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Influenza vaccine for all children 6 months to less than 5 years in 2019

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The Northern Territory (NT) will have an influenza vaccine program for all children aged 6 months to less than 5 years commencing in 2019.

Burden of influenza disease in children

Influenza is a common viral illness which infects approximately 10-20% of the population each year. The disease routinely presents as high fever, cough, headache, myalgia, sore throat and coryza. Complications include croup, bronchiolitis, febrile seizures, sinusitis, otitis media, encephalitis, pneumonia and in children, gastrointestinal manifestations can occur.¹ Influenza infection can be fatal in children and a review of deaths in New South Wales found confirmed or probable influenza infection caused 15 deaths in children under 18 years over a 10 year period.²

Hospitalisation rates for children with influenza infection under 5 years in the NT were 300/100,000 children in 2018 (unpublished data, NT Notifiable Disease Data).

While children with underlying health problems are at higher risk of acquiring influenza, healthy children are also at risk. One study found 57% of Australian children admitted to hospital with influenza were otherwise healthy and had no chronic medical conditions.³

Influenza infection in young children causes significant economic and social impact with increased presentations to hospitals and outpatient clinics, time off work for parents and absenteeism for children, with 65% of children

absent from school or child care with the average length of time being 3 days.⁴

In addition to the protection accorded to the individual child, influenza vaccination of children has the added benefit of providing indirect protection against influenza to others in the community including protection against influenza-related mortality in the elderly.⁵

Influenza vaccine effectiveness

The influenza vaccine is effective against disease in children although the effectiveness does vary from year to year depending on the circulating strain. The Western Australian Influenza Vaccine Effectiveness study estimated the vaccine effectiveness (VE) of trivalent influenza vaccine against any

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laboratory-confirmed influenza to be 64.7% among children aged 6–59 months attending a paediatric emergency department.⁶ The PAEDS-FluCAN collaboration has previously demonstrated a VE against hospitalization in children of 55.5% in 2014⁷ and 30.3% in 2017.⁸

Vaccine safety

The influenza vaccine safety profile in young children has been closely monitored in recent years with the AusVaxSafety active safety surveillance system,⁹ which functions by sending out a text message 3 days after a child is vaccinated to parents across Australia to monitor for any potential reactions. Recent data shows that the common adverse events following influenza vaccine in children aged 6 months to less than 3 years are fever (1.8%), injection site reaction (1.2%), medical attendance (0.7%) and rash (0.4%).¹⁰ Febrile seizures can occur and are classified as adverse events following immunisation, but are uncommon. It should be noted that febrile seizures occur at a higher rate in children who are infected with influenza than as an event following influenza vaccination.

Childhood influenza vaccine programs in other jurisdictions

Western Australia has funded an influenza vaccine program for all children aged 6 months to 5 years since 2008 and other states/territories introduced influenza vaccine programs for all children under 5 years in 2018.

The National Immunisation Program has funded influenza vaccine for Aboriginal children aged 6 months to less than 5 years since 2015. The NT has achieved high influenza vaccine coverage in Aboriginal children 6 months to less than 5 years with coverage of approximately 60.8% in 2018.¹¹ Children with chronic medical conditions aged 6 months and over are also eligible for free influenza vaccine and this program is promoted with vaccine providers each year.

Summary

- Influenza is a serious disease in young children under 5 years of age.
- Influenza vaccine is both effective and safe and should be promoted in this age group.
- High vaccine coverage will reduce disease and hospitalisation in young children but also increase herd immunity and protect other vulnerable people in the community.

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Missed notifications of acute post-streptococcal glomerulonephritis in hospital settings in the Northern Territory: A retrospective review

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Abstract

Introduction: Acute post-streptococcal glomerulonephritis (APSGN) is a self-limiting condition which is a sequela of Group A streptococcus (GAS) infection. There is a high burden of disease among Aboriginal young people in Australia. APSGN is a notifiable condition in the Northern Territory (NT) and the identification of cases is important to carry out public health responses and surveillance. This study aims to identify cases of APSGN which were missed and therefore not notified in the NT.

Methods: NT Hospital admission data were retrieved using the International Classification of Diseases and Related Health Conditions (ICD)-10 codes between April 2013 and April 2018. Codes related to the clinical features and microbiology of APSGN were used to identify potential hospital presentations due to APSGN. Known cases of APSGN, identified to the NT Notifiable Diseases System (NTNDS), were removed. Complement component 3 (C3) laboratory data were used to assist in identifying potentially missed cases of confirmed APSGN.

Results: Using selected ICD-10 codes, 1965 non-duplicate episodes of emergency department presentations and hospital admissions were identified as potential APSGN episodes. There were 185 confirmed APSGN cases identified from the NTNDS, of which 167 were also identified using the select ICD-10 code retrieval and these were removed from the potential missed cases list. Laboratory C3 data reduced the potential episodes of those that could fulfil the APSGN case definition to a final list of 71 hospital admissions to be interrogated. Of these, 13 cases of confirmed APSGN were identified as missed notifications across the NT.

Conclusion: A relatively small number of cases of APSGN were missed over a 5-year period. C3 laboratory data may help as a prompt to improve the notification of suspected cases.

Key words: Acute post streptococcal glomerulonephritis, group A streptococcus, complement 3.

Acute post-streptococcal glomerulonephritis (APSGN) is a self-limiting inflammatory condition of the kidney occurring 2 to 3 weeks after Group A streptococcus (GAS) infection and occurs mainly in children under 18 years of age.¹ In the Northern Territory (NT), the burden of diseases is high with an incidence of 90 to 230 per 100,000 people per year^{1,2} compared to 6 per 100,000 people per year in the rest of Australia² and 9 to 18 per 100,000 people per year worldwide.^{3,4} Up to 20% of the NT population is estimated to experience an episode of APSGN at some point in their lives.^{5,6} Furthermore, Aboriginal populations are 50 times more likely to suffer an episode of APSGN, compared to the non-Aboriginal population.¹ Factors thought to contribute to increased rates of APSGN include crowding, poor hygiene, poverty and delayed presentations to acute medical care.¹

Acute post-streptococcal glomerulonephritis is a clinical syndrome characterised by facial oedema, haematuria and hypertension.^{3,7,8} Diagnostic criteria are based on clinical and laboratory features. APSGN is most often preceded by GAS skin infection, although respiratory and other sources of infection have been documented as the preceding insult.^{3,7} It is estimated that approximately 20-90% of acute renal failure in children is caused by APSGN^{9,10} and approximately 50-88% of acute renal impairment caused by any infection is due to APSGN.^{11,12}

The presentation of APSGN is most often self-limiting with rates of renal impairment necessitating dialysis low⁷ and mortality rates very low.² The effect on long term renal outcomes is uncertain, however, some evidence indicates that APSGN may be a risk factor for long term renal impairment,^{6,13,14} albuminuria^{15,16} and haematuria.¹⁵ One review estimates the risk of chronic renal failure in those who have had APSGN to be 5-6 times higher than the remaining population.¹⁵ Thus, identifying cases and follow-up monitoring is important as is the public health response to contacts of cases, with the aim to both reduce further cases and optimise individual case management.¹⁷

Missed opportunities in the diagnosis of APSGN can occur when APSGN as a cause is not considered in the setting of suggestive presentations and when appropriate confirmatory laboratory tests are not ordered. This can occur both in inpatient and community settings. The aim of this study is to retrospectively review clinical records, within public hospital settings, to identify missed cases of APSGN. Ethics, for this study, was obtained from the Menzies School of Research, Human Research Ethics Committee, HREC 2018-3099.

Methods

The NT accounts for 17.6% of the Australian landmass and with just under 250,000 people is very sparsely populated. The population is unique with approximately 26% of the population identifying as Aboriginal Australians in comparison to 2.8% of the remaining Australian population.¹⁶ In the NT, 49% of the Aboriginal population live in rural or remote areas with reduced access to healthcare and poor health outcomes.¹⁶

Acute post-streptococcal glomerulonephritis has been a legislated notifiable condition in the NT since 1991. The NT Centre for Disease Control (CDC) manages a NT Notifiable Disease Surveillance (NTNDS) system that records NT notifiable disease conditions that fit specified case definitions. The definition for APSGN is shown in Figure 1. Although, a case of APSGN can be confirmed by characteristic renal biopsy findings, this is rarely performed and a combination of laboratory and clinical criteria are most commonly used to confirm a case. A review of all renal biopsies was not undertaken for this study. Only confirmed cases were included in this review.

Specific conditions identified via the International Classification of Diseases and Related Health Conditions (ICD)-10 codes were used to identify potential cases of APSGN which may have been missed. ICD-10 codes used related to hypertension, oedema, haematuria, nephritis, glomerulonephritis and streptococcal infection. These codes were expanded to include all terms used to identify the already notified APSGN cases. The codes were used to extract potential cases presenting to emergency departments or admitted to NT public hospitals (Royal Darwin, Katherine District, Gove District Tennant Creek and Alice Springs) from April 2013 to April 2018, for the age-group 0 to 18 years. A list of presentations that fulfilled the

Figure 1. Case definition of acute post streptococcal glomerulonephritis¹⁷

Confirmed case

Either

1. Laboratory definitive evidence
OR
2. Laboratory suggestive evidence AND clinical evidence

Probable case

Clinical evidence only

Possible case

Laboratory suggestive evidence only

Laboratory definitive evidence

Renal biopsy suggestive of APSGN

Laboratory suggestive evidence

Haematuria on microscopy (RBC >10/ul)

AND

Evidence of recent streptococcal infection (positive Group A Streptococcal culture from skin or throat, or elevated ASO titre or Anti-DNase B)

AND

Reduced C3 level

Clinical evidence

At least 2 of the following

- Facial oedema
- Moderate haematuria on dipstick
- Hypertension
- Peripheral oedema

ICD-10 criteria in the time-period were recorded in a spreadsheet file, using hospital record numbers only. Duplicate encounters were removed.

Notified cases of APSGN aged 0-18 years were identified from the NTNDS from April 2013 to April 2018, and excluded from analysis.

To reduce the remaining number of potential episodes to be interrogated laboratory data for all patients who had a level of complement component 3 (C3) outside the reference range during the study period were obtained from Territory Pathology. Only hospital record numbers were used as identifiers in their retrieval. As confirmed APSGN cases require the presence of a low C3 level, only the potential episodes that had matching record numbers with low C3 levels, were further interrogated to identify missed cases.

Results

A total of 45 ICD-10 codes were used to extract hospital admissions and emergency presentations. These were broadly derived from 7 different search terms, summarised in Table 1.

