**Shigella flexneri 2b in the Northern Territory in 2017**

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**Abstract**

As at 30 November 2017, there were 413 notifications of shigellosis in the Northern Territory in 2017 which was 3.3 times the previous 5 year-to-date mean (126). Most (197, 48%) notifications were due to Shigella flexneri 2b. Of the 197 notifications of Shigella flexneri 2b, 188/197 (95%) were in Aboriginal people, 133/197 (68%) were female, and the median age was 18 years (range 1–90 years).

Key words: Shigellosis; Shigella flexneri 2b; outbreak; Northern Territory.

**Background**

Shigellosis is an acute gastrointestinal disease caused by the gram negative bacteria from the genus, *Shigella*. It is characterised by diarrhoea (often bloody or with mucous), abdominal cramps, tenesmus, fever, nausea and vomiting. It is highly infectious with as few as 10 organisms enough to cause infection. Transmission occurs via the faecal-oral route; most commonly through contamination of food or water, particularly in developing countries or in settings where there is a breakdown in hygiene. Person-to-person spread is common, particularly among young children and in men who have sex with men (MSM).

In the Northern Territory (NT), the majority (typically >80%) of shigellosis notifications are seen in the Aboriginal population with the remainder usually seen in non-Aboriginal people returning from travel to developing countries, particularly Bali, Indonesia. The NT has by far the highest rates of shigellosis in Australia compared with other jurisdictions. In 2014 the national rate was 4.5 per 100,000 while the rate in the NT was 40.5 per 100,000.

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The *Shigella* genus can be divided into 4 subgroups or species; *S. dysenteriae*, *S. flexneri*, *S. boydii* and *S. sonnei* which are further subdivided into a number of serotypes. There are usually a few serotypes circulating in the NT at any one time (Figure 1).

*Shigella* can only be identified to the species level if an isolate is cultured. In late 2013, the largest private pathology provider in the NT, Western Diagnostic Pathology (WDP) began using a faecal multiplex polymerase chain reaction (PCR) assay. This more sensitive assay is able to detect the nucleic acid of non-viable bacteria that would not be able to be detected using traditional culture methods. Approximately 40% of shigellosis notifications in the Darwin region in 2016 were PCR positive but culture negative and this has resulted in untyped *Shigella* being the predominant type of shigellosis notification.

Methods

Data was extracted from the NT Notifiable Diseases System (NTNDS) on 30 November 2017 and analysed from the data warehouse using Business Intelligence and Intercooled Stata 13.1.

An outbreak case was defined as anyone notified with *S. flexneri* 2b in the NT since 1 November 2016.

Results

The outbreak started in November 2016 and notifications were sporadic until May 2017 when cases increased to 30 per month. From 1 November 2016 to 30 November 2017 there were 437 notifications of shigellosis which was about 3.3 times the expected number. Most (204, 49%) notifications were due to *S. flexneri* 2b followed by *Shigella* species (untyped) with 153 notifications (35%).

Of the 204 notifications of *S. flexneri* 2b, 195/204 (96%) were in Aboriginal people, 138/204 (68%) were female and the median age was 18 years (range 1–90 years).

There were 62 notifications in children <5 years old but the majority of notifications (118/204) were in people 15 years and older, particularly females between 25 and 39 years of age (Table 1).
The median age was significantly higher than that of all other shigellosis notifications in 2016/2017 (18 v 11; p<0.05). Figure 2 shows the epidemic curve of *S. flexneri* 2b in the NT since the original importation of the serotype in November 2016 (7 cases in 2016, 197 cases in 2017).

The incidence of *S. flexneri* 2b was sporadic until May 2017 but then became increased and sustained. Since 1 November 2016, *S. flexneri* 2b (204 cases), unserotyped *S. flexneri* (20 cases) and untyped *Shigella* species (153 cases) accounted for 91% of all shigellosis notifications in the NT (Figure 3). Based on the proportions of *Shigella* notifications with known serotypes, we estimate that 19/20 of the unserotyped *S. flexneri* and 110/153 of the untyped *Shigella* species in 2017 are probably related to the outbreak of *S. flexneri* 2b. This gives an estimate of 333 cases since 1 November 2016.

In 2017 there were 98 notifications of *S. flexneri* 2b in the Alice Springs region, 31 in the Barkly region, 47 in the Katherine region and 5 in the Darwin region. There were 16 interstate residents notified, diagnosed while in the NT. Since 1 November 2016, the 204 notifications of *S. flexneri* 2b were notified from 117 distinct localities with no localised outbreaks detected in any particular locality or community. The maximum number of cases in a remote community was 21 over 12 months. Figure 4 shows the rates of notified *S. flexneri* 2b in the different regions in 2017. The highest rates were observed in the Barkly region.

### Table 1. *S. flexneri* 2b notifications by age group and sex in the Northern Territory, 1 November 2016 – 30 November 2017 (n=19)

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>33</td>
<td>29</td>
<td>62</td>
</tr>
<tr>
<td>5-9</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>10-14</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>15-19</td>
<td>7</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>20-24</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>25-29</td>
<td>10</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>30-34</td>
<td>9</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>35-39</td>
<td>13</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>40-44</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>45-49</td>
<td>11</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>50-54</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>55-59</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>60-64</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>≥ 65</td>
<td>13</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>138</td>
<td>66</td>
<td>204</td>
</tr>
</tbody>
</table>

Figure 2. Epidemic curve of *S. flexneri* 2b notifications in the Northern Territory by diagnosis date, 1 November 2016 – 30 November 2017.
Discussion

The lack of detection of localised outbreaks and sustained increased incidence of *S. flexneri* 2b in 2017 suggests that person-to-person transmission was the main driver in communities as opposed to a point source due to contaminated food or water. The cases were spread across a large number of communities and over a vast area of Central Australia which reflects the highly mobile Aboriginal population.

The outbreak investigation was hampered by the wide dispersal of cases and the fact that cases were geographically disparate and not easily contactable. This meant that epidemiological investigation was not always possible.

The incidence of *S. flexneri* 2b increased markedly in May 2017 which coincided with an outbreak of rotavirus (Figure 5). The rotavirus outbreak commenced in Central Australia in April and was the largest in the NT for a number of years.\(^8\) Mild and asymptomatic shigellosis infections can occur\(^1\) and it is possible that this rotavirus outbreak enabled those with less severe infections to become more transmissible or to be detected. This may explain in part the high number of adult females who were notified with *S. flexneri* 2b as this group of people is most...
likely to be involved in child rearing and caring for those who are sick.

This increase in transmissibility was likely exacerbated by the socioeconomic determinants of health that affect Aboriginal people living in remote Australia. It is estimated that up to 23% of Indigenous Australians are living in crowded households with that percentage increasing to over 50% for those living in very remote areas and up to 65% for those in the NT. Crowding also contributes to a decrease in the habitability of these houses with health hardware, including taps, toilets, washing facilities and safe food preparation areas all compromised. The 2012/2013 Health Survey showed plumbing problems were present in 18% of remote households and that 24% did not have a safe area to prepare food.

In crowded houses, hardware fails faster. Increased use means that items such as doors, toilets and taps will inevitably break sooner. The Australian Government’s review of the National Partnership Agreement on Remote Indigenous Housing and the Remote Housing strategy found that the NT performed poorly in terms of its ability to conduct cyclical and proactive maintenance of Aboriginal housing.

The NT CDC issued an alert to clinicians in July 2017 with a number of directives aimed at reducing the incidence of shigellosis. Clinicians and health centre staff were asked to undertake the following actions in their communities:

- promote handwashing and good general hygiene
- encourage appropriate human waste disposal including using functional toilets and the safe disposal of nappies
- encourage and assist those patients who report non-functioning toilets and plumbing to report these faults to the relevant body in their community
- encourage those with diarrhoea not to prepare food or handle food for others and to stay away from school, childcare and workplaces until diarrhoea free.

The NT CDC also encouraged clinicians to assure treatment of all cases of shigellosis with antibiotics in order to decrease transmission. Communicability is at its highest during the acute phase of the illness (usually 4-7 days) but the bacteria can be transmitted by cases for up to 4 weeks after the diarrhoea ceases with some even carrying the bacteria for months. Appropriate antimicrobial therapy can shorten the duration of symptoms and limit the duration of carriage to a few days.

The Environmental Health branch were also involved and have been assisting in promoting hand hygiene messages in schools and childcare.
centres in the affected communities and prioritising repair of health hardware.

**Conclusion**

Shigellosis is a highly infectious disease that contributes to the morbidity of Aboriginal people in the NT. In 2017, the incidence of shigellosis was over 3 times the expected rate with *S. flexneri* 2b accounting for almost half of all shigellosis notifications.

It is possible that the increase in shigellosis was facilitated by an earlier outbreak of rotavirus. Crowding and poor housing conditions likely contributed to the high incidence of both diseases.

In the short term, all shigellosis cases should be treated with appropriate antibiotics to reduce transmission. Health hardware faults need to be reported and fixed promptly.

In the long term, housing in Aboriginal communities, including increasing the amount of appropriate housing being built to reduce crowding and proactive maintenance of essential health hardware, needs to improve. This will work to decrease the incidence of infectious diseases and improve the lives of Aboriginal Australians.

**References**

What is shigellosis?
Shigellosis is an infection of the bowel (gut) caused by the bacteria called *Shigella*.

How is it spread?
Spread can occur by eating food or drinking water that has been contaminated by very small amounts of faeces (i.e. ‘poo’) from infected people.
Spread can also occur through oral-anal contact.

What are the symptoms?
Symptoms usually develop between 1 to 3 days after becoming infected but may take up to a week to appear.
Most people with *Shigella* infection experience diarrhoea (sometimes with blood or mucus), fever, vomiting and stomach cramps.
The illness usually lasts 3 to 4 days but may last longer, particularly in very young, elderly and severely underweight people.
Some infected people only have a very mild illness or no symptoms at all.

What is the infectious period?
People with shigellosis can pass the infection on to others while they are ill and for up to 4 weeks after their diarrhoea has stopped.
Antibiotic treatment will help stop spread of the infection to other people.

Who is at risk?
The most severe infections occur in very young, elderly and severely underweight people.
Children who attend childcare facilities are at greater risk of infections. Spread occurs when children share toys or food that have become contaminated and place it in their mouths.
Particular care has to be taken wherever there are children in nappies.
Travelers to developing countries or to remote communities where sanitation and hygiene are poor are at higher risk of contracting diarrhoeal illness.
Men or women who have anal sex are more at risk of shigellosis through oral-anal contact.

