination coverage is required in the population to ensure herd immunity, due to the measles virus' extremely infectious nature, and subsequent high reproduction number (R_0) in a population susceptible to measles (i.e. those non-immune).[6]

For non-immune individuals exposed to cases of measles there is a narrow window of opportunity to give measles prophylaxis in the post-exposure period of 6 days (144 hours) with best results when given within 3 days (72 hours).[4] Most non-immune exposed individuals should receive MMR (or in some circumstances MMRV) however, for some individuals who are unable to receive the measles-containing vaccine, normal human immunoglobulin (NHIG) is recommended. These individuals include the immunocompromised of all ages, non-immune pregnant mothers and babies born to non-immune mothers from birth to 5 months of age, and for babies 6 to 18 months depending on any doses of measles-containing vaccine they have received, and the timing of post exposure as guided by the CDNA Measles SoNG.[4]

In the Northern Territory (NT), the last measles outbreak occurred in 2019 (Figure 1) with 23 cases total notified, 20 of whom acquired their disease in the NT. The incidence rate for measles in the NT for 2019 was 11[7] per 100,000 which was 16 times greater than the national rate.[7] Over 1,200 contacts were traced to contain this outbreak.[7] Previous studies have shown that effective public health outbreak responses are resource intensive with most cost attributed to staff related activities i.e. interviewing cases, contact tracing and arranging testing and/or post-exposure prophylaxis.[7] Between 2020 and 2024 there were no measles cases notified in the NT, likely due to the COVID-19 pandemic and subsequent reduced international travel.

The most recent notification of a measles case occurred in January 2025 with an overseas born, NT resident returning from international travel with no documentation or recall of being measles vaccinated. The case presented to the hospital emergency department and was discharged home, presenting 2 days later with a rash. The case was admitted overnight, tested for measles and discharged home the following day with a subsequent positive result to measles. We describe the public health response to this notification

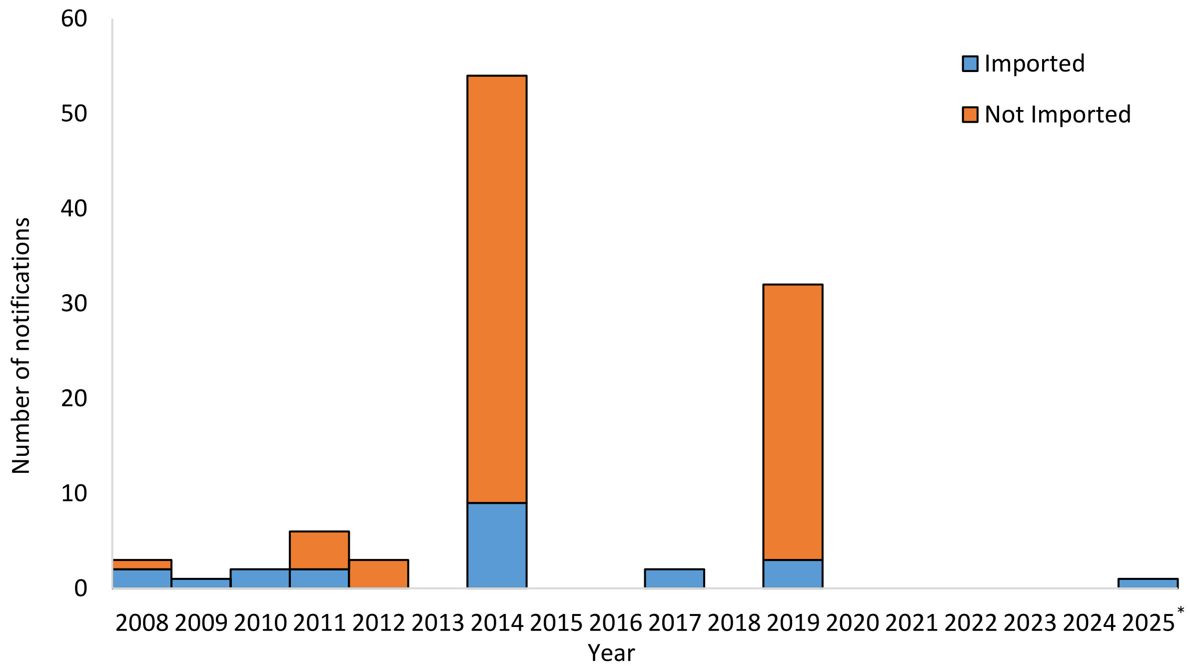
Methods

Outbreak response

The measles index case was confirmed through laboratory definitive evidence, meeting the current national measles case definition defined by the CDNA Measles SoNG.[4] An outbreak management team was formed to respond to the reported case of measles.

The index case was interviewed to determine travel history, infectious period, potential contacts and provided with isolation advice. A timeline of the case movements and contact interventions was devised based on the CDNA Measles SoNG and the NT Centre for Disease Control (CDC) disease reckoner, which calculated a timeframe of dates for the potential development of symptoms in contacts, and the dates of exposure sites for contacts. This enabled prompt collaboration with Cairns Public Health Unit and the National Incident Room in response to the case's interstate movements while infectious.

Figure 1. Number of measles notifications from 2008 to 31 March 2025 by imported/not imported case, Darwin, Northern Territory

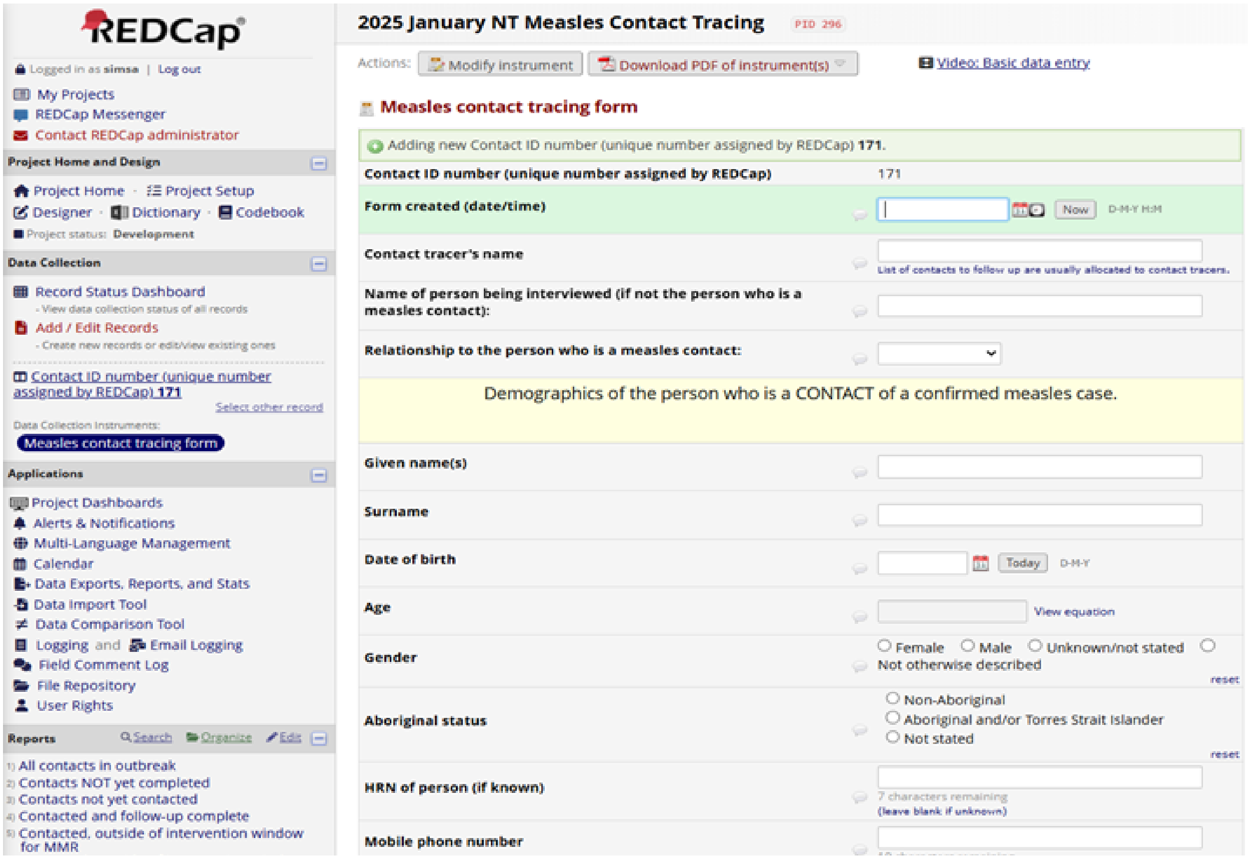


* as at 31 March 2025

Contacts were also identified as per the CDNA Measles SoNG guideline definition; as anyone who had or may have shared the same enclosed area for any length of time with the infectious case.[4] Contacts were grouped according to where the case had visited during the infectious period i.e. emergency department, snack bar, workplace, and family barbeque. We classified any person who was at these locations 30 minutes before, and 30 minutes after the case visited as a potential contact. Identified locations were asked to provide Darwin NT CDC with lists of names and contact details for contacts who were present at the nominated times i.e. hospital's Infection Prevention and Control department to provide contacts lists for the case's workplace management team.