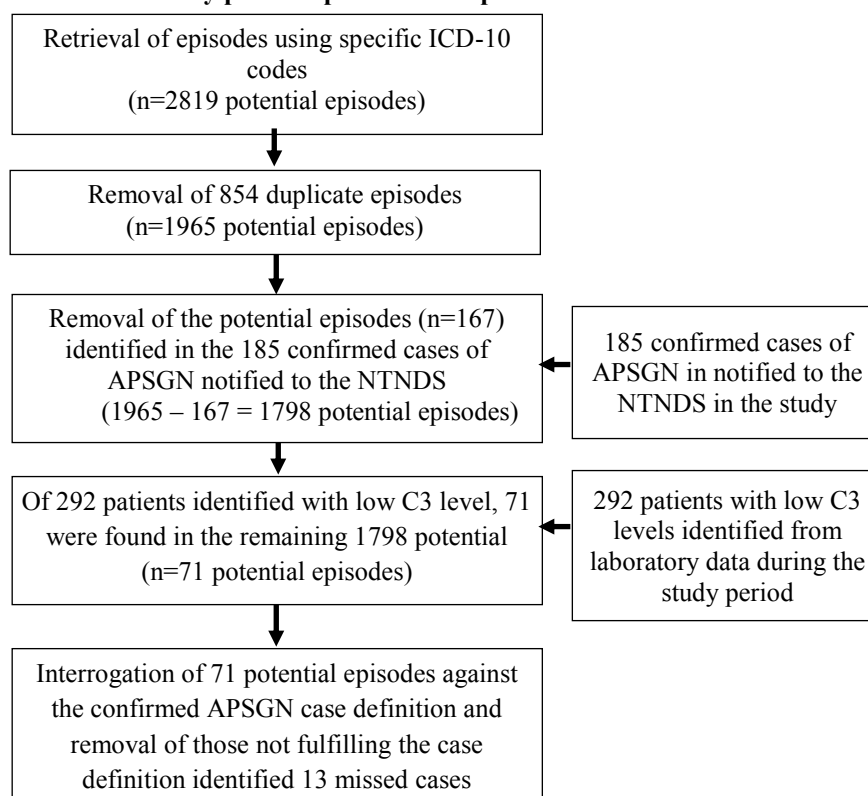
A summary of the patient records identified (referred to as potential episodes) and the process carried out to identify missed confirmed APSGN cases is represented in Figure 2. There were 2819 patient episodes found from patient records identified using ICD-10 codes from hospital admission and ED presentation data during the study time. Of these, 854 patient records were duplicate episode presentations and were removed, leaving 1965 potential episodes. There were 185 notified APSGN confirmed cases retrieved from the NTNDS system in the 5-year study period. Of these, only 167 confirmed APSGN cases were identified in the remaining 1965 potential episodes, leaving 1798 potential episodes for further consideration. It was determined that the 18 notified confirmed APSGN cases on the NTNDS system not found in the ICD-10 extract group were diagnosed as outpatients and therefore not retrieved using the emergency departments or hospital admission data.

Table 1. Search terms for ICD codes, number of overall episodes retrieved and number of missed cases retrieved

Search terms	Overall episodes	Missed cases
Nephritic syndrome	345	4
Unspecified bacterial infection	44	0
Secondary hypertension and unspecified hypertension	16	0
Group A streptococcal infection	1553	2
Non-specified streptococcal infection	117	0
Haematuria	427	3
Other renal conditions	317	4
Total	2819	13

There were 292 patients identified with low C3 levels in the study period of whom 71 were found to be in the remaining 1798 potential episodes retrieved. The electronic records of these 71 patient admissions were interrogated to determine if the patient met confirmed diagnostic criteria for APSGN. This process revealed 13 cases of APSGN who met the confirmed case definition. Of these cases 6 were from Alice Springs, 6 from Darwin and 1 from Gove. Of note most of the cases identified as

Figure 2. Procedure for identifying missed cases of APSGN that meet the case definition for notifiable confirmed cases in the NT study period April 2013 to April 2018



confirmed APSGN were coded under a limited number of terms for ICD-10 codes which included nephritic syndrome, Group A streptococcal infection and haematuria.

Discussion

In a 5-year period from 2013 to 2018 there were 185 confirmed APSGN cases notified in the NT via the NTNDS. This study identified an additional 13 missed cases of confirmed APSGN that were identified using hospital data, laboratory data and electronic medical records. This represents 6.5% of the total 198 (13 new plus 185 previously notified) that are now notifiable confirmed APSGN cases in the study period.

Identifying an optimal method to capture all cases of APSGN requires clinician awareness of the condition and attention to clinical presentations and laboratory data to make the diagnosis. The great majority of notifiable diseases in the NT requires only laboratory notification. As APSGN requires clinical input to satisfy the case definition, understanding APSGN by clinicians is necessary as is commitment to report the finding of this notifiable disease to the NT CDC. Possible ways to avoid missed cases include having prompts at discharge for notifiable conditions. At present, there are no ICD-10 discharge codes specifically for acute post-streptococcal glomerulonephritis, making the prompt to notify and also identification of missed cases difficult. Although, a small number of codes identified most of the missed cases, these codes also uncovered a large number of non-case admission data, making it difficult to use this method to identify missed cases. As a low C3 is required to diagnose a confirmed case of APSGN, when a biopsy is not available, it is possibly a more useful method for identifying some missed cases. However, this requires a C3 to be ordered by the treating clinicians. In this study, there were only 292 patients reported in a 5 year period with a low C3. Consideration could be given to improving notification of APSGN by recommending all low C3 levels be brought to the attention of the clinician to share with CDC for further evaluation to rule APSGN in or out.

Although, no comparative studies were found in the literature that attempted to quantify missed cases of APSGN, there was one study that

looked at factors resulting in delays in diagnosis of APSGN.¹⁸ Delays were more likely when there was no macroscopic haematuria or no infection as a cause for presentation to a health facility.¹⁸

The burden of end stage renal failure (ESRF) in the Aboriginal population in Australia is reported as up to 80 per 100,000 with up to 10% of the Australians who are on dialysis being Aboriginal or Torres Strait Islander.¹⁹ The Aboriginal population in Australia has rates of ESRF that are 8 times higher than the remaining population and in the NT the rates are up to 26 times higher than the general population.¹⁹ Aboriginal patients with ESRF requiring dialysis tend to be younger than the non-Aboriginal patients, with over half aged less than 55 years.¹⁹ Although typical risk factors including diabetes and hypertension contribute to this burden,¹⁹ preventing other forms of kidney injury is important. While there is no definitive evidence that APSGN causes ESRF, several studies have found impaired renal function at 0-9 years of follow up in cases with APSGN.^{6,13,14,20}

A limitation of this study is that only hospital presentations were identified for review and therefore potential cases managed only in outpatient settings were not included. Additionally, probable and possible suspect cases (see Figure 1) were not assessed. Probable cases do have public health action implemented (i.e. screening of family, household and close contacts) when diagnosis is supported by a paediatrician. This study was unable to address these potential cases, as identification of such cases would be difficult in retrospect. The identification of missed cases also relies upon clinicians ordering a C3 level, as this forms part of the case definition. It is likely that there were missed cases where C3 levels were not ordered.

Overall, only a relatively small number of confirmed cases of APSGN were not notified to the NTNDS in the NT over the 5-year study period. The findings suggest that based on review of hospital setting data most APSGN cases are notified. Consideration might be given to using a low C3 finding in anyone under 18 years of age, as a possible prompt to investigate further for APSGN. This study did not aim to assess if the *Northern Territory guidelines for acute post-streptococcal glomerulonephritis*¹⁷

were followed for notified cases of APSGN including appropriate management of contacts. Such a study would offer useful information and allow for beneficial review of the Guidelines. Continued awareness regarding the signs and symptoms of APSGN along with clinicians' recognition of duty to notify cases to initiate appropriate public health responses will work to optimise the notification of APSGN cases and decrease the number of new cases.

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Conflicts of interest nil

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Acute intussusception in infants and children in the NT, June 2013 to May 2018

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Abstract

Intussusception surveillance has been undertaken in the Northern Territory (NT) since 2003 initially to establish baseline incidence and then to provide prospective surveillance when rotavirus vaccination commenced on the childhood immunisation schedule in 2006. This report covers the years from mid-2013 to mid-2018. The Centre for Disease Control (CDC) has established a simple ongoing method of monitoring intussusception cases through NT Health Hospital Emergency Department surveillance systems. This monitoring will alert the CDC of any potential intussusception cases that present to NT public hospital emergency departments. Rates of intussusception in NT children <2 years of age have remained low throughout these 5 years and further studies to actively monitor cases are considered unnecessary. With no evidence of increased intussusception since rotavirus vaccine introduction on the childhood schedule, consideration should be given to relaxing the upper-age restrictions on rotavirus vaccination with current intussusception monitoring in place.

Key words: Intussusception, rotavirus vaccine, Northern Territory

Background

Intussusception is the invagination of a proximal segment of bowel into the distal bowel lumen, most often a segment of ileum moving into the colon through the ileo-caecal valve. The condition may develop at any age but commonly occurs in the 2 month to 2 year age-group with a peak incidence at 5 to 9 months.¹ Although intussusception is a major cause of bowel obstruction in infants, it is a rare condition, and Australian and Northern Territory (NT) studies have shown a low incidence in the NT population.^{2,3}

The monitoring of intussusception in young children became important following the introduction of an oral tetravalent rotavirus vaccine *Rotashield*[®] in the United States in the late 1990's. Shortly after commencement of the vaccine program post-marketing surveillance detected an apparent association with an

increased incidence of intussusception in the vaccinated cohort and the vaccine was withdrawn from the market.⁴

The historical high rates of rotavirus disease in the NT often resulted in significant morbidity, particularly in Aboriginal children and in outbreaks that were associated with high health care costs. The NT, therefore, was eager for the development and licencing of safe rotavirus vaccines. It was recognised, however, that surveillance of intussusception would be required to establish a baseline and then to monitor for vaccine safety. Following a retrospective NT study for the years 1993 to 2003,² a prospective intussusception study commenced in 2003 until 2006.⁵ This study was extended to coincide with the introduction of the rotavirus vaccine (*Rotarix*[®]) to the NT infant immunisation schedule in October 2006 and to provide an ongoing mechanism for monitoring intussusception incidence that continued until 2013. The NT surveillance system was further modified in 2013 to ensure effective but less resource intensive, active surveillance continued. This surveillance is presented in this report.

Methods

The study was undertaken as a hospital-based surveillance system at Alice Springs Hospital (ASH) and Royal Darwin Hospital (RDH) and consisted of 3 main actions for identifying intussusception by the study coordinator.