What is the treatment?
It is important to prevent and/or treat dehydration caused by vomiting or diarrhoea. Anyone with vomiting or diarrhoea should drink extra fluids to avoid dehydration. Drinking oral glucose/electrolyte solution is very effective. If children do not want to drink this solution, diluted fruit juice may be given (1 part juice to 4 parts water).
Continue to offer normal feeds to babies plus extra fluids in between feeds.
Children with diarrhoea, who vomit or who do not want extra fluids should see a doctor.
Anyone with diarrhoea that will not stop or severe diarrhoea, or who have symptoms that worry them, should see a doctor.
Do not take medicine that stops vomiting or diarrhoea, especially do not give to children, except when prescribed by a doctor.
When the diagnosis of shigellosis is confirmed by a lab test, the doctor may prescribe antibiotics. This can reduce the risk of complications and the spread of infection to others.
How can shigellosis be prevented?

Good hygiene is the best way to prevent shigellosis.

Hands should be washed thoroughly with warm soapy water:
- after going to the toilet
- before preparing or handling food
- after every nappy change
- after changing soiled linen.

Other measures:
- never change nappies on tables or benches where food is prepared or eaten
- clean nappy changing areas with warm soapy water and disinfectant after every nappy change
- clean books, toys, equipment, furnishings, floors and toilets regularly (including toilet door handles)
- wash raw fruit and vegetables carefully before eating

- make sure that toilets and bathrooms in the home are working. If you rent, tell your landlord or housing provider if your toilet or plumbing is broken.

How can it be controlled?

Anyone with diarrhoea should not go to childcare/school for 24 hours after the diarrhoea has stopped.

People with diarrhoea should not prepare or handle food that will be eaten by others.

Anyone with diarrhoea should not swim, wade or paddle in public pools.

Doctors and public health workers are interested in preventing outbreaks of diarrhoea. If there are 2 or more people with diarrhoea in a group or family, call the local Centre for Disease Control.

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

Fax to (number):_______________________ Date:_____/______/______

Shigellosis follow-up

To the Manager of .........................................Community Health Care Centre/Clinic

Your client ........................................................HRN: 

Has been notified as suffering from shigellosis. Due to an increase in cases we have developed the following recommendations to prevent transmission.

①https://nt.gov.au → search “shigellosis"

We recommend clinicians do the following                (tick ✓ when completed)

☐ Treat all cases of shigellosis with antibiotics.* Treat even if diarrhoea has resolved. Treatment is important to reduce transmission.

☐ Promote good personal and household hygiene. In particular encourage hand-washing before and after food preparation and after nappy changing or going to the toilet.

☐ Promote proper human waste disposal. Promote the use of functioning toilets and safe disposal of nappies.

☐ Help people to have functioning health hardware. Encourage and assist your clients to report non-functioning toilets and plumbing to the relevant body in the community so it can be repaired.


☐ Exclude people with diarrhoea from school, childcare or work.

They should not handle or prepare food for others until 48 hours after diarrhoea has ceased.

If the case attends/works at a school, preschool or child care centre, exclude

If the case attends/works at a school, preschool or child care centre, exclude them until they have not had a loose bowel motion for 24 hours.

☐ Inform cases not to swim in public swimming pools until after diarrhoea has ceased.

☐ Notify the Centre for Disease Control (89228044) if;

  o there are any further related cases

  o the case is a food handler

  o there are two or more cases in an institution (eg child care, school, nursing home)

☐ Report environmental concerns in the community (eg leaking sewage) to Environmental Health on 89227377.

NT Centre for Disease Control

Therapeutic Guidelines, Antibiotic version 15, 2014

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Mumps outbreak in the Northern Territory 2015-2017: A continuous rise in the vaccinated population

Priya Darshene Janagaraj, Centre for Disease Control, Darwin

Abstract

The mumps outbreak continues in the Northern Territory (NT). The outbreak started in July 2015 and has since spread throughout the NT with 283 cases of which 261 (92.2%) were in Aboriginal people. The age range of cases was between 3 and 70 years, with a mean of 24.1 years. A total of 84% of the cases occurred in the 10 to 40 years age group. Analysis of the Mumps-Measles-Rubella (MMR) vaccination status of the cases showed that 46.3% of the cases had been fully vaccinated, 16.6% were partially vaccinated and 37.1% had no vaccinations records or were unvaccinated. Out of the 21 cases of mumps in the non-Aboriginal population, 85.7% of cases had no record of vaccination or were unvaccinated. Public health responses were implemented with isolation of cases and catch up immunisation of contacts. The frequent movement, crowding and communal living of Aboriginal people appears to facilitate circulation and transmission of the virus. There have been no studies successfully demonstrating the role of the third dose MMR vaccine as an outbreak control measure in a non-congregate setting.

Key words: MMR; Aboriginal; mumps; outbreak; vaccine.

Introduction

Mumps is a communicable illness caused by a RNA virus of the paramyxoviridae family.1 The introduction of the mumps vaccine in 1981 in Australia has significantly reduced the incidence of mumps and its associated morbidity.2

Mumps transmission occurs by direct contact with secretions or respiratory droplets of an infected person.1 Mumps commonly presents with fever and parotitis and the infectious period is from 7 days prior to onset of parotid swelling to 9 days after the onset. The incubation period is between 12 to 25 days. About a third of people with mumps are asymptomatic with subclinical infection, but they can still transmit the disease. The disease is generally benign with a spontaneous resolution but can lead to serious complications, such as pancreatitis, orchitis, meningitis, and encephalitis.1,3,4

In Australia, the mumps containing vaccine was introduced into National Immunisation Program in 1983 and in 1994 a second dose was added.2 Mumps vaccine is currently part of the combined Mumps-Measles-Rubella (MMR) vaccine and is on the Australian National Immunisation Program Schedule for children aged 12 months with a second dose at 18 months of age. According to the National Centre for Immunisation Research and Surveillance, MMR vaccine can be safely given from 9 months of age.2

Globally, there has been a resurgence of mumps cases in highly vaccinated populations over the last decade.4,5 On 15 July 2015, the Centre of Disease Control (CDC) Northern Territory (NT) was informed of a mumps case in a 2-dose vaccinated 18-year-old female from a small Aboriginal community in the Katherine district with close cultural and familial ties with Western Australian communities affected by a mumps outbreak during that time. More cases were subsequently reported, primarily among vaccinated Aboriginal teenagers and young adults.

Materials and methods

Data collection

Mumps is a nationally notifiable condition in Australia and has a national case definition based on either confirmatory laboratory evidence, or a combination of suggestive laboratory, clinical and epidemiological evidence. Cases are usually diagnosed by polymerase chain reaction (PCR) testing on a buccal or throat swab or urine sample. Mumps cases may be notified to the CDC by the laboratory or health care workers. Following notification, supplementary data is collected by CDC staff and entered into the NT Notifiable Diseases System (NTNDS). CDC collects information on demographics, laboratory results,
vaccination history, symptom onset date and hospitalisation dates. Vaccination status of cases is verified by CDC staff from electronic patient information systems and the NT immunisation register.

All cases of confirmed mumps likely to have been acquired in the NT from the beginning of July 2015 were included in the outbreak. Those known to have been acquired outside the NT were excluded. It is important to note the vaccine policy changes of MMR vaccine have resulted in inconsistency in the definition of fully vaccinated status based on having received a first dose of MMR vaccine after 11.5 months of age. Up until 1998, all Aboriginal children in the NT had their first dose of MMR vaccine at 9 months of age as part of the Immunisation guidelines.2 In this analysis, cases with records of at least 2 MMR vaccines, regardless of age at first dose, were defined as fully vaccinated and those with a single dose of MMR vaccine were defined as partially vaccinated.

All mumps cases in the NT between July 2015 and 17 November 2017 were extracted from the NTNDS and analysed using Microsoft Excel and SPSS.

Results

From the beginning of the current mumps outbreak in the NT until 17 November 2017, there have been 283 cases of which 261 (92.2%) were in Aboriginal people. There was no significant difference in the gender distribution of the cases (46.6% females vs 53.4% males).

The epidemic curve of the 2015-2017 mumps outbreak in NT based on region is illustrated in Figure 1.

The outbreak distribution across the various regions in the NT has shifted since the start of the outbreak in August 2015. Until August 2016, the Barkly and Katherine regions predominated, however after that rates in Darwin and Alice Springs increased. Katherine region’s contribution has remained fairly constant and there have been few cases in East Arnhem. A public health response was mounted in the Barkly and Katherine regions towards the end of 2016 which may have contributed to the decline in cases. In the Barkly region, 3 communities implemented a catch-up vaccination program for all residents with incomplete vaccination status in September 2016. In Katherine district, a similar approach was undertaken towards the end of 2016, with 3 Aboriginal communities initiating a community-wide catch-up immunisation program for MMR for residents aged between 8 to 35 years old.

The age range of cases was between 3 and 70 years, with a mean of 24.1 years and a median of 22 years. A total of 84% of the cases occurred in the 10 to 40 years age group. Figure 2 illustrates the age and gender distribution of the mumps cases.

**Figure 1. Epidemic curve of mumps outbreak by region of residence, Northern Territory, July 2015-mid November 2017**
Despite the low number of cases in non-Aboriginal people, there is a significant difference in the peak incidence ages of mumps distribution among both groups. The peak incidence of cases in the Aboriginal population was between the ages of 10 to 19 years old with 42.91% of cases occurring in individuals in this age group, while there was only 1 case in the non-Aboriginal population in this age group. However, the high incidence of mumps cases occurring in teenagers and young adults in the Aboriginal cohort seems to be consistent with the global epidemiological data. The difference in peak incidence in ages of mumps cases between non-Aboriginal and Aboriginal people is depicted in Figure 3.

Analysis of the MMR vaccination status of the cases showed that 46.3% of the cases had been fully vaccinated, 16.6% were partially vaccinated and 37.1% had no records of vaccination or were unvaccinated (see Figure 4). Out of the 21 cases of mumps in the non-Aboriginal population, only 1 had a vaccination status validated as 2 doses of MMR. 85.7% of non-Aboriginal cases had no record of vaccination or were unvaccinated.

The hospitalisation rate was 6.4% (18 cases), with an average admission length of 2 days and a maximum admission length of 8 days. There has been no mortality reported in the outbreak.
Don Dale Youth Detention Centre

There has been a cluster of mumps cases notified to CDC from Don Dale Youth Detention Centre (DDYDC). The first case at DDYDC was notified on 11 August 2017 with no identified epidemiological link. Since then, there have been 10 cases confirmed as meeting the criteria for notification into NTNDS. All cases have been in Aboriginal males between the ages of 11 to 18 years. All 10 cases in the correctional centre had been previously fully vaccinated for MMR. In addition to these cases, there was a single isolated case in September 2016 in DDYDC.

Mumps cases were isolated and the public health response recommended targeted catch-up vaccination for all inmates in DDYDC. The prison medical department initiated an additional response to ensure that all staff members working at the detention centre were fully vaccinated.