Contact tracing was conducted and managed using REDCap (Research Electronic Data Capture) database – a secure web base application for developing and managing online surveys and databases, and the Telstra Integrated Messaging (TIM) system – a rapid, automatic broadcast notification system for two-way short message service (SMS). TIM was used to send SMS to all identified contacts asking them to contact Darwin NT CDC. To distribute the workload, members of the outbreak team were allocated groups of contacts to actively telephone while at the same time receive incoming calls. During telephone calls with contacts a standardised questionnaire was administered via REDCap (Figure 2), with information collected on demographic details, susceptibility to infection, identification of further contacts, and public health advice.

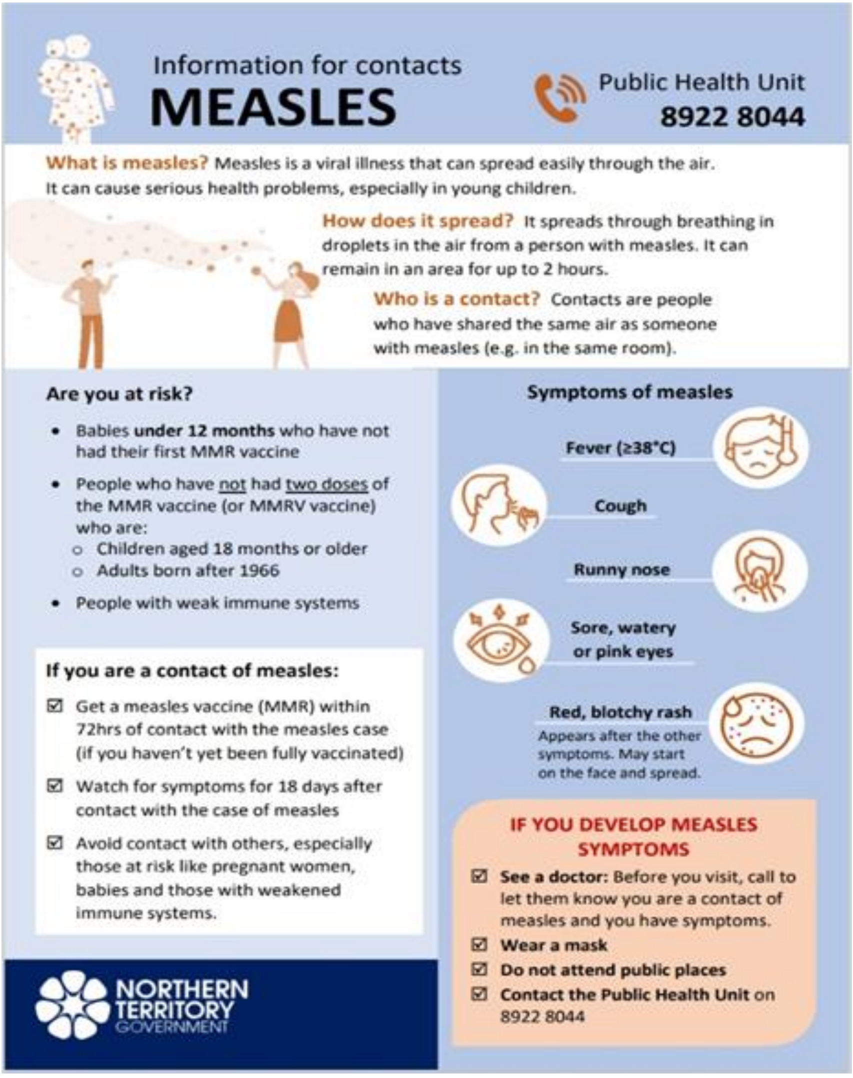
Figure 2. Screenshot of REDCap – Measles questionnaire during contact tracing



Depending on the response to the questionnaire, contacts were categorised into groups to assist with organising and prioritising the outbreak response: (1) suspected cases, (2) contacts requiring post-exposure prophylaxis, (3) contacts waiting for call back, (4) contacts unable to contact/lost to follow-up, and (5) contacts whose follow-up was complete. For telephone calls unanswered, a second text message was sent asking people to call Darwin NT CDC with an attached hyperlink to the NT Health measles factsheet (Figure 3)

Vaccination history of contacts was obtained from the Australian Immunisation Register (AIR) where possible and prepopulated to identify susceptible contacts.[8] Contacts who were considered to be susceptible to measles infection were advised to receive post-exposure prophylaxis. The provision of MMR, MMRV or NHIG was delivered at health clinics or NT CDCs according to the CDNA Measles SoNG.[4] Vaccinations and immunoglobulin was supplied by the Royal Darwin Hospital Pharmacy, co-ordinated by the immunisation staff members of the outbreak team. The CDNA Measles SoNG guidelines outline the eligibility criteria for post-exposure prophylaxis and time of first exposure to infectious case.

Figure 3. Measles factsheet – information for contacts, NT Health



Data Analysis

Data from REDCap was extracted and descriptive statistical analysis was conducted using Microsoft Excel 2016 and STATAv18. We calculated frequencies and proportions for variables including vaccination status, contact tracing, and testing outcomes.

A cost analysis was calculated retrospectively to describe the staff costs of this measles outbreak response, with Darwin NT CDC staff members' hourly rate and hours worked during the outbreak summed. While the immediate response occurred over 4 days, surveillance and remaining follow up continued up until the final date of the potential period of development of symptoms in contacts, however these follow up days were excluded from the cost analysis. Laboratory time and testing costs were not included.

Laboratory

Measles virus polymerase chain reaction (PCR) testing on clinical samples was performed at Territory Pathology, with genotyping performed at the Victorian Infectious Diseases Reference Laboratory (VIDRL).

Results

A total of 162 contacts were identified during the measles outbreak. We successfully contacted and completed follow up for 94% (153/162) of contacts identified. Of the 162 contacts overall, 84% (136/162) were defined as immune to measles with 90% (123/136) confirmed to have received 2 doses of the measles-containing vaccine; 7% (9/136) were born before 1966; and 3% (4/136) reported a previous measles infection as a child.

During the response, 90% (146/162) of contacts were provided advice only, with no further action required, 6% (9/162) were uncontactable and lost to follow up and 2% (4/162) were provided the MMR vaccine. Only 1 contact received NHIG (1/162). Testing for measles was advised and carried out for 1 contact (1/162), and a recommendation to receive the MMR vaccine given for 1 contact (1/162). Of the 9 contacts who were uncontactable or lost to follow-up, 4 were identified as having received 2 doses of the measles-containing vaccine according to their medical records; 1 had a record of only 1 dose of the MMR vaccine and 4 had no documented history of receiving a measles-containing vaccine in the medical records accessed by contact tracing staff. Outcomes resulting from public health actions are summarised in Table 1.

Table 1. Outcome summary of public health actions for contacts identified during measles outbreak response, Darwin, NT January 2025 (n=162)

Outcome	n	%
No further action – advice only	146	90
Uncontactable / lost to follow up	9	5
Given MMR[1] at CDC[2]	4	2
Advised to get MMR[1] vaccine	1	1
Given NHIG[3] at CDC	1	1
Testing for measles arranged / advised	1	1
Total	**162**	**100%**

Note: 1. Measles Mumps Rubella
2. NT Centre for Disease Control
3. Normal human immunoglobulin

There were 5 contact locations identified within the NT during the response. Contacts were ascertained from the 2 presentations to the emergency department which accounted for 78% (127/162) of identified contacts, while additional locations the case had visited when infectious included: household 9% (14/162); workplace 6% (9/162); local snack bar 2% (4/162) and a social gathering 5% (8/162).

The outbreak response took place over a weekend with a total of 8 staff including 1 medical officer, 4 nurses, 2 epidemiologists and 1 Master of Applied Epidemiology (MAE) student, working a cumulative 88 hours overtime over a total of 4 days. We estimated the measles outbreak response to have cost approximately $7,300 in Darwin NT CDC staff resources alone.

Appropriate infection prevention was undertaken when a measles diagnosis was suspected on admission to hospital. Laboratory testing reported the measles genotype D8 with sequence matching strains circulating in Indonesia, re-affirming it as an imported case. There were no secondary cases identified and no further cases notified in the NT as of 31 March 2025.

Discussion

In January 2025, a single case of measles occurred in the NT with a total of 162 contacts identified, of whom 153 (94%) were contacted and given public health advice and actions completed. There were no subsequent cases from this event. The response occurred over a weekend, with the estimated cost for performing this public health response estimated at $7300.