1. NT Hospital Emergency Department (ED) Surveillance

For this surveillance a daily report was generated from the routinely collected NT public hospital ED data which includes the de-identified demographic details of any case with a discharge diagnosis of intussusception presenting the previous day. This report was emailed automatically to the study coordinator.

2. Enhanced active surveillance

For this surveillance the study coordinator undertook further investigation of cases in children <2 years that were investigated for intussusception (e.g. barium or hydrostatic enema and ultrasound

procedures) by the ASH and RDH radiology departments. Additionally the study coordinator made ad-hoc checks with the ASH and RDH paediatric ward staff to check for admitted cases of intussusception.

3. Review of NT public hospital discharge data

For this review process the study coordinator received reports annually generated from the Production Patient Management System (Caresys) for children aged 0 to 2 years with the International Classification of Diseases (ICD) code of intussusception (K56.1). The final 845–intussusception report was refreshed on 23 August 2018.

When any of the 3 systems flagged a case of suspected or confirmed intussusception in a child aged <2 years the case was investigated. Data were collected via electronic and medical record review with immunisation details obtained from both NT and National Immunisation Registers. Cases were categorised according to the Brighton Collaboration intussusception definition.⁶ Only cases meeting level 1, 2 or 3 of diagnostic certainty were included in the study.

Cases categorised at any level of the Brighton Collaboration Intussusception Working Group case definition that were considered a potential adverse event following rotavirus vaccination were reported to the Therapeutic Goods Administration via the routine Centre for Disease Control (CDC) adverse event following immunisation reporting system.

The study commenced on 1 June 2013 and ceased on 31 May 2018. Estimated Resident

Population Data available on the Australian Bureau of Statistics website⁷ was used to calculate incidence rates and analysis of the data was undertaken using Microsoft Excel and STATA, Version 13.

Ethical approval for the study was granted by the Human Research Ethics Committees of the NT Department of Health and Menzies School of Health Research, and the Central Australian Human Ethics Research Committee.

Results

A total of 14 cases of confirmed intussusception in children <2 years of age was identified during the study with 2 to 4 cases occurring each year. Over the entire study period the average yearly rate was 0.36/1000 child-years. There were 6 cases in females compared to 8 cases in males. When analysed by single year age-groups the female rates were greater than males in those aged <1 year of age, 0.62/1000 compared to 0.39/1000 (IRR 1.6 95%CI 0.45-5.53). There were no cases in females in the second year of life and only 1 child was identified as Aboriginal (0.07% of all cases). The age at presentation ranged from 3 to 21 months (median 8 months) with variations evident between males and females (Table 1).

Clinical presentation, investigation and outcome

A summary of the reported symptoms of cases are shown in Table 2. Vomiting and abdominal pain were the most frequently reported symptoms while only 3 (21%) were noted to have the classic late sign of intussusception, red currant jelly stool. Three cases reported previous gastrointestinal-tract conditions; anal fissure and

Table 1. Numbers and rate per 1000 child-years of intussusception cases in NT children by sex, age group and year, June 2013 to May 2018

Year	Male		Female		Total
	Aged 0 to 1 year	Aged 1 to <2 years	Aged 0 to 1 year	Aged 1 to <2 years	
Age range months (Median)	3-11 (7)	11-21 (13)	4-10 (7)	N/A	
	number (rate)	number (rate)	number (rate)	number (rate)	number (rate)
June -Dec 2013	1 (0.85)	1 (0.84)	0	0	2 (0.42)
2014	0	2 (1.02)	2 (1.05)	0	4 (0.51)
2015	1 (0.48)	1 (0.51)	1 (0.53)	0	3 (0.39)
2016	1 (0.48)	0	1 (0.49)	0	2 (0.25)
2017	1 (0.49)	0	2 (1.06)	0	3 (0.38)
Jan-May 2018	0	0	0	0	0
Total all years	4 (0.39)	4 (0.40)	6 (0.62)	0	14 (0.36)

Table 2. Summary of reported symptoms of intussusception cases in NT children June 2013 to May 2018

Symptom	Number	% all cases
Previous GI tract condition	3	21%
Vomiting	12	86%
Bile stained vomiting	4	29%
Pallor	6	43%
Lethargy	9	64%
Bloody stool	6	43%
'Red currant jelly' stool	3	21%
Abdominal pain	11	79%
Rectal bleeding	1	07%

infrequent passing of stools associated with pain, eosinophilic colitis with large bowel obstruction and previous intussusception.

There were 6 cases that had stool samples collected with only one case isolating a pathogenic organism (*Salmonella species*). All cases had undergone ultrasound, however, only 8 were definitively diagnosed using this procedure. Of the cases requiring enema, 4 received barium enema and a further 4 received hydrostatic enema. The intussusceptions were reduced surgically in 6 cases with 2 requiring a bowel resection. Although all children were hospitalised none required management in an intensive care facility and there were no deaths. The length of hospital stay ranged from 1 to 10 days with a median of 4 days.

Vaccination status

All of the 14 cases had received at least 1 dose of a rotavirus containing vaccine but only 1 female aged 4.5 months had received a vaccine (dose 2 of *Rotarix*[®]) within the 30 days prior to the onset of symptoms. The days between vaccination and onset ranged from 14 to 520 days (median 110 days).

Quality assurance

A total of 16 other children aged <2 years were identified as possible cases through the surveillance systems and found to be either not a case of IS ($n=12$), or were diagnosed as intussusception cases but with insufficient evidence to meet the Brighton Collaboration case definition ($n=4$). There were 2 children with insufficient evidence to meet the case definition who were vaccinated with rotavirus vaccine within the previous 30 days.

Discussion

The previous study of children diagnosed with intussusception in the NT undertaken by Webby et al. for the years 1993-2003 identified 23 cases and established a baseline intussusception rate of 0.65/1000 live births in this population.² In 2003, a prospective surveillance system for intussusception was designed and implemented in the NT, with administered rotavirus vaccine records included for cases from August 2006.^{5,8}

The small NT population and low intussusception case numbers denotes local data alone is insufficiently powered to detect a correlation between intussusception and rotavirus vaccine receipt in children, however this 2013-2018 study found no increase in the incidence of intussusception compared to pre-vaccine data^{2,3,5} with an overall rate of 0.36/1000 child-years. The higher rate of intussusception observed in females aged <1 year compared to males, is of interest given intussusception is historically found to be higher in males,^{3,6} but no conclusion can be drawn from this result. The single Aboriginal case (0.07% of all study cases) is in keeping with other studies that have shown low rates in Aboriginal children in Australia.^{2,3,9}

There have been numerous large scale post-licensure evaluations on the safety of the currently licenced rotavirus vaccines.^{10,11,12,13,14,15} Study results have varied with some but not all, showing an association between rotavirus vaccination and an increased risk of intussusception, most notably in the first 7 days following dose 1.^{12,13,14,15} Where an association was found, it was considerably less conclusive than what was reported with the initial rotavirus vaccine *Rotashield*.^{®16}

In December 2013, the World Health Organisation (WHO) reviewed the safety of the 2 rotavirus vaccines, *Rotateq*[®] and *Rotarix*[®], and maintained its previous position that the benefit of protection from severe rotavirus disease outweighs the small risk of intussusception. The WHO therefore continued to recommend the vaccine be given to all infants from 6 weeks of age with the number of doses given according to the specific vaccine requirements. Through modelling, the review reported a calculation that the additional lives saved in low and middle income countries by relaxing the age restriction for rotavirus vaccination would by-far

outnumber the excess vaccine-associated intussusception deaths.¹⁶ The WHO now recommends for all immunisation programs, rotavirus vaccine can be given up to 24 months (2 years) of age, (as opposed to the previous recommendation for the vaccine course to be initiated by 15 weeks of age and completed by 32 weeks of age) in order to benefit those children who may present late for their initial infant vaccines.¹⁷

The rotavirus vaccination schedule in Australia currently consists of 2 doses of *Rotarix*[®] and is recommended to be given from 6 to 14 weeks (before turning 15 weeks of age) for dose 1 and at 10 to 24 weeks (before turning 25 weeks of age) for dose 2.¹⁸

Overall, the program has been remarkably successful both in reduction in disease burden and as a health cost-saving strategy.^{19,20} However, outbreaks do continue to occur in the NT particularly within the Aboriginal population²¹ and although mortality is low, the impact is still a concern.²² A review of vaccine coverage in NT children born in 2017 showed 2% reduced coverage for dose 1 *Rotarix*[®] and 5% reduced coverage for dose 2 *Rotarix*[®] when compared to the same scheduled *Infanrix*[®]-*hexa* doses measured at 6 and 12 months of age. (Rosalind Webby, personal communication). This is likely to be in part due to the age-limitations of the rotavirus vaccination schedule.

Delayed vaccination has long been recognised as an issue within the Aboriginal and Torres Strait Islander children of Australia and also specifically within the NT^{23, 24} and strategies have been implemented to address this.^{23, 25} Relaxation of the upper-age restrictions for rotavirus vaccine as recommended by WHO could be another strategy to consider to further reduce the rotavirus disease burden in this population. Rates of intussusception would need to be carefully monitored and the risk-benefit considered in this population with recognised low intussusception rates.

There are no plans to formally extend the NT intussusception study. Monitoring as part of NT immunisation adverse event case ascertainment will continue by the CDC through the de-identified report generated via the NT public hospital ED surveillance system for persons with

a discharge diagnosis of intussusception. Additionally, currently children who present to the RDH <9 months of age are monitored for intussusception as part of the Paediatric Active Enhanced Disease Surveillance: Hospital-based active surveillance for childhood conditions of public health importance, coordinated by the National Centre for Immunisation and Surveillance.

Conclusion

This study was a continuation of the surveillance of intussusception in NT children initially set up in 2003 to enable active monitoring for cases of intussusception and carried on to monitor cases that may have developed following recent rotavirus vaccination. Although small numbers limit the capacity to detect any significant changes, the study found no increase in intussusception in children <2 years of age in the NT since the introduction of rotavirus vaccine. Into the future, the established NT public hospital surveillance system will be the method used to monitor potential cases of intussusception resulting from rotavirus vaccination.

Further investigation of rotavirus disease burden and epidemiology with relation to age of onset and vaccination history may help to inform a risk-benefit analysis on whether relaxation of upper-age restrictions for rotavirus vaccine should be considered in this population.

Acknowledgements

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Aboriginal Health Practitioner Sexual Health Workshop Refresher 2019

Letishia Parter, Centre for Disease Control, Darwin

In February 2018, I piloted a Sexual Health Refresher Workshop for Aboriginal Health Practitioners (AHP) and Aboriginal Health Workers (AHW) in urban Darwin in my role as an Aboriginal Health Practitioner. Feedback from the 2018 evaluation forms was positive, and included requests that a future workshop be held to focus on syphilis education due to the ongoing syphilis outbreak. The role that AHP/AHWs play in engaging with the young Aboriginal people who are most affected by the outbreak is crucial to the success of the outbreak response measures being implemented.