Discussion

The World Health Organisation (WHO) has recommended that mumps vaccine coverage should be at least at 90% to prevent mumps outbreaks. The disparity in the high proportion of Aboriginal people affected could be linked to the MMR vaccine policy as Aboriginal people were receiving MMR vaccine at 9 months of age up until 1998 in comparison to the non-Aboriginal people receiving their first dose at 12 months. This however would effect those Aboriginal people mainly 19 years and older.

Globally, a resurgence of mumps continues to occur in highly vaccinated populations. In the pre-vaccination era, mumps was the leading cause of acquired unilateral sensorineural deafness in children. Mumps vaccine has reduced the disease incidence and the morbidity associated with it. Despite being a mild disease, 10% of cases are usually associated with encephalitis.

In the mumps outbreak in Scotland in 2016, hospitalisation was 1.2% and 5.3% had the complication of orchitis. There are no data available on the NTNDS regarding complications, but the hospitalisation rate was higher in our outbreak (6.4%) in comparison to the Scotland outbreak.

97% of the samples in the Scottish outbreak were identified as genotype G, however genetic sequencing of samples from before and after the outbreak were found to be genetically different. In the state of Sao Paulo in Brazil, the epidemiological surveillance of the mumps genotype noted a varying distribution of genotype across the years with genotype M (2011), K (2012-2013, 2015), N (2014-2015) and G (2015-2016). Genotyping performed on isolates from the 2007-2008 mumps outbreak in the Kimberly identified genotype J. In 2008, Dayan et al stated that countries using the genotype A derived vaccines had outbreak.
clusters of genotype B, C, D, G, H and I, and countries using genotype B derived vaccines had outbreak clusters of mainly genotypes C, D, G, J, K and L. The current vaccine used in Australia is genotype A derived and it raises possible concerns about the effectiveness of the current vaccine to provide immunity against the different genotypes of mumps virus. The importance of genotype identification is to facilitate development of new targeted mumps vaccines and understand the mode of transmission. The lack of vaccines targeting specific circulating genotype strains has led to countries using a third dose MMR vaccine in an outbreak situation.

The 2009-2010 mumps outbreak in an Orthodox Jewish community in the United States pioneered the use of a third dose MMR vaccine as an outbreak control measure. Various studies have suggested the concept of waning immunity along with antigenic variation of the mumps outbreaks increases susceptibility of disease occurrence.

Various outcomes have been observed from administering the third dose MMR vaccine to reduce mumps occurrence. There were 287 cases of mumps reported in primary school aged children in Guam despite 93% vaccination coverage with 2 MMR doses. A third dose of MMR vaccine was administered to 1068 school aged students and it was noted that 3-dose vaccinated students had an incidence of 0.9/1,000 compared with 2.4/1,000 among 2-dose vaccinated students but the difference was not statistically significant (p=0.67). The success of the third vaccination dose was demonstrated by a MMR vaccination campaign in Iowa University between 2015 and 2016. Mumps cases in students who received a third vaccination dose declined by 9% compared to those that did not which was statistically significant (p=0.01). A similar result was demonstrated in a multicentre case control study of universities in France, that concluded that the odds of mumps occurring in fully vaccinated individuals increased by 10% for every year since the second dose of MMR vaccine with an OR 1.10, 95% CI :1.02-1.19 and p=0.02. Based on this study, the French High Council of Public Health currently recommends a third dose of MMR vaccine during outbreaks in individuals who received their second dose MMR more than 10 years previously. A United States study also supports the waning immunity of mumps vaccine, reporting that students had 9 times the risk of acquiring mumps if they had received the second MMR dose 13 years or more before the outbreak. The United States, France and United Kingdom have required university students to have 2 doses of MMR prior to commencing class in university.

Cardemil et al recently published data on the effectiveness of a third dose MMR vaccine in a highly vaccinated institutional setting in reducing the incidence of mumps. A total 4783 university students received a third dose MMR vaccine in the 2015-2016 outbreak. A third dose MMR vaccine was associated with 78.1% lower risk of mumps at day 28 post vaccination. The incidence of mumps was lower in a 3-dose vaccinated students (6.7 per 1000) in comparison to 2-dose vaccinated students (14.5 cases per 1000) which was statistically significant (P<0.001). In October 2017, the United States Advisory Committee on Immunization Practices (ACIP) recommended a third dose of MMR vaccine as an outbreak control measure in high risk outbreak settings, such as those occurring in universities or sports teams.

The success of the third dose mumps vaccine in congregate settings overseas cannot necessarily be applied in the NT as the demographics of our cases are different. To date, there have been no clusters of cases reported in universities or schools in the NT. The frequent movement, crowding and communal living of Aboriginal people appears to facilitate circulation and transmission of the virus. Previous studies have also linked crowding as a contributing factor in the spread of mumps virus and remote Aboriginal people have been disproportionately affected by crowding.

Conclusion

In conclusion, surveillance of the current outbreak with complication data and genotyping will aid in assessing any antigenic differences between the circulating mumps virus and the current vaccine strain. Further research is required to develop new mumps vaccine against phylogenetically and genotypically different mumps strains to prevent recurrent outbreaks.
Waning immunity has also possibly contributed to the ongoing outbreak in the NT, however the role of a third dose MMR vaccine as an outbreak control measure in a non-congregate setting remains unclear.

**Conflicts of interest**

No conflicts of interest to report.

**Acknowledgements**

Thanks to Christian James for collating the data on the mumps outbreak in NT and for providing background information on the ongoing public health response to the cases.

**References**

Was it the bean sprouts? Investigating an outbreak of *Salmonella* Saintpaul associated with ready-to-eat meals in the Darwin region, April 2016

Linda Garton,1,2 Peter Markey,1 Claire Morton,1 Joshua Heath,3 Katrina Roper,4 Anthony Draper1


Abstract

In April 2016, the surveillance section of the Northern Territory Centre for Disease Control (CDC) detected a significant increase in *Salmonella* spp. notifications with linkages to food purchased from several food businesses in the Darwin urban region. Hypothesis generating questionnaires revealed a cluster of *Salmonella* Saintpaul cases that were associated with the consumption of ready-to-eat meals purchased from a food business between the 5-11 April. The CDC formed an outbreak investigation team to identify the source. A retrospective cohort study was conducted with a total of 16 cases out of a cohort of 39 detected (Attack Rate 41%). Epidemiological analysis did not reveal any statistically significant association with a specific food; however, 2 meal samples tested positive for *S*. Saintpaul with an identical genome to that which was causing a nationwide outbreak due to contaminated bean sprouts. The environmental health investigation found the business premises were not compliant with requirements of the National Food Standards Code.

Key words: foodborne disease; outbreak; *Salmonella*; *Salmonella* Saintpaul; Northern Territory; bean sprouts; mung beans.

Background

*Salmonella* is a leading cause of gastrointestinal illness both globally and nationally.1,2 The illness can result in severe complications such as disseminated infection and even death, thereby placing a significant burden on the health care system.1,2,3 A study in the United States reported salmonellosis was the most common infection notified in 2010 (17.6 per 100,000 population) and was associated with the most hospitalisations, resulting in 29 deaths.4

In Australia surveillance of foodborne gastrointestinal illness is based on notification data, which relies on cases accessing healthcare and being tested. Therefore the actual burden on the general population and the health care system is under-represented in surveillance data.5 OzFoodNet, a national food-borne illness surveillance network, uses enhanced surveillance systems across Australia to monitor foodborne gastrointestinal illness and assess emerging patterns of disease and causal factors, leading to prompt public health responses and outbreak control.6 The OzFoodNet quarterly report for September to December 2014 reported the highest number of gastrointestinal illness outbreaks associated with consumption of contaminated food ever reported across Australia (n=54), with 54% associated with restaurant prepared food and the main aetiological agent being *Salmonella*.6

Several salmonellosis outbreaks have been associated with fresh produce contaminated during production or processing, highlighting the risk of multi-jurisdictional outbreaks due to cross-border transportation of contaminated foods. For example, in 2006 a multi-state outbreak of *Salmonella* Saintpaul was strongly associated with rockmelon consumption where produce had been widely distributed interstate from one wholesaler.7

In 2015-2016, a large multi-jurisdictional foodborne outbreak of *S*. Saintpaul occurred, with a peak in incidence from March to April 2016. This was linked to bean sprout consumption with produce distributed across borders by 1 food wholesaler. Overall, 508 cases were detected (OzFoodNet Working Group, unpublished report). Simultaneously, in April 2016, the NT was experiencing a significant increase in local salmonellosis notifications, with 5 outbreaks identified after food consumption from restaurants, salad bars and canteens (OzFoodNet Working Group, unpublished report).
A cluster of 5 confirmed cases of S. Saintpaul were associated with ready-to-eat cooked and chilled meals from one particular food business. This paper describes the investigation of this cluster.

**Methods**

**Epidemiological investigation**

In April 2016, a complete list of customers that purchased the meals from the food business during the first 3 weeks of April was obtained and a retrospective cohort investigation was conducted. The cohort was defined as anyone who ate ready-to-eat meals supplied by this business from the 3-26 April, 2016.

A confirmed outbreak case was defined as anyone with diarrhoea plus fever and abdominal pain following consumption of ready-to-eat meals from the food business after 1 April and had laboratory-confirmed S. Saintpaul infection. A probable case was defined as anyone with diarrhoea plus fever or abdominal pain, typical of salmonellosis, who had consumed ready-to-eat meals from the food business after 1 April.

A standardised questionnaire was developed, based on the list of ingredients used plus a meal menu, to assess exposures among the cohort. We contacted customers by mobile phone from the 26 April onwards, with 3 attempts made to contact each one. Further individuals were included if they were living with customers and had eaten the ready-to-eat meals. We hypothesised there would be an association between consuming bean sprouts and falling ill.

All data were collected and entered into Microsoft Excel 2010 with statistical analysis conducted using Stata I/C 13.1 (StataCorp, USA). Risk of association, with foods consumed and falling ill, was assessed using Chi-Square test, or Fishers exact when counts were less than 5. A risk ratio (RR) with 95% confidence interval and p value was established for each exposure (foods consumed) to compare the risk of becoming ill in those exposed with those unexposed. Where the risk ratio was unable to be defined, we used exact logistic regression to calculate odds ratio (OR) with 95% CI.

**Environmental Health investigation**

On 18 April, Environmental Health Officers undertook an initial inspection of the premises to determine whether there were any obvious sources of contamination and to ensure the premises met national food safety standards. Information was collected on food processing and handling practices, temperature control and staff training.

Fresh produce and 2 ready-to-eat meals were sampled for microbiological testing from the business. Snow peas and bean sprouts, in particular, were sampled due to the current concerns regarding the multi-jurisdictional outbreak and links with similar products. Detailed information on the supply and distribution of all products, particularly fresh produce was obtained from the business in order to facilitate a trace-back and ascertain if there were links with the national outbreak.