During previous measles outbreaks, Darwin NT CDC used NetEpi as their contact tracing database, however in February 2021 it was decommissioned by the Commonwealth. The NT CDC replaced it with REDCap and incorporated the same recording fields used in NetEpi. As part of the CDC's routine public health surveillance activities, REDCap is used daily, enhancing staff familiarity and proficiency during an outbreak response. Associated policy guidelines and procedure manuals regarding public health surveillance and response to measles is saved on a cloud-based platform (SharePoint) and made accessible to staff to support professional development, and practical guidance during an outbreak response. Following the outbreak response in 2017, regular measles response training for staff was introduced to ensure staff are adequately prepared during a measles outbreak. Our success with this approach supports an evaluation conducted by Hunter New England Health NSW in 2008 on health service capacity to manage protracted public health emergencies, which identified and recommended that staff should be familiar in their routine work with data systems that will be used during an outbreak response.[9]

To inform public health responses during an outbreak response, timely and accurate data collection is needed to inform public health responses, however during public health emergencies, staff and resources on the ground are often stressed which can impact the quality, usefulness, and completeness of collected data.[10] Data extracted from REDCap during this outbreak revealed missing data due to incomplete documentation during contact tracing. To address this challenge, implementing standardised tools to facilitate the collection of essential and consistent data entry has proven effective, such as WHO's disease-specific Outbreak Toolkits that recommend data elements for data collection, reporting and use.[11] Similarly, piloting data collection tools, and training staff in response preparedness can contribute to improving overall data quality.

Darwin NT CDC retrieved contact lists from the hospital's Infection Prevention and Control (IPC) unit. This facilitated and expanded contact tracing and also highlighted an opportunity for both units to review and streamline the timeliness of current processes for future outbreak responses. It was noted that some contact details in the medical records accessed during contact tracing were either incorrect or outdated. Routine documentation is a legal obligation and crucial for the continuity of patient care, with pubic hospital systems recommended to maintain up-to-date documentation including contact information in patient medical records.[12]

The estimated cost of this outbreak response for 1 case was $7,300 compared to $2,433 per case investigated during an outbreak in Sydney in 2011 that culminated in 26 measles cases being notified.[13] The higher cost we observed may well represent some economy of scale and efficiency that Sydney gained in their case responses over time. However, the cost of responding to a measles case was identified as far less than the cost of hospitalisations as occurred in Sydney or any potential Intensive Care Unit (ICU) admission in Australia, that can occur with measles with an average daily cost ranging from $966 to $5381 per day.[14] Also, not calculated here are those costs associated with potential loss of activity, loss of income and other costs that may be associated with serious illness and care giving.

Globally, measles cases have been increasing with a number of notable outbreaks recently occurring across the United States and European regions.[15] Strict travel restrictions imposed during the COVID-19 pandemic reduced the number of imported cases in Australia, however there have been an increasing number of internationally imported measles cases occurring across states and territories, with local transmission occurring in New South Wales and Victoria, and isolated instances occurring in Western Australia, South Australia and the Northern Territory in the first quarter of this year.[16] Setbacks in immunisation services following the pandemic have also contributed to this increase. To achieve herd immunity for infectious diseases like measles, national coverage needs to be high to prevent transmission. Australia's national vaccination coverage target for all vaccines is 95%.[17] Currently, the fully vaccinated coverage rate in Australian children 5 years of age is 93.76%, while the coverage rate for measles specifically in 2023 was 96.4%.[18] In 2023 coverage of the dose 2 of the measles-containing-vaccine for children aged 24 months of age varied across regions in the NT (81% to ≥95%).[19] It is difficult to estimate coverage of measles immunity for the population 5 years and older who were born after 1966. We do know there are under-vaccinated groups such as Australian adults born between 1966 and 1994 who were initially only recommended 1 dose of the measles-containing vaccine who were later targeted for a recommended 2nd dose in a catch-up program which they may or may not have received. Additionally, there are NT residents and citizens born overseas who may not have been offered or obtained a 2-dose schedule of a measles-containing vaccine.

The global resurgence in measles and regular international travel into Australia increases the risk of local transmission and highlights the need to improve and ensure timely and more complete vaccine uptake.[15] In response to this current resurgence of measles, public health and primary care services across Australia's jurisdictions are frequently updating and disseminating measles health alerts, educational resources and following the CDNA Measles SoNG regarding the diagnosis and management of measles to prevent sustained local transmission. As demonstrated by Darwin NT CDC, an efficient and timely public health response to a single imported case of measles is a priority and needed to prevent ongoing transmission of the virus. Key factors contributing to this systematic public health response included laboratory timeliness for positive PCR notification, staff preparedness training in measles response, accessibility to online resources and staff familiarity with electronic management systems (i.e. REDCap, TIM).

Conclusion

This measles outbreak response highlights the importance of a rapid, co-ordinated response and herd immunity. The response was critical to preventing transmission of measles, and subsequent outbreak containment, and highlighted the value of using familiar online databases, accessible staff resources and preparedness training. This overall preparedness facilitated a co-ordinated approach within only a small outbreak management team of 8 staff members and reduced costs.

The use of low-cost technologies such as TIMs, also proved to be effective for the efficiency of contact tracing activities and was advantageous in providing a simple method for distributing public health information. With structured and streamlined outbreak response infrastructure, this measles outbreak investigation reinforces the crucial role public health surveillance and response plays in an effective and efficient measles outbreak response. This outbreak investigation is a timely reminder of the need for high childhood vaccination coverage as well as the need for catch-up vaccination in other groups that are non-immune. It reminds all travellers of the need for measles immunity and reinforces the importance of maintaining herd immunity as a most effective public health strategy in maintaining measles elimination in Australia.

References

1. Centers for Disease Control and Prevention. About Measles [Internet]. Measles (Rubeola). 2024 [cited 2025 Feb 10]. Available from: https://www.cdc.gov/measles/about/index.html
2. World Health Organization. Measles [Internet]. [cited 2025 Feb 10]. Available from: https://www.who.int/news-room/fact-sheets/detail/measles
3. Gavi, the Vaccine Alliance. The story of measles in five charts [Internet]. [cited 2025 Mar 4]. Available from: https://www.gavi.org/vaccineswork/story-measles-five-charts
4. Australian Government Department of Health. Measles: CDNA National Guidelines for Public Health Units [Internet]. [cited 2025 Mar 24]. Available from: https://www.health.gov.au/sites/default/files/documents/2020/02/measles-cdna-national-guidelines-for-public-health-units.pdf
5. Australian Government Department of Health and Aged Care. Measles | The Australian Immunisation Handbook [Internet]. 2025. Available from: https://immunisationhandbook.health.gov.au/contents/vaccine-preventable-diseases/measles
6. Ramsay N, Sidhu H, Waters EK. Mathematics for medical practitioners and patients: Understanding how vaccines work for the community. *Aust J Gen Pract*. 2020 May 1;49(5):293–4.
7. NewsGP. Darwin measles outbreak 'over' [Internet]. [cited 2025 Mar 4]. Available from: https://www1.racgp.org.au/newsgp/clinical/darwin-measles-outbreak-'over'
8. Services Australia. Australian Immunisation Register - Services Australia [Internet]. Available from: https://www.servicesaustralia.gov.au/australian-immunisation-register
9. Eastwood K, Durrheim D, Massey P, Kewley C. Hunter New England Health XFG Pandemic Influenza Exercise, 22–26 September 2008: Interim Exercise Report [Internet]. Wallsend (NSW): Hunter New England Area Health Service; 2008 Dec. Available from:

https://www.health.nsw.gov.au/pandemic/Documents/HNEH-XFG.pdf

10. Perrocheau A, Brindle H, Roberts C, Murthy S, Shetty S, Martin AIC, et al. Data collection for outbreak investigations: process for defining a minimal data set using a Delphi approach. *BMC Public Health.* 2021 Dec 13;21:2269.
11. World Health Organization. Measles Outbreak Toolbox [Internet]. Available from: https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes/measles-outbreak-toolbox
12. Demsash AW, Kassie SY, Dubale AT, Chereka AA, Ngusie HS, Hunde MK, et al. Health professionals' routine practice documentation and its associated factors in a resource-limited setting: a cross-sectional study. *BMJ Health Care Inform.* 2023 Feb 16;30(1):e100699.
13. Flego KL, Belshaw DA, Sheppeard V, Weston KM. Impacts of a measles outbreak in western Sydney on public health resources. *N S W Public Health Bull.* 2013;37(3).
14. Carrandi A, Liew C, Maiden MJ, Litton E, Taylor C, Thompson K, et al. Costs of Australian intensive care: A systematic review. *Crit Care Resusc.* 2024 Jun 1;26(2):153–8.
15. NewsGP. Is measles making a comeback in Australia? [Internet]. Available from: https://www1.racgp.org.au/newsgp/clinical/is-measles-making-a-comeback-in-australia
16. CDC Australia. Snapshot [Internet]. Available from: https://www.cdc.gov.au/newsroom/news-and-articles/measles-australia-and-our-strong-vaccination-record
17. Australian Government Department of Health and Aged Care. Childhood immunisation coverage [Internet]. 2025. Available from: https://www.health.gov.au/topics/immunisation/immunisation-data/childhood-immunisation-coverage
18. National Centre for Immunisation Research and Surveillance. Vaccination coverage in children [Internet]. Available from: https://ncirs.org.au/annual-immunisation-coverage-report-2023-summary/vaccination-coverage-children
19. National Centre for Immunisation Research and Surveillance. NCIRS Annual Immunisation Coverage Report 2023 [Internet]. Available from: https://ncirs.org.au/sites/default/files/2024-10/NCIRS%20Annual%20Immunisation%20Coverage%20Report%202023.pdf

Top of the Document

Media and health alerts issued January to March 2025

Public health alerts were issued on Measles and Syphilis by the NT Centre for Disease Control (CDC) from January to March 2025. Below are excerpts from these alerts, noting some may no longer be active at the time of publishing this issue. The full Syphilis alert is available on the following page. Current and previous health alerts can be viewed at the NT Health website.