On 20 February 2019, the second Aboriginal Health Practitioner Sexual Health Refresher Workshop was held in Darwin. The workshop reached full capacity with 20 AHP/AHW from Aboriginal Community Controlled Health Services (ACCHS) and Northern Territory Government (NTG) health services across the Top End. The day was supported by facilitators from the Centre for Disease Control's Sexual

Health and Blood Borne Virus unit, Family Planning and Welfare Association of the NT and Danila Dilba Health Service (a local ACCHS).

The workshop focussed on syphilis education, point of care testing (PoCT) and an update on the management of sexually transmissible infections, including how to engage with communities around improving sexual health, a topic people often find difficult to discuss. The workshop aimed to improve the knowledge and competencies of AHP/AHW around syphilis and its control so that they are able to deliver prevention-focussed health promotion messages (such as promoting condom use), engage in testing through PoCT, and provide messages about the importance of getting treated so that the disease is not passed on to others in their community. Feedback from participants was positive, including a request for the workshop to be run in Alice Springs in the near future for staff in Central Australia, which is being explored.



Figure. Participants in the Aboriginal Health Practitioner Sexual Health Workshop, Darwin, 2019

A snapshot of enteric disease in the Northern Territory in 2018

Anthony Draper, Centre for Disease Control, Darwin.

Abstract

In 2018, the number of notifications of foodborne disease in the Northern Territory was 11% higher than the 5 year mean. Salmonellosis notifications accounted for 40% of all foodborne disease notifications in 2018 followed by shigellosis (31%) and campylobacteriosis (27%). There were a number of foodborne and non-foodborne disease outbreaks investigated in 2018.

Key words: OzFoodNet, Salmonellosis, Typhoid, Shigellosis, Campylobacteriosis, Cryptosporidiosis, Outbreak, Northern Territory

Introduction

There has been an OzFoodNet epidemiologist in the Northern Territory (NT) since 2003. The position is based in the Centre for Disease Control (Darwin) within the Department of Health and is funded by the Commonwealth Government. The purpose of the position is to enhance enteric and foodborne disease surveillance in the NT and to assist with foodborne and non-foodborne illness investigations both within the NT and across Australia.

Methods

Data was extracted from the NT Notifiable Diseases System (NTNDS) and also analysed from the data warehouse using Business Intelligence. Population figures were obtained from the NT Department of Health's Research and Innovation branch population data.¹

Results and discussion

In 2018, there were 1391 notifications of foodborne or potentially foodborne disease* reported in the NT. This is 4% lower than 2017 (1439) but 11% higher than the 5 year mean (1250). In 2018, salmonellosis notifications accounted for 40% of the foodborne disease

notifications in the NT, followed by shigellosis notifications (31%) and campylobacteriosis notifications (27%).

There were 276 non-foodborne enteric disease notifications reported in the NT in 2018. This is 12% lower than the 5 year mean (314) and 33% lower than the previous year (443). Rotavirus notifications made up 61% of these non-foodborne disease notifications. Rotavirus notifications were 17% lower than the 5 year mean (202). Cryptosporidiosis notifications (106) were also much lower (23%) than the 5 year mean (138). There were 34 investigations undertaken in 2018; 7 foodborne or suspected foodborne disease outbreak investigations; 22 non-foodborne outbreak investigations; and 5 investigations following triggers of emergency department syndromic surveillance system alerts.

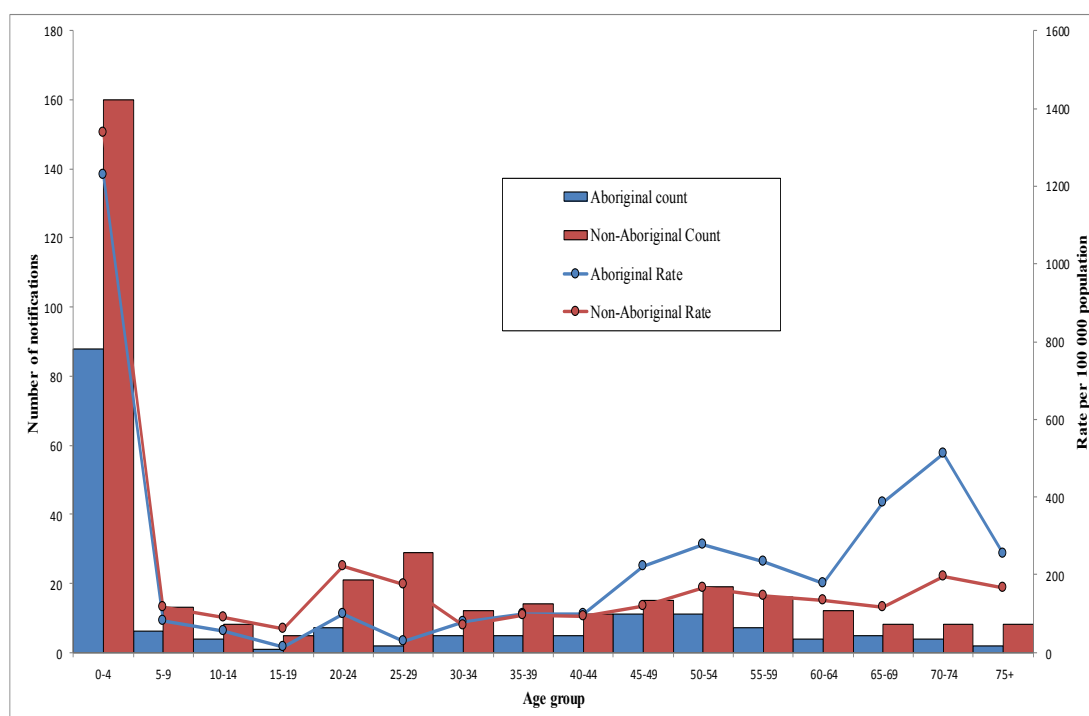
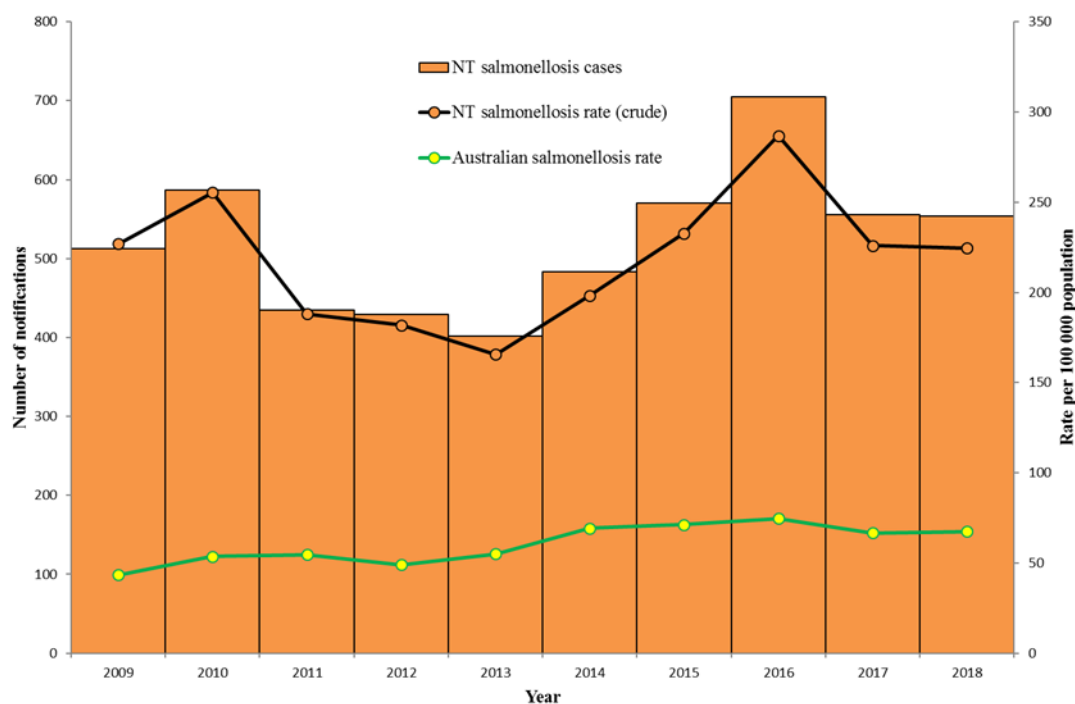
Salmonellosis

In 2018, there were 554 notifications of salmonellosis in the NT which is on par with the previous 5 year mean (543 cases) and an almost identical number of notifications to 2017 (556 cases). The overall rate of salmonellosis was 225 cases per 100 000 population. The median age of salmonellosis cases was 11 years (range 0–87 years). The 0–4 year age group represented 46% of all salmonellosis notifications with 255 cases and a rate of 1333 cases per 100 000.

The rate of salmonellosis in the Aboriginal population was 218 cases per 100 000 (167 cases) compared to 211 cases per 100 000 (359 cases) in the non-Aboriginal population (Figure 1). This was the fifth consecutive year that the rates of salmonellosis in Aboriginal and non-Aboriginal Territorians did not differ significantly from each other.

In the NT, salmonellosis notifications normally increase during the wetter, warmer months and in 2018 the peak was in April, which coincidentally followed a late cyclone in the Top

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

Figure 1. Salmonellosis rates, by age and Aboriginal status, Northern Territory, 2018**Figure 2. Number of cases and rate of disease of salmonellosis in the Northern Territory, 2009-2018**

End (Tropical Cyclone Marcus). The NT consistently observes higher rates of salmonellosis than the rest of Australia (Figure 2) largely due to the high number of children <5 years old who contract salmonellosis, usually from environmental rather than food sources.

In 2018, 94% (519/554) of salmonellosis notifications were identified to the serovar level. In 2018, the serovar with the highest number of notifications was *Salmonella* Saintpaul (n=64) which was also the highest in 2017 and 2016, followed by *S. Virchow* (n=52), *S. Typhimurium* (n=47) and *S. Ball* (n=38).

S. Saintpaul, *S. Virchow*, *S. Ball*, *S. Lansing*, *S. Reading*, *S. Anatum* and *S. Hvittingfoss* are all considered environmental serovars and are traditionally the most commonly notified in the NT.