**Laboratory investigation**

Stool samples were tested for the presence of oocysts, parasites and bacteria by standard culture methods or by multiplex polymerase chain reaction (PCR). Testing for viruses was not included in the standard faecal test. Isolates obtained from cases that tested positive on culture for Salmonella were sent for subtyping to either to SA Pathology, South Australia or the Microbiological Diagnostic Unit (MDU) at the University of Melbourne.

Several different ready-to-eat meals were sampled from 4 households where confirmed cases reported they had consumed ready-to-eat meals from the business. A total of 24 meals were sent for microbiological testing. All food samples were sent to the Food and Environmental Laboratory of SA Pathology and tested for Salmonella using a rapid unique test to detect non-motile Salmonella spp. in less than 24 hours.\(^8\) Resulting Salmonella isolated from the food samples were subtyped.

All S. Saintpaul isolates (both clinical and food) were sent to the Microbiological Diagnostic Unit (MDU) at Melbourne University, Victoria, where whole genome sequencing (WGS) was performed.
Results

Epidemiological Findings

In total there were 43 individuals identified in the cohort. We were able to contact 39 individuals with 4 (9%) excluded from the investigation as they were uncontactable (e.g. wrong mobile number). Of the 39 people, 16 met the outbreak case definition (AR 41%). The median age of cases was 32 years (range: 22 to 59 years) compared to a median age of 27 years in non-cases (p=0.04).

All cases reported diarrhoea and abdominal pain, with 81% reporting lethargy (13/16), 69% experienced nausea (11/16), fever (50%, 8/16), headache (44%, 7/16), bloody diarrhoea (25%, 4/16) and only 1 case experiencing vomiting. The epidemic curve of the outbreak is shown in Figure 1. A median incubation period could not be calculated as we were unable to determine which particular meal had caused individuals to fall ill.

Participants who consumed peas were twice as likely to fall ill (RR: 2.1, 95% CI 1.0–4.6, p=0.07), however, the result was not statistically significant. In contrast, those who consumed turkey meatballs were less likely to fall ill (RR: 0.4, 95% CI 0.2–0.9, p=0.04).

Consumption of bean sprouts was measured as a stand-alone food, consumed by association with other foods (e.g. stir fry) and as a combination of both these variables (e.g. any sprouts eaten) However, there was no significant statistical difference to support the association with exposure to this food and falling ill (Table 1).

Environmental Health Findings

Several breaches of the Food Safety Act and National Food Safety Standards were found on investigation by the Environmental Health team. The business was preparing a high volume (~500) of cooked and chilled ready-to-eat meals weekly. The meals were consumed (after re-warming) over a number of days at home. Ready-to-eat meal preparation occurred in the same space as food being produced for café dining. Large containers of food were set up in a processing line on the café dining benches and where food was portioned into individual containers for ready-to-eat meals. The ingredients used to prepare the meals were stored in the same areas as the foods used for café dining.

The ready-to-eat meal process was being undertaken in an area of the cafe not designed or fitted out to enable appropriate storage, processing and service of such meals. The area was small and was used for other activities including service and customer dining. Some raw ingredients that were cooked or otherwise preserved were inadequately processed. The storage temperatures of foods in cool rooms

Figure 1. Epicurve of S. Saintpaul outbreak by symptom onset date

![Epicurve of S. Saintpaul outbreak by symptom onset date](image)
<table>
<thead>
<tr>
<th>Exposure</th>
<th>People who ate food</th>
<th>People who didn’t eat the food</th>
<th>AR</th>
<th>RR</th>
<th>95% CI</th>
<th>p-value*</th>
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<tbody>
<tr>
<td>Peas</td>
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<td>15</td>
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<td>13</td>
<td>46.1</td>
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<td>22</td>
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<td>5</td>
<td>13</td>
<td>38.4</td>
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<td>Meatloaf</td>
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<td>18</td>
<td>44.4</td>
<td>7</td>
<td>17</td>
<td>41.1</td>
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<td>Carrots*</td>
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<td>35</td>
<td>42.8</td>
<td>0</td>
<td>2</td>
<td>0.0</td>
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<tr>
<td>Beans</td>
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<td>28</td>
<td>42.8</td>
<td>1</td>
<td>6</td>
<td>16.7</td>
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<td>41.3</td>
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<td>8</td>
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<td>33.3</td>
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<td>6</td>
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<tr>
<td>Any sprouts**</td>
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<td>33</td>
<td>39.3</td>
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<td>33</td>
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<td>25.0</td>
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<td>22</td>
<td>41.0</td>
</tr>
</tbody>
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*2-sided Fisher’s exact
†OR, 95% CI and p value calculated using exact logistic regression.
** Exposure variables for bean sprouts
were not kept below 5°C, thereby increasing the risk of microbiological growth. Further risk of growth was enhanced by inadequate cooling processes in place and out of temperature monitoring not being controlled.

The café staff had poor knowledge, skills and limited understanding of appropriate food safety controls required to undertake a cook-chill process. The meals, although labelled in accordance with Part 1 of the Food Standards Code, were lacking in basic advisory information required for consumers including on detailed ingredients, ongoing storage, shelf life, heating instructions and allergen and warning information.

Due to the number and type of contraventions found during inspections, the business was issued with a ‘Food Improvement Notice’ requiring improvements to the process, staff training and detailed meal labelling in order to continue their supply of ready-to-eat meals. The business was also directed to limit the production to 100 meals a day until a more suitable location with adequate equipment and processing set up.

**Laboratory results**

The 2 ready-to-eat meals and fresh produce samples of bean sprouts and snow peas taken from the food business tested negative for salmonella on culture. Of the 24 meal samples submitted from household cases; 1 fish, vegetable and rice meal, and 1 beef, vegetable and rice meal tested positive for *S. Saintpaul*. None of the meals sampled appeared to contain bean sprouts or other additional uncooked garnishes.

The WGS results showed that the clinical isolates and food isolates from the cases were indistinguishable from the *S. Saintpaul* strain causing the large multijurisdictional outbreak in South Australia, New South Wales and NT (OzFoodNet unpublished data) which was associated with contaminated bean sprouts.

**Discussion**

In the NT, most *S. Saintpaul* infections notified are in children and are likely to have been acquired through environmental exposure rather than through contaminated food. However, the sudden increase of salmonellosis notifications of April 2016 was detected in adults after contaminated food consumption, resulting in 5 separate outbreaks being investigated across the Darwin urban region with 12 people hospitalised. The recent 2015-2016 outbreak of *S. Saintpaul*, affecting 4 jurisdictions, including cases detected in NT, was strongly associated with contaminated bean sprouts transported from one producer (OzFoodNet Working Group, unpublished report). Our cohort investigation focused on a cluster of cases of *S. Saintpaul* occurring in adults who had eaten ready-to-eat meals from a Darwin café.

While our investigation did not find a cause for the outbreak, our results are nevertheless consistent with bean sprouts being associated. Significantly, the WGS of *S. Saintpaul* isolated from cases and food samples was indistinguishable from that causing a concurrent multi-jurisdictional outbreak associated with contaminated bean sprouts. In light of this finding, NT CDC issued a warning to the general public, in April 2016, not to eat raw bean sprouts as the type of *Salmonella* bacteria being detected in Darwin was the same *S. Saintpaul* strain detected across borders.

However, there were 2 unusual findings in this investigation. Firstly, *Salmonella* was isolated from meals which didn’t contain bean sprouts and secondly, the relative risks for bean sprouts, both when recalled by clients and when associated with other meals were low and did not reach significant values.

The unusual laboratory finding could have been due to undetected bean sprouts in the food samples, or because of contamination from the bean sprouts to other food in the sample. Certainly, the poor food hygiene standards, lack of adequate design, space and staff knowledge support the hypothesis that contamination from bean sprouts could have transmitted to other foods and also to surfaces by staff, utensils, storage and processing equipment. Furthermore, bean sprouts could have been a hidden food as meals were inadequately labelled and consumers had difficulty recalling what they had eaten as often reported ingredients were mixed to together.
The low relative risks for those who ate bean sprouts could have been due to poor recall of foods eaten, with those who were ill not remembering that they had eaten bean sprouts. This would have led to a lower attack rate in the exposed, a higher attack rate in the unexposed and subsequent falsely low RR.

There are several limitations to this investigation. We controlled for bias by using a standardised questionnaire based on meal menus and ingredients provided by the food business. However, we did not start interviewing consumers until 2 or more weeks after their illness so they may have had difficulty remembering what they had eaten. Further to this, the imprecise ingredient descriptors for meals provided by the business may have diluted the influence of bean sprouts as a cause for the outbreak because many consumers were unable to remember the detail of foods eaten and were more likely to select ‘no’ if unsure.

Even in the face of these unusual findings, we considered that bean sprouts are most likely to have been the cause as WGS of S. Saintpaul isolated from two meals and clinical samples, was indistinguishable from that causing the S. Saintpaul outbreak in other states. However, it is not possible to say with certainty at which point the contamination of the meals occurred. Salmonella could have been transmitted to other food during the preparation phase, point of sale due to packaging not being equipped with tamper proof seals, subsequent storage within households or bean sprouts undetected as a hidden food within the ready-to-eat meals.

Conclusion

This epidemiological investigation did not identify the cause of the outbreak. However, the WGS of the clinical S. Saintpaul isolates and those from the food samples were indistinguishable from the WGS of S. Saintpaul which was causing a concurrent multi-jurisdictional outbreak of S. Saintpaul due to contaminated bean sprouts. Our hypothesis was that bean sprouts were bought into the business contaminated with Salmonella from the processing unit in South Australia and due to poor temperature control, food processing practices and staff knowledge, there was cross contamination and microbiological growth of bacteria on one or more ingredients used in the ready-to-eat cook-chill process. This investigation highlights the ongoing importance of ensuring high quality processing of ingredients and supplies to the catering and retail industry and adherence to the basic food safety standards required in all food businesses.15

Acknowledgements

Heather Cook (CAN-PD Surveillance Project Officer), Rowena Boyd (Clinical Nurse Specialist), Kathleen McDermott (NCCTRC Trauma Research Coordinator), Karen Kirkham (Public Health Nurse), Environmental Health Officers from the Darwin team of the NT Department of Health.

References

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6 ways to access the NT TB guidelines

It came to our attention during our recent TB workshop that some clinicians are not sure where to access the Guidelines for the Control of Tuberculosis in the Northern Territory.

Here are 6 ways:

1. The preferred option is: via the Centre for Disease Control (CDC) resources and publications page- https://health.nt.gov.au/professionals/centre-for-disease-control/resources-and-publications (listed under ‘Tuberculosis’)

2. Google™ ‘NT TB guidelines’ (or something similar). They come up as one of the first links through the NT Department of Health (DoH) Digital Library and are open access


4. Come to your local CDC TB clinic, there are plenty of hard copies for your reference


6. The document is also available for NT Department of Health staff on the NT Health Intranet page at the Policy and Guidelines Centre (PGC).