Syphilis

An outbreak of infectious syphilis has been ongoing in the NT since 2013, with a total of 2,377 cases now notified.

Communities on Groote Eylandt and nearby areas have been reporting increased infectious syphilis cases since September 2024, mainly in the 15-24 year age group. 12 of these cases were notified in the 6 months up to February 2025, compared to 3 cases notified in the same period the year prior.

Read the full alert issued 17 February 2025

Measles

A confirmed case of measles has been notified to the NT Centre for Disease Control (CDC) in an adult who had travelled recently to Indonesia.

Measles is a highly infectious viral illness, which is spread by breathing in air droplets.

There are ongoing outbreaks of measles in multiple countries across south-east Asia, and this case is the 7th case notified in recently returned travellers in Australia since 1 January 2025

Read the full alert issued 3 February 2025

Infographic - Get vaccinated against measles. WHO

NORTHERN TERRITORY GOVERNMENT

Centre for Disease Control

NT HEALTH

⚠ Public Health Alert

Issued: 17 February 2025
Issued to: Health Staff, NT Wide

Increase in syphilis cases on Groote Eylandt

Epidemiology

- An outbreak of infectious syphilis has been ongoing in the NT since 2013, with a total of 2,377 cases now notified.
- Communities on Groote Eylandt and nearby areas have been reporting increased infectious syphilis cases since September 2024, mainly in the 15-24 year age group.
- 12 of these cases were notified in the 6 months up to February 2025, compared to 3 cases notified in the same period the year prior.
- It is very likely that undiagnosed infectious syphilis cases are present in this area, posing an increased risk of further transmission.

About

- Common presentations of infectious syphilis in adults include painless oral, ano-genital ulcer/s (occasionally painful), regional lymph node enlargement, rashes that can involve palms and soles, patchy hair loss, fever, sore throat and fleshy lesions resembling genital warts, ocular involvement and elevated liver enzymes.
- Untreated syphilis can have devastating consequences in pregnancy, leading to miscarriage, stillbirth, neonatal death, low birth weight and congenital syphilis.
- Congenital syphilis, a preventable condition, is caused by untreated maternal syphilis infection and can lead to serious lifelong sequelae and death.

Clinical management

- Treat all symptomatic people and contacts with:
  - **Benzathine penicillin 2.4 million units IM stat (2 pre-filled syringes)**
- Perform syphilis/HIV serology at the same time but do not wait for serology results to commence treatment.
- Collect dry swabs from all genital ulcers/lesions for Syphilis PCR (NAAT).
- If Point of Care Test (POCT) is positive for syphilis with no previous positive serology, **treat immediately** and perform syphilis/HIV serology.

Centre for Disease Control
Public Health Division
(08) 8922 8044 or 1800 008 002
CDCSurveillance.DARWIN@nt.gov.au

Testing

- **At least 1 full STI screen is required each year for all sexually active heterosexual people under the age of 35 years** that includes testing for chlamydia, gonorrhoea, trichomoniasis, syphilis and HIV.
- A **full STI screen** should also be offered when a person has any of the following:
  - STI symptoms
  - a positive STI test
  - is a contact of a STI case
  - has a new sexual partner
  - if a STI check is requested
- **Antenatal screening for all pregnant people** in the NT should include testing for syphilis at least **3 times** during pregnancy: 1) first visit, 2) 28 weeks, and 3) 36 weeks or at birth.
- **Aboriginal woman who live in outbreak affected regions** require **5 antenatal syphilis screens** at: 1) first visit, 2) 28 weeks, 3) 36 weeks, 4) at birth, and 5) 6 weeks postnatal.

Public health management

- Actively follow up contacts/request clients to inform sexual partners and encourage them to attend for testing and treatment.

Contact & advice

- Please call the NT Syphilis Register **(Darwin 8922 7818 / Alice Springs 8951 7552)** for the interpretation of Syphilis serology results and treatment history.
- You can also refer to the ASHM Decision Making in Syphilis resource.

View all CDC units NT wide: Centre for Disease Control contacts | NT Health

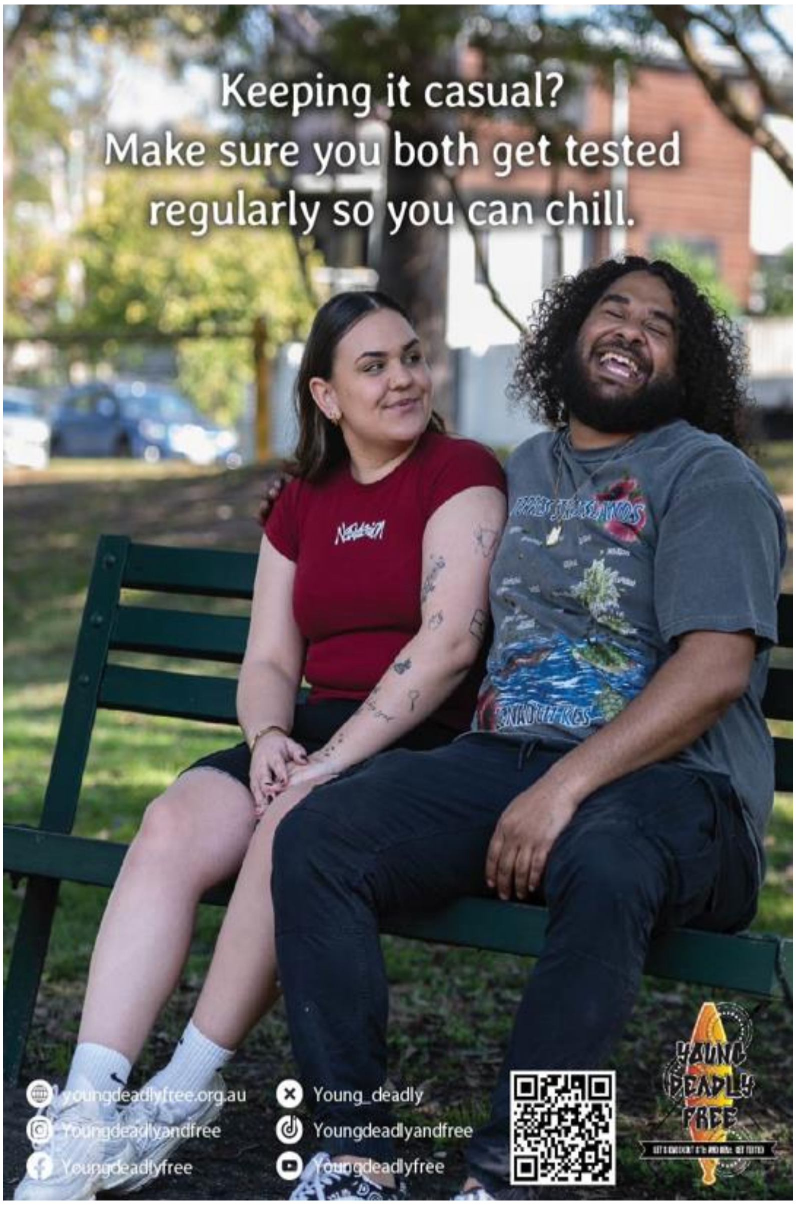
Scan below for more on Public Health Alerts

Issued by:

Dr Vicki Krause, Director, Centre for Disease Control, Public Health Division, NT Health

Dr Manoji Gunathilake, Head of Sexual Health and Blood Borne Virus Unit, Centre for Disease Control, Public Health Division, NT Health

Centre for Disease Control
Public Health Division
(08) 8922 8044 or 1800 008 002
CDCSurveillance.DARWIN@nt.gov.au



Remember to Test

- At least 1 full STI screen is required each year for all sexually active heterosexual people under the age of 35 years that includes testing for chlamydia, gonorrhoea, trichomoniasis, syphilis and HIV.
- A full STI screen should also be offered when a person has any of the following:
  - STI symptoms
  - a positive STI test
  - is a contact of a STI case
  - has a new sexual partner
  - if a STI check is requested
- Antenatal screening for all pregnant people in the NT should include testing for syphilis at least 3 times during pregnancy: 1) first visit, 2) 28 weeks, and 3) 36 weeks or at birth.
- Aboriginal women who live in outbreak affected regions require 5 antenatal syphilis screens at: 1) first visit, 2) 28 weeks, 3) 36 weeks, 4) at birth, and 5) 6 weeks postnatal.