Shigellosis

In 2018, there were 432 notifications of shigellosis in the NT. The number of cases was 2.1 times the previous 5 year mean (202 cases) but 6% lower than the number of notifications received in 2017 (462 cases). The most commonly reported biotype of *Shigella* was *Shigella flexneri* 2b (225 cases, 52% of all notifications). This is the first year there has been a decrease in notifications since 2014. The overall rate of shigellosis was 175 cases per 100 000 population which is 17 times the rate in the rest of Australia. The majority of cases (396/432, 92%) were in Aboriginal people. The median age of cases was 20 years (range 0–89 years) which was double the median age observed in 2016 (9 years), prior to the increase of *S. flexneri* 2b.

There has been a widespread and sustained outbreak of *S. flexneri* 2b in the NT and neighbouring jurisdictions since early 2017.² The initial case was notified in late 2016 and

cases were notified sporadically until May 2017 when there was a marked increase which coincided with an outbreak of rotavirus in Central Australia. Although a large increase was observed, there were no locally detected point source outbreaks. In response to the increase, the CDC asked clinicians to treat all notified cases of shigellosis as well as to assist clients to report housing faults so that they may be repaired quickly. Notifications of shigellosis due to this biotype were sustained for some time but have been slowly decreasing in recent months (Figure 3).

Shigellosis is more commonly reported in the Aboriginal population. The rate of shigellosis in the Aboriginal population was 516 cases per 100 000 population (396 cases) compared to 19 cases per 100 000 population in the non-Aboriginal population (33 cases), with a rate ratio of 26.6 (95% CI 18.6–39.1, $p < 0.0001$). Of the 33 non-Aboriginal shigellosis cases, at least 10 were known to have acquired their infection overseas.

In 2018, the rate of shigellosis was twice as high in females compared to males (RR 2.0, 95% CI 1.7–2.5, $P < 0.0001$) with a rate of 236 cases per 100 000 in females (285 cases) versus 117 cases per 100 000 in males (146 cases). This perhaps

Figure 3. *Shigella flexneri* 2b in the Northern Territory (2016–2018)

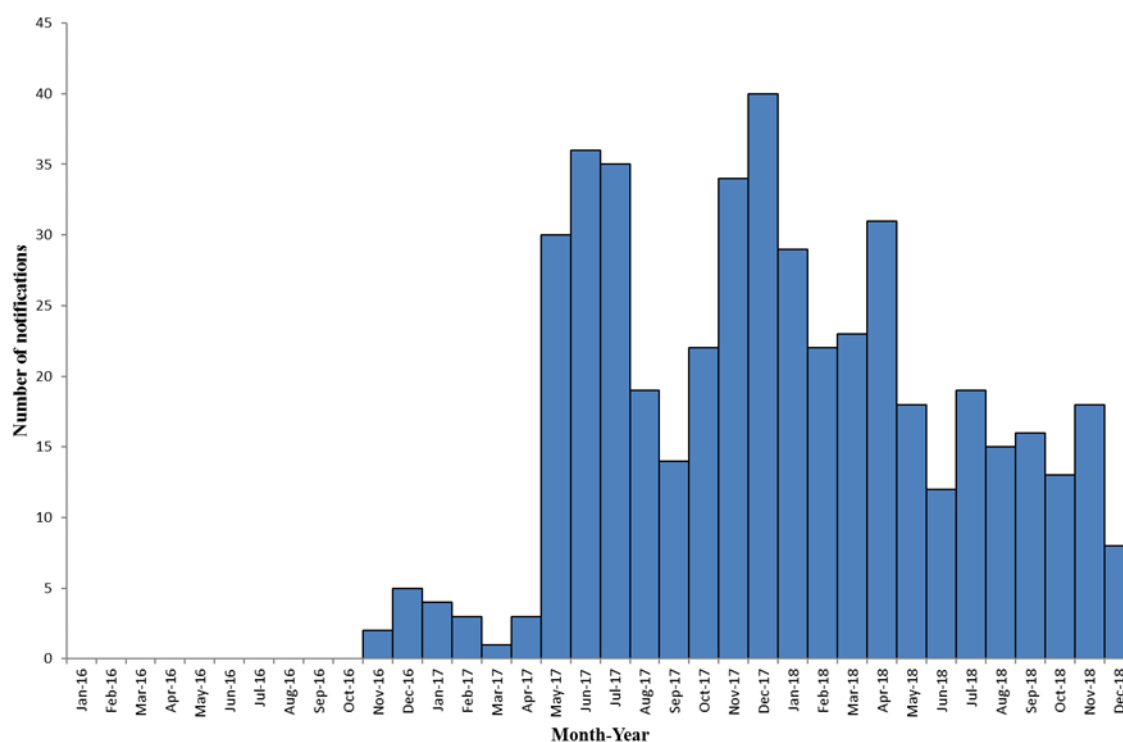
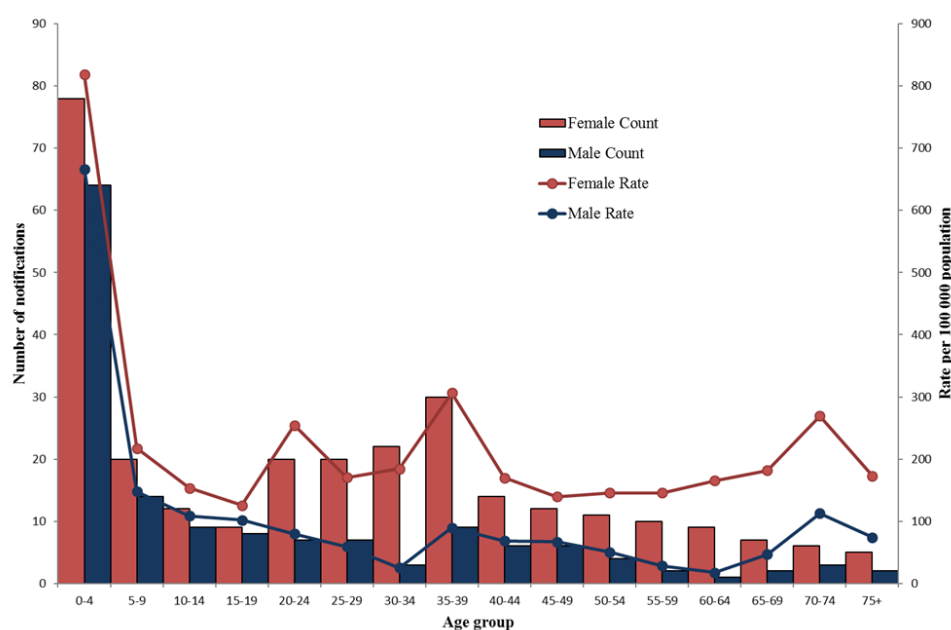
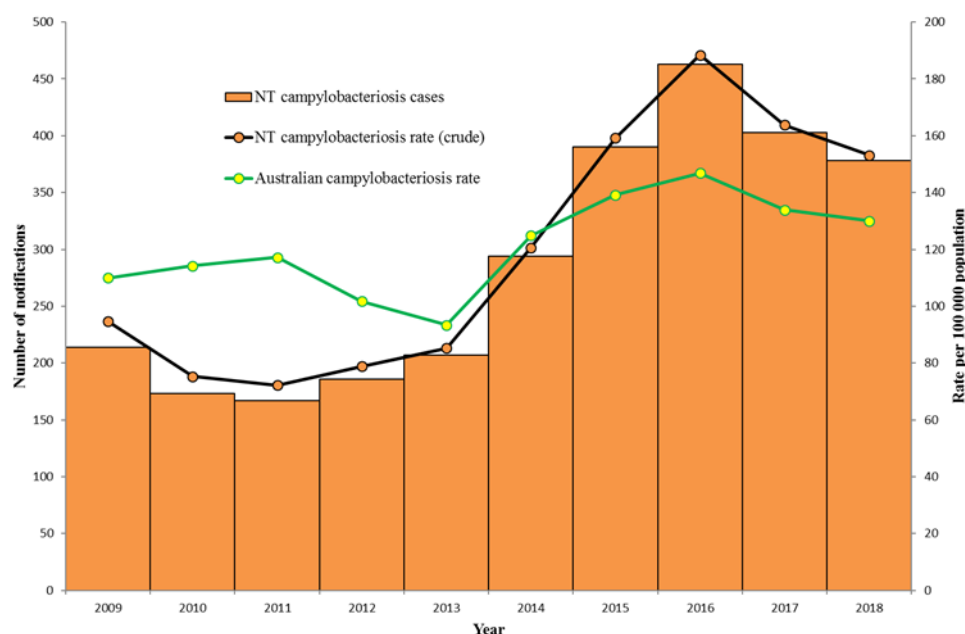


Figure 4. Shigellosis rates, by age and gender, Northern Territory, 2018**Figure 5. Number of campylobacteriosis cases and rate of disease in the Northern Territory, 2009-2018**

may be due partially, to women providing care to young children and becoming infected (Figure 4).

Campylobacteriosis

In 2018, there were 378 notifications of campylobacteriosis in the NT. This was 8% higher than the previous 5 year mean of 351 cases but 6% lower than the previous year (403 cases). The overall rate of campylobacteriosis was 153 cases per 100 000. The median age of campylobacteriosis cases was 28 years (range

0-91 years). Generally, there has been an increase in the rate of campylobacteriosis across Australia since the introduction of culture independent testing by private pathology laboratories in late 2013 (Figure 5).

The highest number of cases and rate of disease was seen in the 0-4 year age group with 116 case notifications and a rate of 606 cases per 100 000. This age group represented 31% of all campylobacteriosis notifications in the NT. The rate of disease in this age-group was significantly higher in the Aboriginal population

(1186 cases per 100 000) than the non-Aboriginal population (242 cases per 100 000) with a rate ratio of 4.9 (95% CI 3.2–7.7, $p < 0.0001$). In the remaining population (>4 years old), the non-Aboriginal rate of campylobacteriosis (119 cases per 100 000) was significantly higher than the Aboriginal rate (50 cases per 100 000) with a rate ratio of 2.4 (95% CI 1.6–3.5, $p < 0.0001$).

Cryptosporidiosis

In 2018, there were 106 notifications of cryptosporidiosis which was 23% lower than the 5 year mean (138 cases) but 13% higher than the number notified in 2017 (94 cases). Cryptosporidiosis is predominantly a disease reported in children, with 90 of the 106 cases (85%) being in the 0–4 year age group. The rate of disease was significantly higher in the Aboriginal population with 104 cases per 100 000 (80 cases) compared to 14 cases per 100 000 (23 cases) in the non-Aboriginal population (RR 7.7, 95% CI 4.8–12.8, $p = < 0.0001$).