Please do not hesitate to contact your local TB Unit on the numbers below if you have any problems viewing the guidelines or email us at TBCDCServices.DOH@nt.gov.au with any feedback which we could include in subsequent editions.

Darwin (08) 8922 8804
Katherine (08) 8973 9049
Gove (08) 8962 4259
Tennant Creek (08) 8951 7549
Alice Springs (08) 8987 0357

**********
The new December 2017 immunisation schedules are now available.

Changes from 1 December 2017 are:

- Children at 12 months of age will receive a single dose of meningococcal ACWY vaccine (Nimenrix®) and a single dose of Haemophilus influenzae type b (Hiberix®) vaccine. These vaccines will replace the combined meningococcal C - Haemophilus influenzae type b vaccine (Menitorix®)
- Gardasil®9 will be available from early 2018 as a 2 dose course given at 0 and 6 month intervals for children aged 12-14 years, further information is presented in the following article on page 26.

Meningococcal ACWY vaccine at 12 months

Why is meningococcal ACWY vaccine introduced at 12 months of age?

The Northern Territory (NT) and Australia are reporting an increase in cases of meningococcal W disease, noting that serogroup W has become the emergent strain in Australia and overseas and was the predominant strain in Australia in 2016. The NT, including border regions of South Australia and Western Australia, has had 32 cases since the beginning of 2017. All cases have been in Aboriginal people, giving a rate of 204 per 100,000 in the under 20 year old Aboriginal age-group. This compares with an annual all-age incidence of meningococcal disease in the NT Aboriginal population of 2 per 100,000 person years over the previous 5 years (unpublished data, NT Notifiable Diseases System, CDC, NT). The NT has also had 3 cases of meningococcal Y disease in 2017. This Y strain is also increasing in other jurisdictions.

In response to the outbreak of meningococcal W disease, a meningococcal ACWY vaccination program was implemented for children aged 1-19 years in Alice Springs, Barkly and Katherine regions in early October 2017. High vaccination coverage has been achieved in the region, especially in Aboriginal children aged 1-19 years, and subsequently meningococcal W cases have decreased.

Replacing the meningococcal C-Haemophilus influenzae type b vaccine on the National Immunisation Progam with NT funded meningococcal ACWY and Haemophilus influenzae type b vaccines at 12 months of age will provide ongoing protection from meningococcal ACWY and Haemophilus influenzae type b disease.

Which brands of meningococcal ACWY vaccine and Haemophilus influenzae type b will be funded and how to use them?

The brand of meningococcal ACWY vaccine will be Nimenrix® and the Haemophilus influenzae type b brand will be Hiberix®. These vaccines should be given at the same time as other vaccines at 12 months of age. Encourage parents to give their children all the scheduled vaccines on the same day and explain that it is safe and effective to give 3 or 4 vaccines at the same visit. Remember to reconstitute these vaccines.

The common side effects associated with these vaccines are:

- Localised pain, redness and swelling at injection site
- Headache
- Low-grade temperature (fever)
- Irritability, crying, drowsiness or tiredness or loss of appetite.

Serious adverse events are rare. Please report all adverse events following immunisation to the Centre for Disease Control on 89228044 and complete the adverse event form available on the NT Department of Health immunisation website at https://health.nt.gov.au/professionals/centre-for-disease-control/resources-and-publications under “I” for Immunisation.

Resources


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# Childhood Vaccination Schedule

**December 2017**

www.health.nt.gov.au

<table>
<thead>
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<td>Polysaccharide Pneumococcal (23vPPV)</td>
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</table>

**Vaccine notes**

- **All children:**
  - ORAL VACCINE: first dose must be given by 16 weeks and 6 days of age; second dose must be given by 24 weeks and 6 days of age.
  - Aboriginal people only.
  - From 2018, Gardasil® 9 (9-valent HPV) will be given at 2 doses (3, 4 months).
  - Children with immunocompromising conditions and those aged 15 years and older will receive 3 doses (2, 6, 12 months).
  - If 2 doses of HPV vaccine (either HPV or Gardasil® 9) are given with an interval of less than 5 months between doses a third dose is required at least 12 weeks after the second dose.
  - NEVER to be given as 1st dose of the MMR containing vaccine. MMR should only be given to people 14 years and under.

- **Aboriginal children only aged 6 months to less than 5 years:**
  - All children with a chronic medical condition 6 months of age and over, and all 2 doses, 28 days apart to children under 5 years of age who are receiving influenza vaccine for the first time in their life.

**Additional funded vaccines for catch up and medically at risk individuals**

**12 months Hepatitis B**

Children born at less than 32 weeks gestation and/or < 2000g birth weight are recommended to be given a booster dose of the hepatitis B vaccine at 12 months of age.

**12 months and 4 years Pneumococcal**

Children with medical risk factors including premature infants born at less than 28 weeks gestation are recommended to be given a 4th dose of Pneumovax® at 12 months of age and a dose of Pneumovax® at 4 years of age.

**Catch up for people aged less than 20 years**

Childhood vaccines including human papillomavirus vaccine are available for catch up for children aged less than 20 years who have not received these vaccines. Please use adult dTpa vaccine for children 10 years and over. People aged 15 years and over who need the varicella vaccine require 2 doses at least 28 days apart. See Australian Immunisation Handbook online at www.immunise.health.gov.au for intervals between doses.

**More information**

NT Immunisation Register - Top End: 0922 1305 | Central Australia: 0951 6920

Australian Immunisation Handbook (AIH)
## Adult and Special Groups Vaccination Schedule

**Adult and Special Groups Vaccination Schedule**

### December 2017

**www.health.nt.gov.au**

<table>
<thead>
<tr>
<th>Eligible groups</th>
<th>Diseases covered</th>
<th>Vaccine</th>
<th>Administration</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All people</strong></td>
<td>Measles, mumps, rubella (MMR)</td>
<td>M-MMR² or Priorix²</td>
<td>0.5ml SC</td>
<td>Give two MMR vaccines at least 28 days apart.</td>
</tr>
<tr>
<td>All people born after 1966 who have not received two MMR vaccines or who are not immune.</td>
<td></td>
<td></td>
<td>0.5ml IM</td>
<td></td>
</tr>
<tr>
<td><strong>All people at 70 years of age.</strong></td>
<td>Herpes Zoster (shingles)</td>
<td>Zostavax®</td>
<td>0.55ml SC</td>
<td>All people aged 71 to 79 years can receive the Zostavax® vaccine as part of a catch-up program. Give one dose only.</td>
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<tr>
<td><strong>Aboriginal people</strong></td>
<td>Pneumococcal</td>
<td>Pneumovax23³</td>
<td>0.5ml IM</td>
<td>See NT pneumococcal vaccination and revaccination guideline.</td>
</tr>
<tr>
<td>Aboriginal people 15 years of age and over.</td>
<td>Influenza</td>
<td>Fluzone®Tetra</td>
<td>0.5ml IM</td>
<td>Annually.</td>
</tr>
<tr>
<td><strong>Aboriginal people 20 years to 50 years.</strong></td>
<td>Hepatitis B</td>
<td>Engerix®-B adult or H-B-Vax®II</td>
<td>1ml IM</td>
<td>0, 1 and 6 month schedule.</td>
</tr>
<tr>
<td>If not previously vaccinated or who do not have immunity through natural infection.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non Aboriginal people</strong></td>
<td>Pneumococcal</td>
<td>Pneumovax23³</td>
<td>0.5ml IM</td>
<td>See NT pneumococcal vaccination and revaccination guideline.</td>
</tr>
<tr>
<td>All non Aboriginal people 65 years of age and over.</td>
<td>Influenza</td>
<td>Fluzone® Tetra</td>
<td>0.5ml IM</td>
<td>Annually.</td>
</tr>
<tr>
<td><strong>Pregnancy related</strong></td>
<td>Influenza</td>
<td>Fluzone® Tetra</td>
<td>0.5ml IM</td>
<td>Any stage of pregnancy.</td>
</tr>
<tr>
<td>All pregnant women (every pregnancy).</td>
<td>Diphtheria, tetanus, pertussis (dtap)</td>
<td>Boostrix® Adacel®</td>
<td>0.5ml IM</td>
<td>From the 28th week of pregnancy.</td>
</tr>
<tr>
<td><strong>People with chronic medical conditions</strong></td>
<td>Pneumococcal</td>
<td>Pneumovax 23⁴</td>
<td>0.5ml IM</td>
<td>See NT pneumococcal vaccination and revaccination guideline.</td>
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<td>All people six months of age and over with chronic medical conditions or those who are immunocompromised.</td>
<td></td>
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<tr>
<td>Other vaccines may be required, see Australian Immunisation Handbook (AIH) for specific conditions.</td>
<td>Influenza</td>
<td>Fluquad™ Junior (~ 3 years)</td>
<td>0.25ml IM</td>
<td>May require two doses at least 28 days apart if the child is less than nine years of age and receiving influenza vaccine for the first time in their life.</td>
</tr>
<tr>
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<td></td>
<td>FluzaTetra (2,3 years)</td>
<td>0.5ml IM</td>
<td>May require two doses at least 28 days apart, if person is receiving influenza vaccine for the first time post solid or haematological stem cell transplant (irrespective of age).</td>
</tr>
<tr>
<td><strong>Refugees and humanitarian entrants</strong></td>
<td>Diphtheria, tetanus, pertussis, Poliomyelitis Measles, mumps, rubella Hepatitis B</td>
<td>Boostrix® Adacel®</td>
<td>0.5ml IM</td>
<td>Can give dTPa for all three doses of dTPa (dR). Please see Australian Immunisation Handbook for dose intervals.</td>
</tr>
<tr>
<td>Refugees and other humanitarian entrants aged 20 years and over.</td>
<td></td>
<td></td>
<td>0.5ml IM</td>
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<td></td>
<td>Measles MMR³/Priorix²</td>
<td>Engerix®B adult or H-B-Vax®II</td>
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<tr>
<td></td>
<td>Varilrix®/Vorivax®</td>
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<td></td>
<td>Varicella</td>
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<tr>
<td><strong>Household and sexual contacts of people with Hepatitis B</strong></td>
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<tr>
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<td>Hepatitis B</td>
<td>Engerix®B adult or H-B-Vax®II</td>
<td>1ml IM</td>
<td>0, 1 and 6 month schedule.</td>
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<td>Hepatitis B vaccine is also recommended for other groups see AIH for details.</td>
<td>More information</td>
<td></td>
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</table>

**NT Immunisation Register - Top End: 8922 8315 | Central Australia: 8951 6928 | Australian Immunisation Handbook (AIH)**
A 2-dose Gardasil® 9 vaccine to replace 3-dose Gardasil® for adolescents

Philippa Binns, Centre for Disease Control, Darwin

From 2018, Gardasil® 9 vaccine (9vHPV) will replace Gardasil® (4vHPV) vaccine on the National Immunisation Program for adolescent girls and boys. The vaccine will be delivered in the NT through the school based immunisation program for students in Year 7 as a 2-dose schedule. It will also be available from immunisation providers as part of the expansion to the National Immunisation Program that was introduced in 1 July 2017 in which all individuals aged 10 to 19 years are eligible to receive free catch-up vaccinations.