Immunisation coverage in the Northern Territory

Northern Territory immunisation data is accessible from the Australian Government website. The following link provides tables of the latest annualised quarterly report on childhood immunisation coverage from the Australian Government Department of Health and Aged Care, which combines the December, March, June and September quarters for NT and Australia.

The data show the proportion of children fully immunised at one, two and five years of age according to the National Immunisation Program Schedule

Northern Territory disease notifications by onset date and district – 1 January to 31 December (2023 and 2024)

	Alice Springs		Barkly		Darwin		East Arnhem		Katherine		N T	
	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024
Acute Post Strep GN	7	5	4	1	22	11	3	3	5	5	41	25
Adv Vacc Reaction	3	3	2	0	20	9	1	1	2	1	28	14
Amoebiasis	0	0	0	0	0	3	0	1	0	1	0	5
Barmah Forest	1	1	0	1	3	3	2	0	0	1	6	6
Campylobacteriosis	63	41	5	8	237	199	10	5	23	15	338	268
Chickenpox	11	4	0	0	47	40	3	8	16	3	77	55
Chikungunya	0	0	0	0	0	4	0	0	0	1	0	5
Chlamydia	997	1,119	147	127	1,392	1,400	207	119	340	277	3,083	3,042
Chlamydial conj	0	0	0	0	3	5	0	0	2	0	5	5
CJD	1	0	0	0	0	1	0	0	0	0	1	1
COVID-19	606	517	43	69	2,326	1,878	115	170	125	200	3,215	2,834
Crusted scabies	15	12	6	4	36	42	13	25	11	13	81	96
Cryptosporidiosis	8	31	3	6	164	43	10	4	2	1	187	85
Dengue	2	1	0	0	18	52	0	3	1	1	21	57
Diphtheria	0	0	0	0	1	0	0	0	0	0	1	0
Food/water borne dis	0	0	0	0	0	0	0	0	0	0	0	0
Gastro - related cases	0	0	0	0	0	0	0	0	0	0	0	0
Gonococcal conj	0	1	1	0	1	1	0	0	0	0	2	2
Gonococcal infection	1,165	1,203	139	119	739	670	149	98	316	261	2,508	2,351
Gonococcal neon ophth	0	1	1	0	0	0	0	0	0	0	1	1
Group A strep invasive	29	23	13	14	59	58	9	10	20	13	130	118
Hepatitis A	0	0	0	0	0	0	0	0	0	0	0	0
Hepatitis B - chronic	0	1	0	1	0	6	0	9	0	1	0	18
Hepatitis B - new	1	0	1	0	1	3	0	0	1	0	4	3
Hepatitis B - unspec	12	16	1	1	67	108	8	11	6	6	94	142
Hepatitis C - new	1	3	0	0	0	4	0	0	0	1	1	8
Hepatitis C - unspec	26	13	2	2	66	63	2	3	3	4	99	85
Hepatitis D	0	1	1	0	0	1	0	0	0	0	1	2
H Influenzae b	1	0	1	0	1	0	0	0	0	0	3	0
H Influenzae non-b	3	5	0	1	5	7	3	0	1	1	12	14
HIV	7	11	1	2	15	19	0	1	1	1	24	34
HTLV1 adult TCL	1	1	0	0	1	0	0	0	0	0	2	1
HTLV1 asyptom/unspec	80	41	2	5	6	3	0	0	4	3	92	52
HUS	0	0	0	0	1	0	0	0	0	0	1	0
Influenza	852	1,036	109	121	1,155	1,788	406	385	348	157	2,870	3,487
Japanese Encephalitis	0	0	0	0	0	0	0	0	0	0	0	0
Kunjin Virus	0	0	0	0	0	0	0	0	1	0	1	0
Lead - elevated	0	2	1	1	333	187	8	10	10	6	352	206
Legionellosis	0	0	0	0	4	3	0	2	0	0	4	5
Leprosy	0	0	0	0	0	0	0	1	0	0	0	1
Leptospirosis	0	0	0	0	4	5	0	0	4	1	8	6
LGV	0	0	0	0	0	3	0	0	0	0	0	3

(Table continued next page)

	Alice Springs		Barkly		Darwin		East Arnhem		Katherine		N T	
	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024
Listeriosis	0	0	0	0	2	1	0	0	0	0	2	1
Malaria	1	0	0	2	7	12	0	1	0	0	8	15
Melioidosis	1	2	0	2	52	59	10	6	4	9	67	78
Meningococcal infection	1	1	0	0	2	1	0	0	0	0	3	2
Mpox virus infection	0	0	0	0	0	4	0	0	0	0	0	4
Mumps	0	0	0	0	1	4	0	0	0	0	1	4
MVE	1	0	1	0	3	0	0	0	3	0	8	0
Non TB Mycobacteria	2	1	0	0	21	12	1	0	0	0	24	13
Ornithosis	0	0	0	0	1	0	0	0	0	0	1	0
Paratyphoid	0	0	0	0	2	0	0	0	0	0	2	0
Pertussis	0	32	0	7	3	69	0	1	0	9	3	118
Pneumococcal disease	25	28	14	6	32	20	1	0	5	10	77	64
Q Fever	0	2	0	0	1	2	0	0	0	0	1	4
Rheumatic Fever	102	67	18	24	43	51	21	25	21	25	205	192
Rheumatic heart disease	35	51	2	13	29	40	13	11	22	12	101	127
Ross River Virus	2	2	2	2	48	54	10	1	7	8	69	67
Rotavirus	67	28	18	13	100	70	14	10	11	9	210	130
RSV infection	220	407	30	78	256	969	82	133	34	200	622	1,787
Salmonellosis	37	47	13	27	262	331	16	12	38	41	366	458
Shigellosis	70	36	14	10	51	39	18	19	23	5	176	109
STEC/VTEC	1	0	2	0	3	0	1	0	0	1	7	1
Syphilis < 2y duration	123	98	19	11	46	99	2	27	35	53	225	288
Syphilis > 2y or unk duration	17	14	1	2	18	38	4	1	4	15	44	70
Syphilis congenital	2	0	0	0	0	0	0	0	0	0	2	0
Trichomoniasis	936	1,001	208	194	1,255	1,152	405	342	430	381	3,234	3,070
Tuberculosis	2	4	0	0	21	24	0	1	5	5	28	34
Typhoid	1	1	0	0	5	3	0	0	0	0	6	4
Typhus	0	0	0	0	2	0	0	1	0	0	2	1
Varicella - unspec	24	14	1	4	85	53	6	6	11	6	127	83
Vibrio food poisoning	0	0	0	0	3	3	0	0	0	0	3	3
Vibrio invasive	0	0	0	0	0	0	0	1	0	0	0	1
Vibrio parahaemolyticus infection	0	0	0	0	0	0	0	0	0	0	0	0
Yersiniosis	8	2	0	0	30	23	0	0	2	2	40	27
Zika	0	0	0	0	0	4	0	0	0	0	0	4
Zoster	56	57	9	7	275	331	14	24	20	19	374	438
Sum:	**5,626**	**5,987**	**835**	**885**	**9,386**	**10,087**	**1,567**	**1,491**	**1,917**	**1,784**	**19,331**	**20,234**

Dengue notifications for October to December 2024

Number of cases	Origin of infection	NT Region notified
7	Indonesia (3), Cambodia (1), India (1), Nepal (1), Timor-Leste (1)	Darwin
1	Nepal (1)	East Arnhem

Malaria notifications for October to December 2024

Number of cases	Origin of infection	Agent	Chemoprophylaxis	NT Region
1	Solomon Islands	*Plasmodium vivax*	Nil	Darwin
1	Papua New Guinea	*Plasmodium ovale*	Nil	Darwin
1	Uganda	*Plasmodium falciparum*	Nil	Darwin

NT HEALTH SYPHILIS OUTBREAK RESPONSE

New syphilis testing recommendations for the NT:

- Increased syphilis testing for ALL pregnant people to 5 times (first visit, 28 weeks, 36 weeks, at birth, and at 6 weeks postnatal), and
- Syphilis testing for ALL people aged 15 years and over presenting to ANY health service, including NT Health primary health care, ACCHOs, Emergency Departments, Prison Health, private GP practices.

The Northern Territory (NT) syphilis outbreak was declared in 2013. As of 31 March 2025, there have been 2,428 cases of syphilis.