Hepatitis A

There were 2 cases of hepatitis A notified in the NT in 2018. Both cases were linked by whole genome sequencing (WGS) to a national multijurisdictional outbreak of hepatitis A due to contaminated, imported pomegranate arils.³ These were the first 2 locally acquired hepatitis A cases notified in the NT since 2010. Since the introduction of the funded vaccine for all Aboriginal children under 5 years of age in the NT (along with South Australia and Western Australia) in 2005, there has been a decline in the number of hepatitis A notifications in the both the Aboriginal and non-Aboriginal population (a herd effect). Since then, nearly all cases of hepatitis A reported in the NT have been overseas acquired; many of the cases were people living in Australia who returned to their country of birth for a holiday or to visit family.

Typhoid

There were no cases of typhoid notified in 2018.

The NT has averaged 1–2 notifications of typhoid per year since 2007, all in people returning from typhoid endemic countries. Since 2012 all notified cases were either returning to

their birth countries or visiting family members in typhoid endemic countries. This type of traveller is less likely to seek pre-travel health advice and seek vaccination.⁵

Paratyphoid

In 2016, paratyphoid fever became a notifiable disease in its own right. Previously, infections caused by *Salmonella* Paratyphi, *Salmonella* Paratyphi A and *Salmonella* Paratyphi B were notified as salmonellosis.

There were 2 cases of paratyphoid notified in 2018. Both were acquired overseas (Bangladesh and Cambodia).

Shigatoxin producing Escherichia coli (STEC) /haemolytic uraemic syndrome (HUS)

There was 1 case of HUS reported in the NT in 2018; a 6 month old Aboriginal child in a remote community who also tested positive to STEC by PCR.

There were 4 other cases of STEC reported. STEC/HUS is not often reported in the NT and STEC is not routinely tested for by most of the laboratories that service the NT. The sporadic cases that have been reported historically have generally been in the region that SA Pathology services as all blood-stained stool samples are screened for STEC as part of their standard procedure.

Yersiniosis

There were 16 cases of yersiniosis notified in 2018 compared to 11 notified in 2017. Notifications of yersiniosis have increased since the introduction of culture independent testing in 2013.

Listeriosis

Listeriosis is not often reported in the NT and in 2018 no cases were notified.

Amoebiasis

There were no cases of amoebiasis notified in 2018.

Ciguatera

There were no cases of ciguatera fish poisoning notified in 2018.

Ciguatera was made a notifiable disease in the NT in 2010 and there have only been 2 cases notified (1 in 2013, 1 in 2016).

Vibrio food poisoning

There were 4 cases of *Vibrio* food poisoning notified in the NT in 2018. There were 2 cases imported, one each from Sri Lanka (non-toxicogenic *Vibrio cholerae*) and Vietnam (*Vibrio parahaemolyticus*). There were also 2 locally acquired *Vibrio parahaemolyticus* infections in Aboriginal people living in remote communities.

Botulism

There were no cases of botulism notified in 2018. There has only ever been 1 notification of botulism in the NT and that was in the year 2000.

Outbreak Investigations

There were 34 investigations undertaken in 2018: 7 foodborne or suspected foodborne disease outbreak investigations; 22 non-foodborne outbreak investigations; and 5 investigations following triggers of emergency department syndromic surveillance system alerts. Selected outbreak investigations are briefly summarised below.

An outbreak of food poisoning from a kebab shop

There were 3 out of 4 family members who ate chicken kebabs from a kebab shop and experienced symptoms of vomiting and diarrhoea within hours of eating who reported this to the NT Environmental Health (EH) Branch. The NT CDC followed up social media postings and hospital department presentations and in total 9 persons were found to have experienced identical symptoms after eating chicken kebabs from the same shop. In all instances, symptoms resolved within 8-12 hours and no stool samples were collected. A toxin-mediated illness was suspected. EH officers conducted an inspection and observed that meat

sticks were being defrosted and reheated in an unsatisfactory manner and that cooked meat was being shaved off the spit into a drip tray containing raw meat juices. The business voluntarily closed its premises and was issued with an improvement notice until it was able to demonstrate compliance with the *Food Act*.⁴

An outbreak of gastroenteritis due to contaminated drinking water

An outbreak of gastroenteritis was reported among students and staff attending a school camp.⁵ Of the 31 attendees, 18 fell ill with the most common symptoms being diarrhoea (18/18) and abdominal pain (17/18) of approximately 1-2 days duration. Drinking water collected from the kitchen at the camp contained *E. coli* at levels above safe drinking water guidelines. A cohort study of 29/31 attendees was undertaken and drinking water from the kitchen at the camp was shown to have a significant association with illness (adjusted odds ratio 18.0, 95% CI 1.3-247, $p < 0.03$).

An outbreak of Salmonella Ball at a private party

An outbreak of gastroenteritis affected 23/45 guests who attended a birthday party at a private residence. The most common symptoms were diarrhoea and abdominal pain with a median incubation period of 24 hours. A total of 9 stool samples were tested and all were positive for *Salmonella* Ball. A cohort study of 39/45 guests showed an association with a stir-fry mixed vegetable dish 'chop suey' (relative risk after univariate analysis 2.4, 95% CI 1.3-4.5, $p < 0.001$). EH officers discovered that 2 businesses that were not registered to provide catering services were servicing the party. Fruit salad prepared by the party organiser tested positive for *S. Ball* but the fruit salad was not considered to be the cause of the outbreak. Environmental contamination of multiple food items was suspected. Both businesses were issued infringement notices and given compliance direction. One was prohibited from producing food in a location that were unsuitable for catering for large events.

An outbreak of norovirus at a wedding

An outbreak of norovirus occurred at an outdoor catered wedding. In total, 32/122 guests reported

nausea, vomiting, diarrhoea, abdominal pain or fever. Norovirus was detected in the single stool sample that was collected. Five guests from interstate reported gastrointestinal illnesses prior to the wedding. The investigation suggested probable spread of the virus from person-to-food-to-person as well as from person-to-person at the wedding.

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Abstracts from peer reviewed published articles related to the Northern Territory

How many doses make a difference? An analysis of secondary prevention of rheumatic fever and rheumatic heart disease

de Dassel JL, de Klerk N, Carapetis JR, Ralph AP

J Am Heart Assoc. 2018 Dec 18;7(24):e010223. doi: 10.1161/JAHA.118.010223.

Background Acute rheumatic fever (ARF) and rheumatic heart disease cause substantial burdens worldwide. Long-term antibiotic secondary prophylaxis is used to prevent disease progression, but evidence for benefits of different adherence levels is limited. Using data from northern Australia, we identified factors associated with adherence, and the association between adherence and ARF recurrence, progression to rheumatic heart disease, worsening or improvement of rheumatic heart disease and mortality.

Methods and Results Factors associated with adherence (percent of doses administered) were analyzed using logistic regression. Nested case-control and case-crossover designs were used to investigate associations with clinical outcomes; conditional logistic regression was used to estimate odds ratios (OR) with 95% CIs. Adherence estimates in 7728 observations were analyzed. Being female, younger, having more-severe disease, and living remotely were associated with higher adherence. Alcohol misuse was associated with lower adherence. The risk of ARF recurrence did not decrease until $\approx 40\%$ of doses had been administered. Receiving $<80\%$ was associated with a 4-fold increase in the odds of ARF recurrence (case-control OR : 4.00 [95% CI : 1.7-9.29], case-crossover OR : 3.31 [95% CI : 1.09-10.07]) and appeared to be associated with increased all-cause mortality (case-control OR : 1.90 [95% CI : 0.89-4.06]; case-crossover OR 1.91 [95% CI : 0.51-7.12]).

Conclusions We show for the first time that increased adherence to penicillin prophylaxis is associated with reduced ARF recurrence, and a likely reduction in mortality, in our setting.

These findings can motivate patients to receive doses since even relatively low adherence can be beneficial, and additional doses further reduce adverse clinical outcomes.

Community-based participatory action research on rheumatic heart disease in an Australian Aboriginal homeland: Evaluation of the 'On track watch' project

Haynes E, Marawili M, Makungun Marika B, Mitchell A, Phillips J, Bessarab D, Walker R, Cook J, Ralph A

Evaluation and Program Planning 74 (2019) 38–53

Strategies to date have been ineffective in reducing high rates of rheumatic heart disease (RHD) in Australian Aboriginal people; a disease caused by streptococcal infections. A remote Aboriginal community initiated a collaboration to work towards elimination of RHD. Based in 'both-way learning' (reciprocal knowledge co-creation), the aim of this study was to co-design, implement and evaluate community-based participatory action research (CBPAR) to achieve this vision. Activities related to understanding and addressing RHD social determinants were delivered through an accredited course adapted to meet learner and project needs. Theory-driven evaluation linking CBPAR to empowerment was applied. Data collection comprised focus groups, interviews, observation, and co-development and use of measurement tools such as surveys. Data analysis utilised process indicators from national guidelines for Aboriginal health research, and outcome indicators derived from the Wallerstein framework. Findings include the importance of valuing traditional knowledges and ways of learning such as locally meaningful metaphors to explore unfamiliar concepts; empowerment through critical thinking and community ownership of knowledge about RHD and research; providing practical guidance in implementing empowering and decolonising principles / theories. Lessons learned are applicable to next stages of the RHD elimination strategy which must include scale-up of community leadership in research agenda-setting and implementation.

Four-weekly Benzathine Penicillin G provides inadequate protection against acute rheumatic fever in some children (in Australia's Northern Territory)

de Dassel JL, Malik H, Ralph AP, Hardie K, Remenyi B, Francis JR

Am J Trop Med Hyg. 2019 Mar 25. doi: 10.4269/ajtmh.18-0907

This study aimed to identify recurrent acute rheumatic fever (ARF) episodes which occurred despite adherence to prophylactic benzathine penicillin G (BPG). Data from Australia's Northern Territory were analyzed; ARF recurrences between 2012 and 2017 diagnosed while the person was prescribed BPG were identified. Days at risk (DAR)-median and interquartile range-preceding ARF onset were calculated. The timing of BPG doses was examined for individuals with no DAR. One hundred sixty-nine ARF recurrences were analyzed; median DAR in the previous 8 weeks before ARF onset was 29. Most recurrences occurred following > 7 DAR (87%). Eight recurrences (5%) occurred despite no DAR; all were aged less than 16 years at the time of their recurrence/s. Recurrent ARF most commonly occurs after delayed BPG doses, but in some cases, receiving every prescribed BPG dose on time did not prevent recurrent ARF. A method to identify high-risk individuals before recurrent ARF is needed.

Case report: Severe disseminated gonococcal infection with polyarticular gout: Two cases in older travelers

Smith EL, Hodgetts KE, Ralph AP, Anstey NM

Am J Trop Med Hyg. 2019 Jan;100(1):209-212. doi: 10.4269/ajtmh.18-0589.