The significant decline in genital warts in young Australian men and women and high-grade cervical abnormalities in women has been largely attributed to implementation of the 3-dose schedule of Gardasil® vaccine introduced with the National HPV Vaccination Program in 2007 for girls and 2013 for boys.¹,²,³,⁴

9vHPV includes the 4 human papillomavirus (HPV) types (6, 11, 16 and 18) in 4vHPV and will continue to provide protection against infection and disease caused by these HPV types including genital warts and cervical, vaginal, vulvar and anal cancers.⁵ In Australia, it is estimated HPV types 16 and 18 account for 77% of cervical cancers and the 5 additional HPV types (31, 33, 45, 52 and 58) included in 9vHPV account for a further 16%.⁶ Almost all of the cancers caused by these 5 additional types occur in women and changing to 9vHPV is therefore expected to extend cervical cancer protection to 93%.

The safety profile of Gardasil® 9 is comparable to that of the 4vHPV vaccine in that it is generally well tolerated. There is an association with a slightly increased risk of erythema, pain and swelling at the injection site compared with the 4vHPV vaccine.⁵ However with fewer doses the prevalence of vaccine side effects will be reduced.⁷ Gardasil® 9 is contraindicated in persons who are allergic to yeast (a vaccine component) and it is not licensed for use during pregnancy.

Overall, moving to a HPV vaccine that covers extra oncogenic HPV types in a less resource intensive schedule with one less dose is anticipated to improve HPV vaccination coverage and disease prevention.⁷

Further details regarding the schedule will be available for 2018 from the online Australian Immunisation Handbook (AIH). General recommendations include:⁸

- Children aged 14 years and under who have not previously received HPv vaccine will require 2 doses given at 0, 6 months
- People aged 15 years and over will require 3 doses given at 0, 2, 6 months
- It will be important to ensure that vaccination commences before the age of 15 to ensure the child can be fully protected by a 2-dose schedule
- Those with specific immunocompromising conditions (refer to online AIH) will require 3 doses given at 0, 2, 6 months
- If 2 doses of HPV vaccine (either 4vHPV or 9vHPV) are given with an interval of less than 5 months between doses, a third dose is required at least 12 weeks after the second dose and at least 5 months after the first dose, whichever is later
- People who have previously been fully vaccinated with Gardasil® (4vHPV) do not require any further 9vHPV
- Children who have not completed their course with 4vHPV can finish with 9vHPV
- 9vHPV can safely be administered at the same visit as other vaccines
- Cervical screening for both vaccinated and unvaccinated women continues to be recommended.⁹

References


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Meningococcal ACWY vaccine program for 1 to 19 year olds

In response to an outbreak of Meningococcal W disease vaccination for all 1-19 year olds living in Alice Springs Urban, Alice Remote, Tennant Creek, Barkly, Katherine Urban and Katherine Remote regions is being promoted. Make sure this group do not miss out.

Thank you to all the immunisation providers for your dedication and effort to vaccinate people aged 1-19 years in the outbreak areas with the meningococcal ACWY vaccination program. Many communities have very high coverage for children 1-19 years which is an excellent achievement.
Abstract

Acute rheumatic fever (ARF) and rheumatic heart disease (RHD) are significant causes of mortality and morbidity among the Aboriginal population in the Northern Territory (NT). While definite ARF has been a notifiable disease in the NT since 1994, probable ARF and RHD are not notifiable. The inclusion of probable ARF and RHD as notifiable conditions in the NT will allow coordinated multidisciplinary patient management by the NT RHD control program, primary health care and tertiary health services.

Key words: Acute rheumatic fever; rheumatic heart disease; Northern Territory; notifiable.

Introduction

Acute rheumatic fever (ARF) is an acute inflammatory illness secondary to an autoimmune response to group A streptococci. The disease commonly affects children between the ages of 5 to 14 years.\(^1,2\) Symptoms of the disease are caused by an inflammatory reaction to group A streptococcus in joints, skin, brain and heart.\(^1,2,3\) The sequelae of the acute phase illness is damage to the mitral and aortic valves resulting in rheumatic heart disease (RHD).\(^1,2,4\)

Since the discovery of penicillin in the mid-20th century, the prevalence and burden of RHD in developed nations has decreased significantly.\(^5,6,7\) ARF is still common in developing nations and in 2005 it was estimated that there were 300,000 new cases per year.\(^3\) RHD has a high burden of disease with 33 million people affected worldwide and 300,000 deaths annually directly attributed to RHD.\(^4\)

In Australia, the annual incidence of definite ARF between 2011 and 2014 was 59 per 100,000 among the Aboriginal population in comparison to an annual incidence of 0.2 per 100,000 for non-Aboriginal people.\(^8\) The overall mortality rate from RHD in Australia has halved between 1979 and 1996, reducing from 3.1 to 1.1 deaths per 100,000 per year in females and 2.0 to 0.9 deaths per 100,000 per year in males.\(^5\) Despite ARF almost disappearing from the non-Aboriginal population in Australia, the incidence of ARF and RHD continues to rise among Aboriginal people with the highest burden of disease occurring in the Northern Territory (NT).\(^5,6,7\) Aboriginal people in the NT suffer from the highest reported mortality rates from RHD in the world with 23.8 deaths per 100,000.\(^6\)

Figure 1. New registrations of RHD in Australia from 2010 to 2015\(^9\)
While definite ARF has been a notifiable disease in the NT since 1994, probable ARF and RHD are not notifiable. Currently, RHD patients’ data on the register are obtained from patients on a voluntary basis and are used to enhance continuity of care in the NT.

**Probable acute rheumatic fever**

There has been an incremental rise in the rates of new and recurrent ARF diagnoses in the NT over the past decade. In 2015, the rate of definite ARF notification in the NT was 1.6 per 1000 in Aboriginal people. The 2012 RHD Australia guidelines included ‘probable ARF’ in the classification of ARF as there were significant concerns about children living in high endemic settings in whom ARF was missed due to failure to meet all the clinical criteria. The RHD Australia guidelines define probable ARF as ‘a clinical presentation that falls short by either 1 major or 1 minor manifestation, or the absence of streptococcal serology results, but one in which ARF is considered the most likely diagnosis.’ The treatment and follow up protocol for probable ARF is similar to definite ARF including a minimum of 10 years of 4 weekly long-acting Benzathine Penicillin.

**Rheumatic heart disease**

RHD is heart valve damage resulting from recurrent ARF episodes. As at 2 August 2017, there were 1884 cases of RHD in the NT based on the RHD register.

Figure 1 depicts new registrations of RHD cases across various jurisdictions in Australia from 2010 to 2015. These data have been obtained from state based registers. Currently, RHD is a notifiable condition in South Australia and Western Australia. Prior to being a notifiable condition, data for the respective jurisdiction based registers were obtained on a voluntary basis.

Despite higher rates of definite ARF notifications in the NT in comparison to all the other jurisdictions, Western Australia (WA) has seen a significant rise in the notifications of RHD at 1.44 cases per 1,000 since RHD was made notifiable in WA in 2015. It is well documented that ARF often leads to RHD but that with effective management patients can delay or prevent this progression. The fewer registrations of patients to the NT RHD register in 2015 in comparison to WA might indicate the success of the NT control program but is more likely to be a failure to capture the actual burden of disease of RHD as the condition is currently not notifiable in the NT. This is concerning as a proportion of RHD patients will not receive optimal multidisciplinary health care services to effectively manage their disease because they are not known to the NT RHD control program.

**Community and global concerns**

The ‘Better Cardiac Care for Aboriginal and Torres Strait Islander People project’ is an initiative of the Australian Health Ministers’ Advisory Council which aims to reduce deaths and morbidity from cardiac conditions amongst Aboriginal people. In 2014, the Better Cardiac Care Forum identified a significant gap between non-Aboriginal and Aboriginal Australians’ cardiac health especially in relation to RHD. This area was made a priority in the national agenda with aims to strengthen the diagnosis, notification process and long term follow up of patients with RHD. These recommendations were similar to the proposed interventions in 2009 by the Australian Government’s Rheumatic Fever Strategy. The establishment of register-based control programs in the NT, WA and Queensland to improve detection, monitoring and management of ARF and RHD was the main aim of the Rheumatic Fever Strategy. A jurisdictional register is essential to assist clinicians and healthcare workers in providing continual care for ARF and RHD patients. It is recognised that the lack of information on the register for RHD patients due to the disease not being notifiable significantly impedes implementation of the multidisciplinary register-based control program approach recommended by the Better Care Cardiac Forum.

Globally, the World Heart Federation (WHF) is dedicated to a have ‘a 25% reduction in premature deaths from ARF and RHD among individuals aged <25 years by the year 2025.’ A register based control program is one of the 5 key areas WHF has included in their strategic target to achieve this goal. Since the UN passed
the Sustainable Development Goals (SDGs) in 2015, WHO has been working towards ending preventable maternal, newborn and child deaths by 2030.\textsuperscript{14} RHD and ARF have been included as part of this SDG as they result in premature deaths in children and adults.\textsuperscript{14} Therefore, for the NT to continue to work to provide the most comprehensive RHD register and control program it is recommended that probable ARF and RHD be made notifiable conditions as we work towards achieving the WHF and UN goals for RHD.

**Conclusion**

ARF and RHD remain significant causes of mortality and morbidity among Aboriginal people in the NT. The inclusion of probable ARF and RHD as notifiable conditions in the NT will allow coordinated multidisciplinary patient management by the NT RHD control program, primary health care and tertiary health services. Consequently, this will strengthen the approach taken by the NT RHD control program towards managing ARF and RHD. It will allow better understanding of the burden associated with ARF and RHD in the NT with the aim of reducing the overall mortality and morbidity associated with the illness.

**Acknowledgements**

I acknowledge Dr.Kate Hardie and staff at the NT RHD Control Program for their input and contribution.

**References**

10. RHD Australia (Rheumatic Heart Disease Australia), National Heart Foundation of Australia & Cardiac Society of Australia and New Zealand 2012. The Australian guideline for the prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease (2nd edition). Darwin: RHD Australia
11. Health (Rheumatic Heart Disease Register of Western Australia) Regulations 2015.

**********
Abstract

In order to overcome the lack of coverage due to population movement between communities, the Northern Territory (NT) Trachoma Program conducted an intensive screening and treatment program in Central Australia over a period of 5 weeks in 2017. The program was logistically challenging however it resulted in 5 communities being screened and 19 community-wide treatments delivered reaching 4,500 people across Central Australia. The program also resulted in increased awareness raising of trachoma in the communities. The Trachoma Program staff will build on lessons learned from this program in planning for future screens in other areas of the NT.