On 28 February 2025, the NT Health Chief Health Officer (CHO) commissioned the standing up of the Syphilis Incident Management Team (IMT) in response to the ongoing infectious syphilis outbreak acknowledging rising notification rates and cases appearing in previously lower incidence geographical regions of the NT.

The Syphilis Outbreak IMT recommended implementing simplified and consistent testing recommendations to increase syphilis testing and diagnosis. The updated recommendations have been supported by the CHO, Chief Medical Officer, Chief Aboriginal Health Practitioner and Chief Nursing and Midwifery Officer. As these recommendations differ slightly from existing guidelines, two letters are now circulating to communicate these changes.

We have started to implement increased syphilis testing in emergency departments. To help clinicians needing support, the syphilis register has introduced an after-hour service.

For any questions please contact Syphilis.IMTDOH@nt.gov.au

Syphilis Register After Hours

Operators are now available during extended hours:

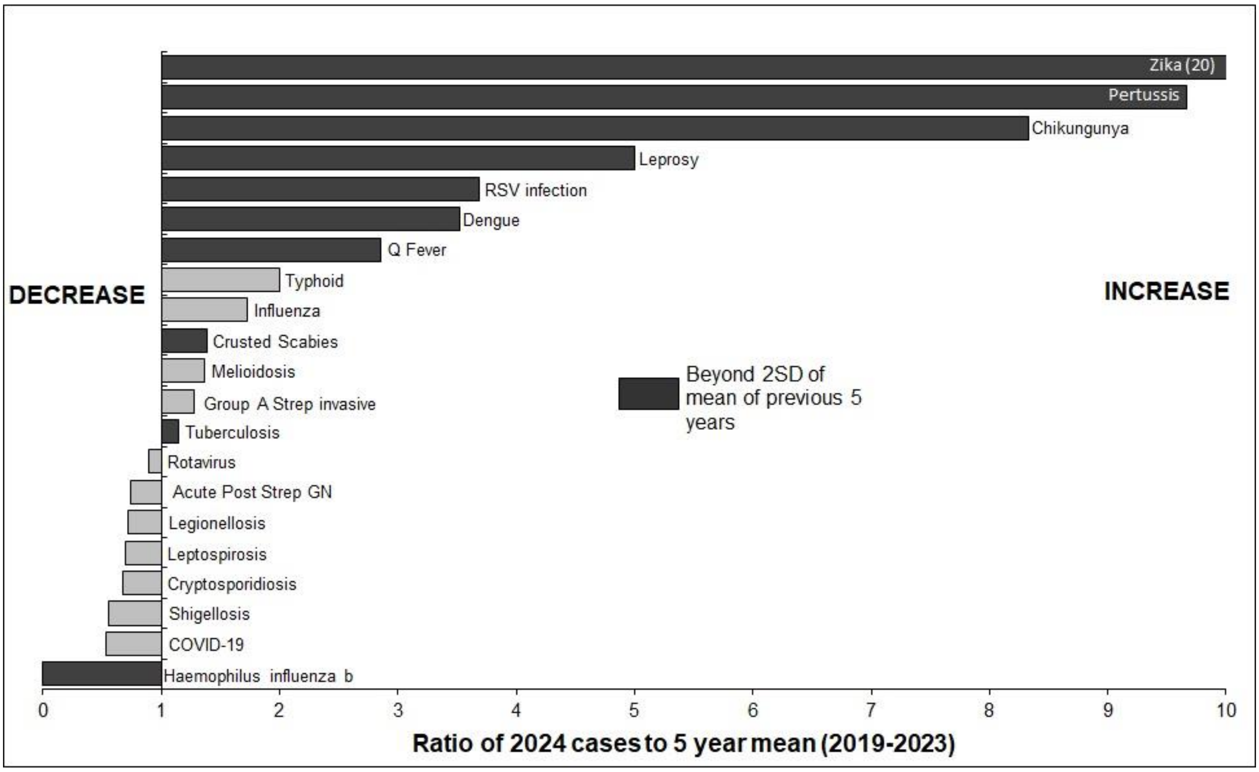
- Weekdays: 5:00 PM – 9:00 PM
- Weekends: 9:00 AM – 9:00 PM

To contact, call **Royal Darwin Hospital switchboard** at **(08) 8922 8888** after hours.

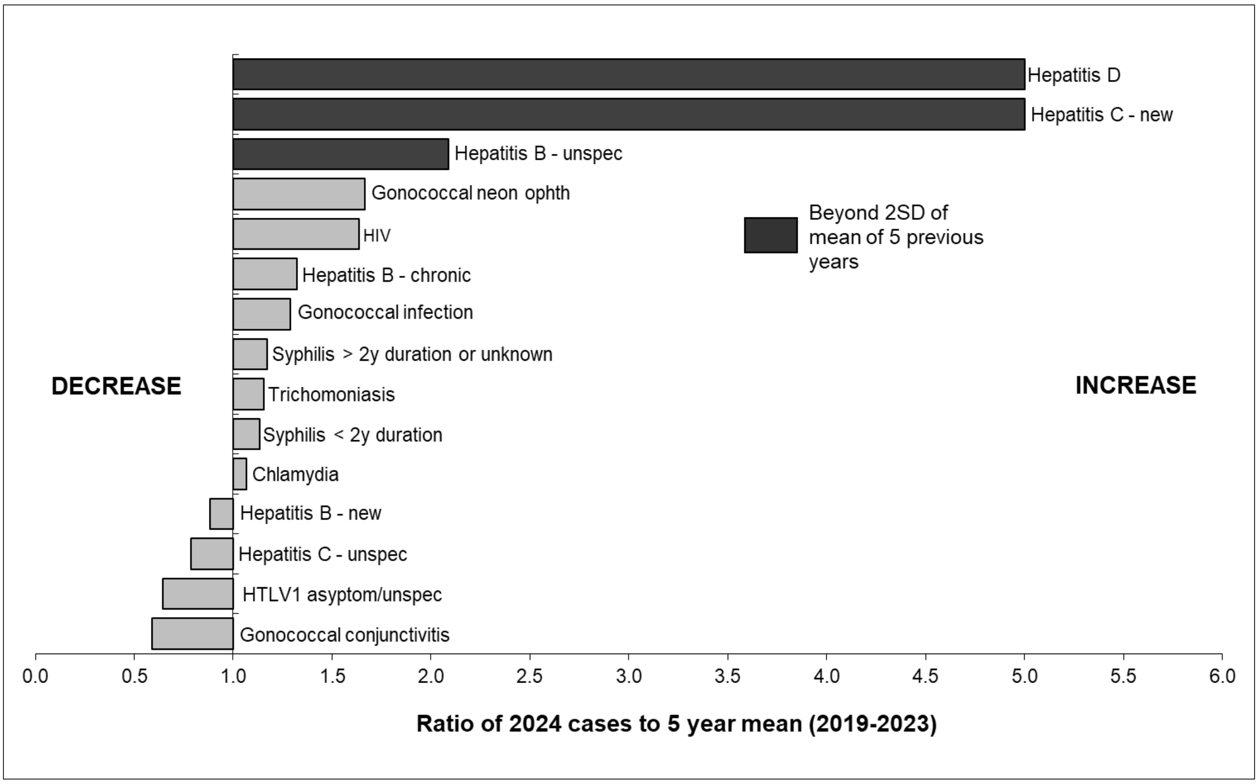
Top of the Document

Graphs of selected diseases and STIs –2024

Ratio of the number of notifications in 2024 to the 5 year mean (2019 – 2023): Selected diseases



Ratio of the number of notifications in 2024 to the 5 year mean (2019 – 2023): Sexually transmitted infections



Comments on selected disease notifications

Amoebiasis

There were 5 notifications of amoebiasis in 2024 which was the most received in a single year. The last amoebiasis case was diagnosed in 2018. All 5 people acquired their infections from overseas; 2 from India, 2 from Indonesia and 1 from Thailand, and 3 (60%) had extra-intestinal spread in the form of liver abscesses. Amoebiasis is not represented on the graph of selected diseases (pg. 34) as no cases were expected based on the previous 5-year mean.

Dengue

There were 57 notifications of dengue virus infection in 2024 compared to the previous 5-year mean of 16 cases per year. All cases acquired their infection overseas. Dengue is not endemic in the NT although the primary vector, *Aedes aegypti*, has been detected in Tennant Creek and is undergoing elimination measures. The majority of the cases (43/57, 75%) acquired their infection in Indonesia with 39 of the 43 cases acquiring their infection in Bali, 4 cases acquired their infection in Timor-Leste, 4 in the Philippines, 3 in Nepal, 1 in Cambodia, 1 in India, and 1 in Thailand.