Two male travelers with histories of gout and hazardous alcohol consumption, presented with a triad of severe culture-positive disseminated gonococcal infection, crystal-positive polyarticular gout, and gonococcal soft tissue collections, following unprotected sexual contact in the Philippines. Both men initially attributed symptoms to gout, since their usual joints were affected, but clinical deterioration occurred with self-administration of anti-inflammatory agents

alone. The clinical courses were severe and protracted, requiring aggressive management of infection with prolonged intravenous antimicrobials and repeated surgery, and prolonged anti-inflammatory agents for gout. Joint symptom onset in each case occurred within a week of sexual exposure in conjunction with hazardous alcohol ingestion. We speculate that acute dissemination of infection to previously damaged joints triggered polyarticular gout, with progressive infection, exacerbated by unopposed anti-inflammatory agents and delayed antibiotics. Disseminated gonococcal infection can occur with polyarticular gout and delays in recognition and treatment, including while traveling, can lead to severe disease from both.

The barriers to linkage and retention in care for women living with HIV in an high income setting where they comprise a minority group

Giles M, MacPhail A, Bell C, Bradshaw CS, Furner V, Gunathilake M et al

AIDS Care, 2019, 31:6, 730-736, DOI:10.1080/09540121.2019.1576843

Women comprise a minority population of individuals living with HIV in Australia, and are often poorly represented in research and clinical trials so their needs remain largely unknown. Data suggests that they are diagnosed later than men and start antiretroviral therapy at a lower CD4 cell count. This raises the question whether there are sex specific barriers to linkage and retention in care. This study analyzed 484 surveys received from clinicians collecting demographic, virological, and reproductive health data along with perceived barriers to linkage and retention in care. Most women (67%) were estimated to have been linked into care within 28 days of diagnosis. For women who were not linked into care for more than 28 days, the most commonly reason cited was fear of disclosure to others, followed by fear of disclosure to their partner. The main reasons given for non-retention in care were related to transport, carer responsibilities, financial pressure, health beliefs and concern about stigma or disclosure.

Australian vaccine preventable disease epidemiological review series: varicella-zoster virus infections, 1998-2015

Sheel M, Beard F, Quinn H, Dey A, Kirk M, Koehler A, Markey P, McIntyre P, Macartney K

Commun Dis Intell (2018). 2018;42. pii: S2209-6051(18)00002-7. Epub 2018 Sep 12.

Introduction: In 2005, the National Immunisation Program implemented a varicella vaccine for children aged 18 months, and in 2016, a herpes zoster (HZ) vaccine for adults aged 70-79 years. This epidemiological review analyses national trends in varicella and HZ for the years 1998-2015 to examine the impact of a funded varicella vaccine and provide a baseline for monitoring the impact of a funded HZ vaccine.

Methods: Varicella and HZ notifications (2002-2015), hospitalisations (1999-2013) and deaths (1998-2013) were sourced. We stratified analyses by age, sex and Indigenous status, and estimated rates and incidence rate ratios.

Results: Funded varicella vaccine led to a rapid decline in varicella notifications, hospitalisations and deaths. During the post-varicella vaccine period, hospitalisations declined in all age groups <40 years, with greatest reduction of 84% in children aged 18-59 months. Annual HZ hospitalisation rate was 10.8 per 100,000. HZ hospitalisation rates increased with age and were highest in persons aged =75 years (87.6 per 100,000). Post-herpetic neuralgia (PHN) was diagnosed in 32.5% HZ hospitalisations with highest hospitalisation rate in persons aged =75 years (32.1 per 100,000). Varicella and HZ hospitalisation rates were significantly higher among Indigenous Australians. Twenty one deaths were coded as due to varicella and 340 deaths were coded as due to HZ in persons aged <40 years and =40 years, respectively.

Conclusions: The national varicella immunisation program substantially reduced varicella associated morbidity and mortality. Burden of HZ and PHN in Australia is substantial. Following the introduction of a funded HZ vaccine, timely and high quality surveillance will be crucial to assess the impact of the national HZ immunisation program.

Northern Territory malaria notifications October to December 2018

Liz Stephenson, CDC Darwin

There was only 1 case of malaria notified in the 4th quarter of 2018. The following table provides details about where the infection was thought to be acquired, the infecting agent, whether chemoprophylaxis was used and where the patient lived.

No of cases	Origin of infection	Agent	Chemoprophylaxis	NT region
1	Uganda	<i>P. falciparum</i>	No	Darwin



Centre for Disease Control

March flies and their medical importance

What is there to know about March flies?

March flies are also known as horse flies or tabanids, with about 200 species known to occur in Australia. They can be a serious pest of both humans and animals, with the females inflicting a painful bite to take a blood meal in order to produce eggs. March flies occur in various habitats, and are known to breed in damp soil, rotting vegetation, sand and tree holes. The life cycle of the different March fly species varies, but the adults generally live for 3-4 weeks. They are most active during daytime.

What medical conditions are triggered by March flies in the NT?

While March flies are not known to transmit disease in Australia, their bite can trigger adverse allergic reactions. In the Top End of the NT, one species (*Pseudotabanus tryphera*) is known to cause serious medical symptoms in some people, including hives, fever, wheezing and in severe cases anaphylactic shock.

Allergic reactions are a response to proteins in the March fly's saliva, injected while biting. Scratching of bites can also lead to secondary skin infection. To relieve the symptoms, ice packs can be applied to the bite.

Mild antihistamines can also provide some relief to painful bites. In case of a severe allergic reaction, urgent medical attention should be sought immediately.

How can March fly bites be prevented?

There are no control measures using insecticides for March flies that are effective, due to their extensive breeding areas and long distance flight range. Personal protection measures are the best way to avoid being bitten.

Personal protection measures include;

- Use protective clothing in outdoor situations. Loose-fitting and light-coloured shirts and long pants are best, as March flies are attracted to dark colours.
- Use personal repellents containing DEET or picaridin on areas of exposed skin in combination with protective clothing. Personal repellent lotions and gels are more effective and longer lasting than sprays.

For more information on March flies contact Centre for Disease Control, Medical Entomology on 8922 8901.

For more information contact the Centre for Disease Control in your region

Alice Springs 8951 7540

Darwin 8922 8044

Katherine 8973 9049

Nhulunbuy 8987 0357

Tennant Creek 8962 4259

Or visit <https://health.nt.gov.au/professionals/centre-for-disease-control/cdc-contacts>



Centre for Disease Control

Murray Valley encephalitis

What is Murray Valley encephalitis?

Murray Valley encephalitis (MVE) is an uncommon but potentially fatal disease that occurs after being bitten by a mosquito carrying the MVE virus. It is the most serious mosquito-borne disease that occurs in the Northern Territory (NT).

How is MVE spread?

The MVE virus is spread by the bite of an infected mosquito (usually *Culex annulirostris* also known as the common-banded mosquito). Only about 1 person in 1000 who is bitten by an infected mosquito will become unwell with MVE.

Where does MVE usually occur?

Although MVE can occur throughout Australia, it is most common in northern Australia. The MVE virus is present from February to July in the Top End of the NT, north-west of Western Australia and inland North Queensland during most years, and can extend into the Barkly and Central Australia in wet years. Most cases are detected between March and May.

What are the symptoms?

Symptoms of MVE usually appear 5 to 28 days after being bitten by an infected mosquito. The early symptoms include headache, fever, nausea and vomiting, and muscle aches, which can progress to drowsiness, confusion, seizures or fits (especially in young children) and in severe cases delirium and coma.

Who is at risk?

People most at risk are babies, young children and newcomers to a region where MVE occurs.

How is it diagnosed?

A blood test is available to test for recent or past MVE infection.

What is the treatment?

There is no specific treatment or vaccine available for MVE. The treatment of severe MVE is supportive and often requires admission to an intensive care unit.

How can MVE be prevented?

The only protection from MVE is to avoid being bitten by mosquitoes. Everyone should take measures to avoid being bitten by mosquitoes, particularly those visiting and camping in or near swamp or river systems during the evening and night, and in rural areas near sites of relatively high mosquito activity.

Mosquito protection for young children and babies is absolutely essential.

Personal protective measure

For self protection from mosquitoes in areas and times of actual or potential mosquito activity:

- Stay indoors when mosquitoes are most active, from just before, until 2 hours after sunset.

 Centre for Disease Control

- Ensure flyscreen's in houses or caravans are in good condition. If camping out sleep in a mosquito-proof tent or under a mosquito net. Repellents only protect against mosquito bites for up to 4 hours, not all night.
- Avoid scents on the body, e.g. perfume, deodorants, and sweat, since these can attract mosquitoes.
- Use protective clothing in outdoor situations including covering feet, legs and arms. Loose, light coloured clothing is best.
- Use personal repellents containing DEET or picaridin on areas of exposed skin in combination with protective clothing.
- Use electric insecticide devices using repellent treated pads in indoor or enclosed areas.
- Use mosquito coils, or candle heated or gas operated devices using insecticide treated pads for patio and verandah relatively sheltered or low wind outdoor situations.

For more information on protection measures see [Personal protection from mosquitoes](#)

For more information contact your nearest Centre for Disease Control.