Key words: trachoma; screening; community wide treatment; Central Australia.

Background

Trachoma is a bacterial infection of the tarsal conjunctiva passed from person to person through eye and nasal secretions. If enough recurrent infections occur then it can cause scarring in the tarsal conjunctiva which in turn, leads to trichiasis (interned eyelashes rubbing on the eyeball). This will scratch the eyeball, causing a corneal opacity – an irreversible visual impairment.

Australia is the only developed country that still has endemic rates of trachoma. In the last decade the NT Trachoma Program has put in a huge effort to eliminate trachoma by applying the SAFE strategy, aligning with the World Health Organisation (WHO) vision of the Global Elimination of Trachoma by 2020 (GET2020). The SAFE Strategy was adopted by the WHO in 1993 and is outlined below:

- Surgery to treat the blinding stage of the disease (trachomatous trichiasis)
- Antibiotics to clear infection, including treatment of cases and contacts and mass drug administration of the antibiotic azithromycin in high prevalence communities. Azithromycin is donated by the manufacturer (Pfizer) to elimination programs through the International Trachoma Initiative
- Facial cleanliness
- Environmental improvement, particularly improving access to water and sanitation.

Heavy emphasis on the Antibiotics component in accordance with the Guidelines for the Public Health Management of Trachoma in Australia has reduced the level of trachoma over years, although there are still pockets of endemic and even hyper-endemic trachoma occurring despite these efforts. During the years of implementing the trachoma program it has become evident that the large population movements which occur between Aboriginal communities are having an impact on the end goal of trachoma elimination. Although potentially imprecise, information collected over previous years indicate that up to 30% of community members are away at the time of trachoma team visits and another 20-30% of people in the community are from elsewhere. Therefore an intensive screening and treatment program was developed.

Aim of the intensive screening and treatment program

As the deadline for trachoma elimination approaches it is apparent that current strategies to mitigate the effects of this population movement need to be investigated. In previous years the screening and treatments have been delivered throughout the year with the aim to cover all the communities within the 12 month period.

The aims of the program are:

- To improve screening and treatment coverage by addressing population movement
- To improve community engagement using broad media coverage and engagement with service providers across Central Australia.

Methods

In 2016 it was decided that in 2017 all communities with similar language groups, in defined geographical locations within which large population movements were known to occur, would be clustered together and screened or treated within a 2 week period. This strategy extended across the Central Australian region and utilised Central Desert Council and
MacDonnell Council region-based language groups and movement patterns.

Activities undertaken over a 5 week period:

- Visits to 22 communities (including surrounding outstations)
  - MacDonnell Council Region – 12 communities in 3 weeks
  - Central Desert Council Region – 10 communities in 2 weeks

Resources used:

- Engaging 22 schools
- Engaging 22 clinics
- Engaging multiple agencies depending on the community
- 6 experienced trachoma nurses to lead trips
- 8 extra staff to assist the trachoma nurses (these included doctors, public health nurses, volunteers, partners)
- Accommodation for 5 to 8 staff each week
- Hiring of 7 appropriate vehicles and coordinated efficiently
- Hiring of 5 satellite phones
- Appropriately timed and co-ordinated media coverage (television commercials and radio announcements)

Other hardware and consumables:

- 8 Microsoft enabled electronic tablets
- 5700 oranges
- 5000 cups, 8 water containers, 8 bin buckets, 8 portable coolers, 10 packing boxes, 8 handmade medication height measuring sticks, 8 weight scales, 21 banners, uncountable stickers, wrist bands and syringes.

Results

Services provided:

- 5 screens (Trachoma check of all 5-9 year olds in the community at the time of the visit)
  - Approximately 120 children aged 5 to 9 years screened across the 5 communities
  - 2 communities were found to have no trachoma at the time of screening visit
  - 1 community screened resulted in case and contact treatment (1 case only)
  - 2 communities were found with endemic rates (prevalence >5%), therefore commenced on community wide treatments
- 19 community wide treatments
- Approximately 4,500 people treated.

Discussion

It is difficult to determine if the intensive program improved treatment coverage because of the different patient information systems used across different communities. The variety in systems limits the ability to interrogate them, however positive outcomes from the program identified include;

- Greater awareness about trachoma within the community. The teams noted that many people stated “I already had my medicine last week in community “A” or even better “I missed out on my medicine in Community B, can I have mine now?” Indicating that the ideas behind the strategy are working
- Improved relationships with community service providers, particularly regional councils. This will benefit future interventions in the F and E space of the SAFE strategy.

Conclusion

The inability to readily combine information from the different electronic patient record systems in use within Central Australia limits the capacity to determine whether overall population coverage has increased. If coverage is increasing; the prevalence of trachoma in Central Australia should decrease in subsequent years.

Other logistical challenges were overcome and the program is now better prepared to undertake a similar activity next year. Future planning will work towards coordinating larger regions across the NT including the Barkly and Katherine West. Clustering screening and treatment will have an added benefit in the future as trachoma staff will have more time to dedicate to improving community engagement and to focus on the F and the E aspects of the SAFE strategy.

References


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Hepatitis C eradication in the NT: Think global, act local
Belinda Greenwood-Smith, Centre for Disease Control, Alice Springs

Abstract

Eradication of hepatitis C has now become possible with the introduction of the new Direct Acting Antivirals which offer shorter, more effective and better tolerated treatment regimens for hepatitis C. Treating the estimated 200,000 people in Australia infected with hepatitis C will require further development of community based treatment infrastructure, along with public health advocacy to strengthen prevention activities and ensure adequate funding for prevention, screening and health promotion.

Key Words: hepatitis C; eradication; models of care; harm reduction; DAAs.

Background

In March 2016, the Australian Government announced that it was committing 1 billion dollars to provide unrestricted access to the new Direct Acting Antiviral medications (DAAs) for treatment of chronic hepatitis C infection over the coming 5 years. Until then, the treatment options for hepatitis C had been prolonged and difficult, largely involving poorly tolerated interferon based regimens, giving only 40-80% viral clearance at best. In contrast, the DAAs are very well tolerated, require shorter treatment duration and give a clearance rate of over 90%. Newer pangenotypic regimens released in August have simplified treatment even further, thus putting this common cause of chronic liver disease within tantalising reach of eradication.

It is estimated in the years prior to 2016, between 2,000-4,000 people took up and completed treatment for hepatitis C per year.1 Since the introduction of DAAs, this number has increased dramatically with over 32,000 people being treated between March and December of 2016 alone.1 This is a great achievement, but with an estimated 200,000 people still living with chronic hepatitis C in Australia, there is clearly a large proportion of infected people yet to be treated. It has been suggested that the high levels of treatment uptake seen after the introduction of the DAAs was probably due to the ‘clearing of the warehouse’ effect, with early uptake by patients who had been attending chronic liver disease clinics over the preceding years delaying their treatment until more tolerable treatments had arrived. It now remains to be seen whether these high rates of treatment uptake will be maintained or whether new strategies will be needed to reach the remainder of the population living with hepatitis C. Simply financing of DAAs alone may not be enough, and it is time to take a look at a broader strategy for eradication.

Eradication strategy

For a disease to be considered as having the potential for eradication it is necessary to fulfil 3 fundamental elements:

A. effective interventions need to exist to interrupt transmission
B. there must be sufficiently sensitive and specific tools available to detect the infection
C. humans must be the only reservoir for the disease.2

The introduction of DAAs has completed this triad making eradication theoretically possible. However, eradication programs need to be adequately resourced and require enough social and political commitment for a sustained and prolonged effort. The WHO has called for eradication of viral hepatitis as a public health priority by 2030, with a 90% reduction in incidence and a 65% reduction in mortality from hepatitis C by 2030.3 Australia has a unique opportunity in being able to achieve these targets. In the WHO Global Health Sector Strategy on Viral Hepatitis, the main aspects of an eradication program are outlined, with the essential intervention strategies focused around prevention, testing and treatment. Below we will consider how aspects of these strategies may apply in the Northern Territory (NT) setting.
Prevention

Broadly speaking, strategies for the prevention of hepatitis C consist of provision of adequate blood safety, injection safety in healthcare settings, harm reduction programs and prevention of mother-child transmission. Australia has programs addressing all of these aspects of prevention but access to harm reduction programs in rural and remote areas can be patchy.

Harm reduction

Needle and Syringe Programs (NSPs) and Opiate Substitution Treatment (OST) programs form the backbone of harm reduction strategies in Australia where improving the safety of injection technique and reducing the frequency of injections by treating the underlying addiction can reduce the transmission of the blood-borne viruses. Hepatitis C prevalence among people who inject drugs (PWID) attending NSPs in Australia was estimated to be 51% in 2016,¹ thus making this population a major potential ‘vector’ for spread of hepatitis C and an important access point for eradication strategies. PWID are often not well linked into health services and the NSPs offer access to this hard to reach population.

The NT NSP provides 35 fixed-site outlets for access to sterile injecting equipment comprising of 3 primary sites run by the Northern Territory Aids and Hepatitis Council (NTAHC) in Darwin, Palmerston and Alice Springs, 10 secondary sites located in sexual health clinics and hospital emergency departments in the major centres (except for of Darwin), 19 access points through pharmacy outlets, and 3 after-hours dispensing units (ADUs) currently under trial in Darwin, Palmerston and Alice Springs. This service has distributed 546 635 units of sterile injecting equipment over the past financial year (unpublished data, personal communication David Decolongon) and a further 21 115 units since the commencement of the ADU trial in December 2016 (unpublished data, NT NSP Minimal Data Set, personal communication David Decolongon), indicating a need for expanded after-hours services to fill unmet demand.

An estimated 24 % of prison entrants in Australia have hepatitis C,¹ representing another large reservoir of disease. Obviously strengthening prevention, testing and treatment in this population will be a key strategy in an eradication campaign. Unlike the rest of Australia, the prison population in the NT has a very low prevalence rate of hepatitis C (current prevalence rate <3%) (unpublished data, personal communication Peter Nihill), but this may change with increasing use of illicit drugs in the urban populations. The NT health services currently offer only selective hepatitis C screening of prisoners on intake into the prisons, thus reducing opportunistic hepatitis C screening and the ability to detect rising rates in this population. It does however provide hepatitis C treatment services to the prison clinics. There are currently no NSP programs operating within any prisons in Australia and the NT is no exception. Given NSPs in correctional settings are unpopular and controversial, the NT correctional services need to be engaged early in the conversation if we are to avoid potential amplification of transmission through this setting.

Enhanced surveillance data

The NT has the highest rate of hepatitis C notifications in Australia with 76/100,000 notifications in 2016 (see Table 1).