Zika virus infection

There were 4 notifications of Zika virus infection in 2024 compared to the previous 5-year mean of 0.2 cases per year. The last case was notified in 2019. Zika is not endemic in the NT noting the primary vector is the same as for Dengue, *Aedes aegypti*. Timor-Leste was the place of acquisition for 2 of the cases and 1 case acquired their infection in Bali, Indonesia. There was a locally acquired case in the NT that was assessed to be sexually acquired from 1 of the cases who returned from Timor-Leste. This likely represents the first documented incidence of sexually transmitted Zika virus in Australia and is described in the previous edition of the *Northern Territory Disease Control Bulletin*.

Chikungunya

There were 5 notifications of chikungunya in 2024 compared to the previous 5-year mean of 0.6 cases per year. Chikungunya is not endemic in the NT noting the primary vector is the same as for Dengue and Zika, *Aedes aegypti*. The majority (4) of the cases acquired their infection in Timor-Leste where an outbreak was occurring and 1 case acquired their infection in Bali, Indonesia.

Pertussis

There were 118 notifications of pertussis in 2024 compared to the previous 5-year mean of 12 cases per year. Australia experienced its highest annual incidence of pertussis on record with over 57,000 cases notified in 2024.

Tuberculosis

There were 34 notifications of tuberculosis in 2024, which was 1.1 times higher than the previous 5-year mean of 30 notifications per year.

Leprosy

There was 1 notification of leprosy in 2024, compared to the previous 5-year mean of 0.2 notifications per year. The case was locally acquired with the last locally acquired leprosy case being notified in 2016.

Crusted Scabies

There were 96 notifications of crusted scabies in 2024, which was 1.4 times higher than the previous 5-year mean of 69 notifications per year.

Respiratory syncytial virus (RSV) infection

There were 96 notifications of respiratory syncytial virus (RSV) infection in 2024, which was

3.7 times higher than the previous 5-year mean of 485 notifications per year.

Haemophilus influenza b

There were no notifications of *Haemophilus influenza* b in 2024 compared to the previous 5-year mean of 2.8 notifications per year.

Q fever

There were 4 notifications of Q-fever in 2024, which was 2.9 times higher than the previous 5-year mean of 1.4 notifications per year. One case was an abattoir worker who was also diagnosed with leptospirosis. Risk factors were not able to be identified for the other 3 cases, but all worked/lived in rural areas.

Hepatitis D

There were 2 notifications of hepatitis D in 2024 compared to the previous 5-year mean of 0.4 notifications per year. Both likely acquired their infection overseas.

Mpox infection

There were 4 notifications of mpox in 2024 – these were the first cases of mpox notified in the NT. Mpox is not represented on the STI graph (pg. 34) as no cases were expected based on the previous 5-year mean. Of the 4 cases, 1 acquired their infection in Nigeria, 2 interstate and 1 locally. There was no onward spread. Case numbers of mpox have decreased across Australia since September 2024.

Hepatitis B (unspecified)

There were 142 notifications of hepatitis B (unspecified) in 2024, which was 2.1 times higher than the previous 5-year mean of 68 notifications per year. The majority of hepatitis B cases in 2024 likely acquired their infection overseas. There were fewer notifications of hepatitis B during 2021-2022 possibly due to COVID-19 travel restrictions in place at the time.

Hepatitis C (new)

There were 8 notifications of hepatitis C (new) in 2024, which was 5 times higher than the previous 5-year mean of 1.6 notifications per year. Of the 8 cases, 2 likely acquired their infection overseas, 2 interstate, 2 locally, and 2 had an unidentified source of exposure.

Lymphogranuloma venereum (LGV)

There were 3 notifications of LGV in 2024, which was 7.5 times higher than the previous 5-year mean of 0.4 notifications per year. Of the 3 cases of LGV, 2 were caused by the L2 serovar of *Chlamydia trachomatis*, and 1 had an unknown serovar.

For the 3 cases of LGV in 2024, 1 acquired the infection in Bali Indonesia/Overseas, 1 in New South Wales/Interstate and 1 the place of acquisition was unknown.

Top of the Document

NT Health Fact sheet

Measles

What is measles?

Measles is a highly infectious viral illness, which can cause serious disease. Measles is now uncommon in Australia because of high levels of immunisation. Since 2000 each year in Australia case numbers of measles have ranged from 10 to 340, with almost all identified in travellers or linked to returned travellers. In the Northern Territory since 2000 there have been 0 to 54 cases per year with the global interruption of childhood immunisation programs due to the ongoing COVID-19 pandemic, there have been increasing cases of measles reported worldwide.

How is it spread?

Measles is spread by breathing in airborne droplets from the coughs and sneezes of people infected with the disease. Measles is one of the most highly infectious communicable diseases. In Australia most measles infection originates from returned overseas travellers or from foreign visitors who can then spread the infection to non-immune individuals.

Who is at risk?

People who are not immune either by vaccination or previous infection are at risk of measles infection.

Signs and symptoms

The symptoms of measles are fever, cough, runny nose and sore eyes, which usually occur about 7 to 10 days (but may take up to 21 days) after exposure to a case followed by a red, blotchy rash 2 to 4 days later. The rash starts on the face and spreads down the body. Up to a third of people with measles will experience a complication. Complications are more common in young children and in adults. Complications include ear infections, diarrhoea and pneumonia, and may require hospitalisation. About one in every 1000 people with measles develops encephalitis (infection of the brain).

Infectious period

A person with measles is infectious from 24 hours before the onset of the first symptoms until 4 days after the appearance of the rash. A person is most infectious in the 24 hours before the rash appears and therefore before measles is suspected.

Prevention

The best protection against measles infection is vaccination and people should receive 2 measles-containing vaccines. In Australia the vaccine is available as a combination vaccine containing measles-mumps-rubella (MMR) or measles-mumps-rubella-varicella (MMRV). All children are currently recommended to get vaccinated for measles at 12 and 18 months of age as part of the National

Immunisation Program. Infants can be vaccinated against measles from six months of age if traveling overseas, or when an outbreak happens, but will still need two more doses at 12 months and 18 months.

People who were born before 1966 were most likely exposed to measles and are considered immune. All people who were born after 1966 should have evidence of either receiving 2 measles containing vaccines or evidence of having had the disease (by a blood test). It is important for all overseas travellers to ensure that they are immune to measles.

No measles-containing vaccine should be given during pregnancy or to women contemplating pregnancy. Pregnancy should be avoided for 28 days after vaccination.

Disease in non-immune people exposed to measles can be prevented by administration of a measles-containing vaccine if given within 3 days of exposure, or by administration of immunoglobulin within 7 days of exposure for people with high risk of complications from measles. See the Measles contact information fact sheet.

Treatment

There is no specific treatment for measles. People with measles should have plenty of fluids and rest and treat symptoms as they occur. While the person remains infectious it is important that they stay at home to reduce the risk of spreading the disease to other people.

Where can I get vaccinated?

The free vaccine is available from your community health centre, Aboriginal medical service and most general practitioners.

How is measles controlled?

People who have measles should stay at home until they are no longer infectious which is usually 4 days after the onset of the rash. Doctors, hospitals, laboratories, schools and childcare centres must notify cases of measles to the local Centre for Disease Control. This is so that people at risk of infection can be identified and control measures can be implemented to prevent further spread of the virus.

Related information

Measles contact information

Contact

For more information contact the Public Health Unit's Centre for Disease Control in your region.

The full list of contacts of contacts can be found at NT Health.

Location	Address	Phone	Fax	Email
Darwin	Ground Floor, Building 4 Royal Darwin Hospital Rocklands Drive Tiwi NT 0810	(08) 8922 8044 1800 008 002	(08) 8922 8310	CDCSurveillance.DARWIN@nt.gov.au
Katherine	O'Keef House Katherine Hospital Gorge Road Katherine NT 0850	(08) 8973 9049	(08) 8973 9048	CDC.Katherine@nt.gov.au
Tennant Creek	Schmidt Street Tennant Creek NT 0860	(08) 8962 4259	(08) 8962 4420	CDC.Barkly@nt.gov.au
Alice Springs	Disease Control Unit Lower Ground Floor Eurilpa House, 25 Todd Street Alice Springs NT 0870	(08) 8951 7540	(08) 8951 7900	CDC.alicesprings@nt.gov.au
Nhulunbuy	Corner Mathew Flinders Way and Chesterfield Court Nhulunbuy NT 0880	(08) 8987 0357	(08) 8987 0500	CDCGove.DoH@nt.gov.au

PGC ID: HEALTHINTRA-1627664142-59633	TRM ID: EDOC2023/98686	
Version: Version: 4.0 DO NOT EDIT THIS	Approved Date: 3/12/2023	Review Date: 3/12/2028

Abstracts from peer reviewed published articles related to the Northern Territory

An outbreak of *Salmonella* Muenchen gastroenteritis after consuming wild hunted kangaroo, Northern Territory, Australia, 2024

Draper A DK, Gerrell J, McKay S, Forrester J, Ordonez A, Meumann E, Baird R, Menouhos D, Basnet M, Creeper T, Max Cummins M, Krause V