Darwin 8922 8044

Katherine 8973 9049

Alice Springs 8951 7540

Tennant Creek 8962 4259

Nhulunbuy 8987 0357

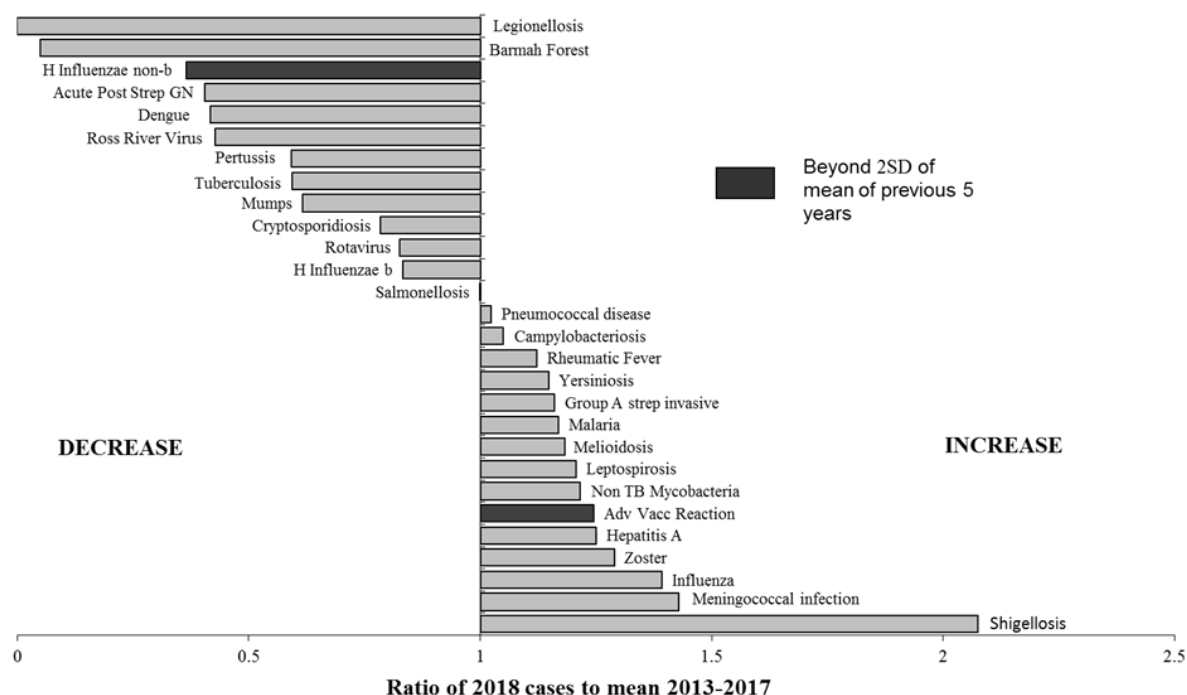
For more information on mosquitoes and virus ecology contact Centre for Disease Control, Medical Entomology on 8922 8901

NT NOTIFICATIONS OF DISEASES BY ONSET DATE & DISTRICTS

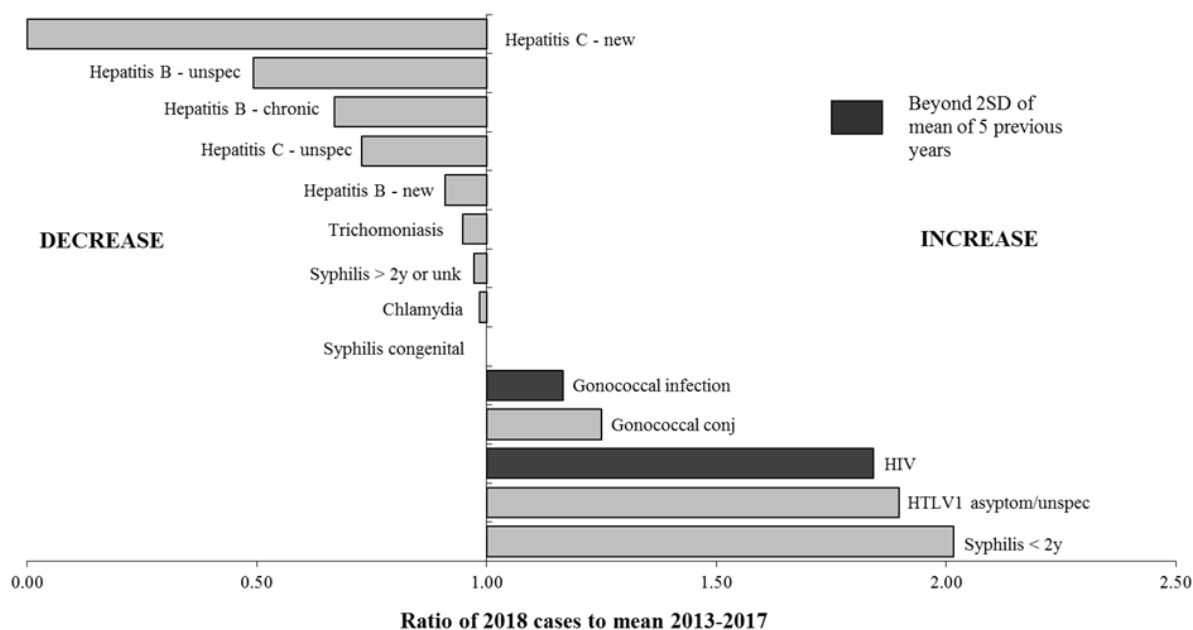
1 January—31 December 2017 and 2018

	Alice Springs		Barkly		Darwin		East Arnhem		Katherine		NT	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Acute post strep glomerulonephritis	15	3	0	2	15	6	6	4	12	5	48	20
Adverse vaccine reaction	11	4	3	0	42	55	2	5	4	4	62	68
Amoebiasis	1	0	0	0	1	1	0	0	0	0	2	1
Barmah Forest	2	0	1	1	16	3	1	0	0	1	20	5
Campylobacteriosis	66	94	10	12	253	216	18	11	64	38	411	371
Chickenpox	16	13	2	3	49	43	4	12	9	4	80	75
Chlamydia	856	809	108	108	1328	1307	185	261	287	342	2764	2827
Chlamydial conjunctivitis	1	16	0	19	5	7	0	0	0	0	6	42
Crusted scabies	4	6	0	2	24	29	18	12	7	10	53	59
Cryptosporidiosis	23	48	4	11	43	24	10	8	14	17	94	108
Dengue	2	1	2	0	30	27	0	0	0	0	34	28
Food/water borne disease	0	0	0	0	1	0	0	0	0	0	1	0
Gastro - related cases	2	1	0	1	1	0	0	0	0	0	3	2
Gonococcal conjunctivitis	0	0	0	1	0	2	0	0	0	1	0	4
Gonococcal infection	865	1065	164	131	404	431	118	212	272	323	1823	2162
Gonococcal neon ophthalmia	0	1	0	0	1	0	0	0	0	1	1	2
Group A strep invasive	24	36	6	2	26	25	3	4	7	10	66	77
Hepatitis A	0	0	0	0	0	2	0	0	0	0	0	2
Hepatitis B - chronic	0	7	1	0	11	14	1	4	0	2	13	27
Hepatitis B - new	3	2	0	0	3	2	0	0	1	0	7	4
Hepatitis B - unspecified	13	17	0	0	80	62	3	2	5	3	101	84
Hepatitis C - new	1	0	0	0	4	0	0	0	0	0	5	0
Hepatitis C - unspecified	27	26	1	3	125	113	0	1	12	11	165	154
H Influenzae b	0	0	1	0	1	1	0	0	0	0	2	1
H Influenzae non-b	3	0	1	0	2	2	0	0	3	1	9	3
HIV	4	9	0	2	19	29	0	0	0	2	23	42
HTLV1 asymptomatic/unspecified	19	68	0	2	1	4	0	0	7	3	27	77
HTLV1 TSP	0	1	0	0	0	0	0	0	0	0	0	1
HUS	0	1	0	0	0	0	0	0	0	0	0	1
Influenza	342	42	62	8	783	928	167	148	210	93	1564	1219
Legionellosis	0	0	0	0	1	0	0	0	0	0	1	0
Leptospirosis	0	0	0	0	9	6	0	0	5	1	14	7
Malaria	2	2	0	0	11	15	0	0	1	1	14	18
Measles	0	0	0	0	2	0	0	0	0	0	2	0
Melioidosis	0	1	0	0	34	53	5	7	4	4	43	65
Meningococcal infection	26	5	5	1	4	6	0	2	4	0	39	14
Mumps	68	7	17	0	20	3	1	4	42	24	148	38
MVE	0	0	0	0	0	1	0	0	0	0	0	1
Non TB Mycobacteria	0	1	0	0	8	8	0	0	1	0	9	9
Pertussis	10	16	1	2	84	38	9	1	8	14	112	71
Pneumococcal disease	40	35	7	1	20	16	4	4	7	6	78	62
Rheumatic Fever	64	52	1	11	46	36	29	22	22	27	162	148
Ross River Virus	17	7	4	4	123	89	17	11	18	17	179	128
Rotavirus	139	85	15	27	110	43	29	1	56	10	349	166
Salmonellosis	68	84	19	12	377	361	33	26	72	63	569	546
Shigellosis	204	206	46	17	74	65	32	39	113	100	469	427
STEC/VTEC	0	1	1	1	1	2	0	0	0	0	2	4
Strongyloidiasis disseminated	0	0	0	0	0	0	0	0	0	1	0	1
Syphilis < 2years duration	52	90	6	9	169	142	25	53	74	52	326	346
Syphilis > 2years or unknown	24	22	1	5	56	38	4	8	17	6	102	79
Syphilis congenital	0	0	0	0	0	0	0	0	1	1	1	1
Trichomoniasis	1045	1072	207	204	1203	953	510	529	593	561	3558	3319
Tuberculosis	3	6	1	0	16	12	0	1	4	0	24	19
Typhoid	0	0	0	0	1	0	0	0	0	0	1	0
Typhus	1	0	0	0	2	1	0	0	0	0	3	1
Varicella - unspecified	0	5	0	0	7	4	0	0	0	0	7	9
Vibrio food poisoning	0	0	0	0	1	3	0	1	0	0	1	4
Vibrio invasive	0	0	0	1	0	1	1	0	0	0	1	2
Yersiniosis	3	2	0	0	11	10	1	0	0	2	15	14
Zoster	55	74	11	5	308	306	18	19	31	39	423	443
Sum:	4,121	4,043	708	608	5,966	5,545	1,254	1,412	1,987	1,800	14036	13408

Ratio of the number of notifications in 2018 to the 5 year mean (2013-17): selected diseases



Ratio of the number of notifications in 2018 to the 5 year mean (2013-2017): sexually transmitted diseases



Comments on notifications

Adverse event following immunisation

In 2018 there were 68 notified adverse events following immunisation which was 13 more than the expected 55 (5 year mean). This was likely due to the increased number of vaccines given due to the meningococcal ACWY vaccine program in addition to an increased uptake of the influenza vaccine for the 2018 season.

Invasive *Haemophilus influenzae* non-B infection

There were only 3 cases of invasive *Haemophilus influenzae* non-B infection in 2018 compared with an expected 8. This is good news, signifying that there has still not been any significant replacement of the virulent B type ('Hib') with other types since the introduction of the vaccine in the early 1990s.

Gonococcal infection

The 2162 cases of gonorrhoea notified in 2018 were 1.17 times the (2013-2017) 5 year mean and reflected the national increase in notifications in 2018. The increase in cases and occurred in both men and women of the Top End and Central regions. This increase had peaked in the NT by May 2018.

HIV

Of the 42 cases of HIV notified in 2018, 36 had NT as their place of residence. Of these, 17 were previously diagnosed and had transferred their care from interstate. The majority of newly diagnosed cases acquired their infection overseas.

The quarterly comparative immunisation coverage data provided from the Australian Immunisation Register for children aged 12-<15 months, 24-<27 months and 60-<63 months usually reported is not available.