Commun Dis Intell (2018). 2025 Feb 19:49.
DOI: 10.33321/cdi.2025.49.010

An outbreak of salmonellosis occurred in August 2024 after consuming wild hunted kangaroo in a remote area of the Northern Territory (NT), Australia. We conducted an outbreak investigation via telephone and face-to-face interviews, using a standardised questionnaire that recorded symptoms and exposures to foods and activities prior to onset of symptoms. A confirmed outbreak case was defined as anyone with laboratory confirmed *Salmonella* Muenchen infection who was part of a group of people who shared meals on 25-26 August 2024. A probable outbreak case was defined as anyone who was part of a group of people who shared meals on 25-26 August 2024 and subsequently experienced diarrhoea, in the absence of a laboratory test. Of the seven members of the group who shared meals, all became ill (attack rate 100%); three were confirmed cases and four were probable cases. The median age was 32 years (range 23-65 years); six (86%) were male. The median incubation period was 24 hours (range 6-30 hours). The most commonly reported symptoms were diarrhoea (100%, 7/7) and abdominal pain (86%, 6/7). Two cases were admitted to hospital, both for an overnight stay; all recovered. All seven cases consumed the same meal - a single, locally hunted and butchered kangaroo. Contamination likely occurred due to unsafe butchering, storage, transportation and insufficient cooking of the meat. This outbreak highlights the risks of contamination of game meat (in this case kangaroo) with *Salmonella*. Those preparing hunted meat should wash hands and knives regularly while butchering an animal to avoid contamination; should store butchered meat below 5 °C to avoid bacterial growth and cook foods thoroughly to kill microbes. We estimate that the cost to society of this outbreak was 9,810 Australian dollars.

Keywords: Salmonella Muenchen; foodborne disease; gastroenteritis; hunting; kangaroo; outbreak; salmonellosis.

Tick tock: the travelling time bomb

Martin M AK, Olenski M E

MJA First published: 25 February 2025
https://doi.org/10.5694/mja2.52615

This report of an imported case of *babesiosis* diagnosed in Darwin, NT, Australia in a male on holiday visiting from the USA was reported in lessons from practice with following summary:

Lessons from practice

- Fever in the arriving traveller can present as much a diagnostic challenge as fever in the returned traveller and requires similar application of an epidemiological and exposure lens relevant to the place of origin.
- Babesiosis is a tick-borne protozoal infection that presents as a non-specific febrile illness, with diagnosis largely hinging on the presence of intra-

erythrocytic parasites seen on blood film examination.

- As co-infection is not uncommon and more specific diagnostics are not readily available, babesiosis treatment typically consists of atovaquone and azithromycin with empirical doxycycline for additional cover if other tick-borne diseases have yet to be definitively excluded.
- Malaria should always be considered in the differential diagnosis for patients with a febrile illness and a compatible travel history and, given the potentially catastrophic consequences of missing severe malaria, empirical intravenous artesunate may be warranted.

18-Fluorine-Fluorodeoxyglucose Positron Emission Computer Tomography Imaging in Melioidosis: Valuable but Not Essential

Bramwell J, Kovaleva N, Morigi JJ, Currie BJ

Trop. Med. Infect. Dis. 2025, 10(3), 69; https://doi.org/10.3390/tropicalmed10030069

Melioidosis is an endemic tropical disease caused by *Burkholderia pseudomallei*. It typically causes pulmonary disease and bacteraemia but can disseminate to cause multi-organ disease. 18-F FDG PET/CT has an evolving role in diagnosing other infectious diseases, especially where the pathogen or extent of infection is challenging to elucidate clinically and with conventional imaging (CT, US and MRI). We present a case series of patients diagnosed with melioidosis who also underwent 18-F FDG PET/CT from December 18th 2018 to September 30th 2022. Indications for imaging were categorised and analysed as to whether 18-F FDG PET/CT changed management over conventional imaging. Twenty-one 18-F FDG PET/CT scans were performed for sixteen patients. Two scans (9.5%) performed for pyrexia of unknown origin changed management in both cases. Twelve scans (57.1%) performed to ascertain the extent of dissemination of melioidosis changed management in only three (25%) cases. Five scans (23.8%) performed to monitor the response to treatment of known foci changed management in all five cases. Five scans (23.8%) performed for suspected or known malignancy changed management in three (60%) cases. 18-F FDG PET/CT is an emerging tool which improves diagnosis and changes the management of melioidosis when applied judiciously and for well-selected indications.

Keywords:

melioidosis; *Burkholderia pseudomallei*; 18-F FDG PET/CT; pyrexia of unknown origin

Burkholderia pseudomallei Sequence Type 46 Transmission from Asia to Australia

Meumann E. M, Kaestli M, Webb J R, Rigas V, Woerle C., Mayo M, Currie B. J.

Burkholderia pseudomallei Sequence Type 46 Transmission from Asia to Australia. Emerging Infectious Diseases, 31(2), 394-397. https://doi.org/10.3201/eid3102.241385.

Melioidosis is caused by the environmental pathogen *Burkholderia pseudomallei.* Among 1,331 patients with melioidosis during 1989–2023 in the Darwin Prospective Melioidosis Study in Australia, we identified 6 locally acquired cases caused by *B. pseudomallei* sequence type (ST) 46. Because of global transmission and expansion of endemicity, clinicians should increase awareness of melioidosis.

Addendum – ST46 is the most common *Burkholderia pseudomallei* ST found in Asia. The arrival mode of ST 46 in northern Australia remains uncertain.

Clinical Implications of High Melioidosis Serology Indirect Haemagglutination Assay Titre: A 20-Year Retrospective Study from the Top End of the Northern Territory, Australia

Ho C, Freeman K, Woerle C , Mahoney M, Mayo M, Baird R W, Meumann E M, Currie B J

Pathogens 2025, 14(2), 165; *https://doi.org/10.3390/pathogens14020165*

Melioidosis, an infection with the bacterium *Burkholderia pseudomallei*, is highly endemic in the Top End of the Northern Territory of Australia. The indirect haemagglutination assay (IHA) is the most widely used serology test globally, but it is not standardised among the limited number of laboratories that perform it. While concerns have been raised about the sensitivity of IHA early in melioidosis infections, the advantage of IHA over more recently developed ELISAs is that testing serial dilutions allows a titre to be recorded. While in Australia a titre of 1:40 or higher is considered positive, the specificity at these low positive titres remains uncertain. However, a high titre is considered to represent recent or past true infection with *B. pseudomallei*, rather than cross-rection with other environmental *Burkholderia* species. Also, the natural history of IHA titres over time, in both asymptomatic infection and melioidosis has been little studied. We have assessed the clinical status and serology time courses of all 534 patients who had an IHA titre of 1:640 or higher, over a 20-year period. Of these, 324 (60.7%) were diagnosed with culture-confirmed melioidosis, with varying time courses of diagnosis of melioidosis in relation to the high serology. Of the 210 without confirmed melioidosis, 22 (10.5%) were considered highly likely to be melioidosis despite being culture-negative, and these were all treated as melioidosis. In the remainder, titres mostly gradually decreased over time, but the majority remained seropositive. A small number who had not been treated for melioidosis continued to have high IHA titres over years and activation from latency with a new diagnosis of melioidosis was occasionally documented. This study highlights the importance of a full clinical workup in those found to have high titre melioidosis serology as well as subsequent close clinical surveillance and where resources allow, yearly IHA in those not confirmed or treated as melioidosis.

Keywords:

melioidosis; *Burkholderia pseudomallei*; indirect haemagglutination assay; neglected tropical disease; serology; latency

Leptospirosis, melioidosis, and rickettsioses in the vicious circle of neglect

Tshokey T, Ko A I, Currie B J, Munoz-Zanzi C, Goarant C, Paris D H, Dance D AB, Limmathurotsakul D, Birnie E, Bertherat E, Gongal G, Benschop J, Savelkoel J, Stenos J, Saraswati K, Robinson M T, Day N PJ, Graves S R, Belmain S R, Blacksell S D, Wiersinga W J

PLoS Neglected Tropical Diseases, January 2025 https://doi.org/10.1371/journal.pntd.0012796

The global priorities in the field of infectious diseases are constantly changing. While emerging viral infections have regularly dominated public health attention, which has only intensified after the COVID-19 pandemic, numerous bacterial diseases have previously caused, and continue to cause, significant morbidity and mortality—deserving equal attention. Three potentially life-threatening endemic bacterial diseases (leptospirosis, melioidosis, and rickettsioses) are a huge public health concern especially in low- and middle-income countries. Despite their continued threat, these diseases do not receive proportionate attention from global health organizations and are not even included on the WHO list of neglected tropical diseases (NTDs). This, in turn, has led to a vicious circle of neglect with continued, yet conceivably preventable, hospitalizations and deaths each year especially in the vulnerable population. This is a call from a group of multi-institutional experts on the urgent need to directly address the circle of neglect and raise support in terms of funding, research, surveillance, diagnostics, and therapeutics to alleviate the burden of these 3 diseases.