In the jurisdictions where Aboriginal status is adequately measured, the rate of newly diagnosed hepatitis C in the NT non-Aboriginal population is the highest of all the jurisdictions at 81.5/100,000¹ (see Figure 1). In contrast, the rate in the Aboriginal population is one of the lowest (56.9/100 000), although this has been increasing steadily each year.¹

It is important that we attempt to better capture the dimension of this emerging problem through enhanced data collection and timely investigation of incident cases of hepatitis C, as this will help determine where prevention strategies are falling down and where resources may need to be directed. Yet, detection of newly acquired hepatitis C (as distinct from newly diagnosed) is notoriously difficult to measure as it requires evidence of preceding
negative serology within the previous 24 months. Improved testing rates will improve the ability to identify these incident cases.

**Testing and Treatment**

In 2016, it was estimated that 81% of people living with hepatitis C had already been diagnosed with the infection but only 14% of
these had received treatment\(^1\) (see Figure 2). In the NT, only 10% of the estimated 3,606 people living with hepatitis C had received treatment in 2016.\(^1\) Testing and treatment will clearly need to be scaled up in order to achieve the WHO target of 80% of people treated by 2030, and developing new and innovative screening programs and models of care outside the tertiary setting will be key to attaining this target.

In general terms, the earlier an infection is detected and treated, the less opportunity there is for that infection to be transmitted (treatment as prevention). Earlier detection of cases will require specific and targeted strategies to reach more marginalised populations such as people who inject drugs (PWID), homeless people, the incarcerated population and people with mental health problems. Likewise, consideration will need to be given as to how to best engage with Indigenous and Culturally and Linguistically Diverse populations, and how to tailor programs for people living in rural and remote areas where access to services can be limited.

**Point of care testing**

Point of care testing would enhance early detection of hepatitis C cases, allowing for incidental testing in General Practitioner (GP) clinics, NSP sites, homelessness services, mental health and Alcohol and Other Drug clinics. Coupled with rapid referral to community based treatment services these 2 strategies alone could improve reach, reduce barriers to access, and improve the efficiency and quality of care. Unfortunately, there are no point-of-care tests currently licensed for use in Australia but potential for trial use in the NT needs to be explored.
**Models of care**

1. Nurse-led models of care

Many jurisdictions have already developed nurse-led models of care, where specialist nurses are employed through existing liver clinics to support visiting specialists. In Alice Springs, the CDC runs such a service at clinic 34, with a permanent nurse based in the clinic and a visiting specialist hepatologist running clinics regularly throughout the year. The support that the nurse is able to give to the patients has been integral to the success of this service with 102 patients being treated since the introduction of DAAs in March 2016 (unpublished data, personal communication Mairead Hetherington). With an estimated total of 250 people with chronic hepatitis C (based on 1% prevalence of 25,000), Alice Springs is well on its way to achieving eradication. This service is not directly attached to the outpatient department of the hospital and it is felt that being able to offer a more community based service has contributed to the success of this clinic.

A similar service runs from the Royal Darwin Hospital with 388 out of an estimated 1370 (based on 1% prevalence of 137,000) people having completed treatment since March 2016 (unpublished data, personal communication Jaclyn Tate-Baker).

2. GP-led models of care

The importance of moving treatment out into the community has been well understood by the federal government, with provision given in the PBS for prescription of the DAAs by GPs in consultation with a specialist. Despite this PBS provision, there has generally been slower uptake by the primary health sector and relatively little experience with GP-led models of care.

Most GP-based care has occurred in clinics that already have a higher case load of patients with hepatitis C such as those in the AOD field. The major advantage of a GP-led model of care is that treatment can be integrated into the usual pathways of care that people are already accessing, thus reducing any stigma and barriers associated with accessing tertiary care. A limitation with a GP-led model however, is that very few GPs have high hepatitis C caseloads outside the major population centres and thought needs to be given as to how to support GPs in this setting. Supports that would assist GPs could include; 1) identification of a network of interested GPs, 2) development of hepatitis C referral pathways through the Primary Healthcare Network ‘health pathways’ project, 3) creation of a GP helpline, 4) improved access to hepatic elastography for cirrhosis assessment, 5) provision of outreach education, development of case finding and decision support tools, and 6) the implementation of a tertiary ‘referral-back’ to GPs offering specialist support or electronic prescriber support systems. Given that most GPs work within a private business model, a potential barrier to GP-led care is the current structure of the Medicare schedule that does not adequately remunerate management of complex problems. If a GP model of care is to work, better access to client support services such as social workers, mental health workers, AOD services and case managers will be necessary to assist the GP in managing the complex psychosocial situations that often surrounds hepatitis C.

Further research also needs to be done into understanding the impact of the fees incurred in community based settings, particularly in rural areas where bulk billing rates are low. Current billing for a private consultation with a GP in Alice Springs is between $70-$90 for general patients and $55 for concessional patients, with a $37.05 rebate available by Medicare. Pharmacy dispensing fees are $38.30 for general patients and $6.20 for concessional patients, per script. These fees do not apply to patients accessing care in the hospital system and could act as a disincentive for community based care.

3. Peer-led models of care

Peer-led models of care can offer the ultimate in flexible community-based care, bringing care directly to people in their own environments and supporting empowerment and ownership of a problem from within the affected community itself. Peer-led models have the potential to greatly improve access to the hard to reach population that is not engaged in any care and
to improve case finding by contact tracing through identification of injection networks. Their capacity to raise awareness of treatment availability and to inform and educate the affected community is a major asset to a program.

4. Special settings
Integration of treatment into existing OST services and prison clinics is occurring in many jurisdictions, providing a natural link to supported treatment services. Priority should be given in the NT to supporting GPs and nurses working in these settings.

Health Promotion

A coordinated and comprehensive health promotion campaign is a much-needed component of any eradication plan but requires adequate resourcing to be effective. The Ottawa Charter of health promotion reminds us to continually reorientate health services towards prevention of illness and promotion of health, rather than to focus all of our resources into tertiary care. Preventing future cases of chronic liver disease due to hepatitis C fits well with this directive.

Conclusion

Australia has an unprecedented opportunity to eradicate hepatitis C and the world is watching and waiting to see if this is possible. In the absence of a national hepatitis C eradication strategy, each jurisdiction has the duty to consider how it might best capitalise on the free availability of the DAAs and how eradication can be achieved in their own communities so as not to miss the unique opportunity that has been offered.

Acknowledgements

Thanks to David Decolongon, Senior Policy Advisor from the Sexual Health and Blood Borne Virus Unit CDC Darwin, and Alice Springs CDC public health nurses Mairead Hetherington and Helen Goodwin for their input and contributions.

References

Abstracts from peer reviewed published articles related to the Northern Territory

Effect of an ageing population on services for the elderly in the Northern Territory

Lowe M, Coffey P.


**Objective:** The aim of the present study was to describe the elderly population of the Northern Territory (NT), explore the challenges of delivering aged care services to this population and implications for the acute care sector.

**Methods:** Data gathered from a variety of sources were used to describe the demographic and health profile of elderly Territorians, the aged care structure and services in the NT, and admission trends of elderly patients in NT hospitals. Information regarding NT community and residential aged care services was sourced from government reports. NT public hospital admissions from 2001 to 2015 were adjusted by the estimated Aboriginal and non-Aboriginal populations.

**Results:** In 2015, elderly people constituted 9.2% of the NT population and this number is predicted to increase. Between 2001 and 2015, the number and rate of elderly admissions to NT public hospitals increased significantly. Compared with other jurisdictions, aged care in the NT is dominated by community services, which are of limited scope. Important geographical and economic factors affect the availability of residential aged care beds. This, in turn, affects the ability of elderly people to transition from hospital settings.

**Conclusions:** The NT has a relatively small but growing elderly population with increasing needs. This population is markedly different compared with its counterparts in other Australian states and territories, but receives aged care services based on national policies.

Recent changes to community-based services and increases in residential beds should improve services and care, although remaining challenges and gaps need to be addressed.

**What is known about the topic?** Increasing health and care needs of elderly people will place significant stress across the health and aged care system. In Australia, most aged care services are apportioned and funded under a national system. The NT has a markedly different population profile compared with the rest of Australia, which gives rise to unique considerations, but its aged care structure is based on nationally developed policies.

**What does this paper add?** Elderly people in the NT are increasingly using acute care services. Aged care services in the NT have higher ratios of community-based services to residential aged care facilities (RACF) as a consequence of a ‘younger’ cohort of Aboriginal elderly people who live remotely. In addition, economic factors affect the low number of RACF places. As evidenced in past years, a small pool of beds can adversely affect the numbers and length of stay of elderly people waiting in hospitals.

**What are the implications for practitioners?** The NT has a small but growing population of elderly people, which will place an increasing burden on acute care services that are ill equipped to manage their specific needs. Recent RACF and flexible care bed approvals may alleviate past difficulties to transition hospital patients awaiting RACF placement. Significant changes at the national level to community-based care services that increase flexibility for providers may bring about better outcomes for remote elderly recipients. However, high costs and issues with remote servicing will remain. Psychogeriatrics remains a major underserviced area in the NT with no prospective solution.
Trimethoprim + sulfamethoxazole reduces rates of melioidosis in high-risk hemodialysis patients

Majoni SW, Hughes J, Heron B, Currie B


**Introduction:** Melioidosis causes sepsis and death in the Top End of Northern Australia during the monsoonal wet season. Dialysis-dependent adults suffer higher melioidosis rates compared to low rates among renal transplant patients who routinely receive trimethoprim+sulfamethoxazole prophylaxis.

**Methods:** We performed a prospective interventional study to determine the efficacy and safety of daily trimethoprim+sulfamethoxazole prophylaxis in hemodialysis patients during the wet season, from 1 November 2014 to 30 April 2015. Hemodialysis (for ≥ 3 months) patients ≥ 18 years of age were offered treatment. A total of 269 patients on hemodialysis were eligible. Eight of the 269 patients (3%) were excluded from the analysis for being on melioidosis treatment. In all, 169 of 261 patients (64.8%) received the prophylaxis, and 92 of 261 patients (35.2%) did not, because of allergy history (n=10), remoteness and logistical reasons (n=60), poor dialysis attendance (n = 11), and refusal (n = 11). We monitored for clinical side effects 3 times weekly and neutropenia, thrombocytopenia, and liver function monthly throughout treatment and for 2 months post-treatment.

**Results:** In all, 169 of 261 patients (64.8%) received the prophylaxis. There was no age (years) difference by group (prophylaxis vs. non-prophylaxis, 54.7 [11.3] vs. 54.3 [11.2] [P=0.751]). Sixteen of 261 patients (6%) had melioidosis. The event frequency was 0% (0/169, prophylaxis, vs. 17.4% [16/92, non-prophylaxis], P<0.001). Higher thrombocytopenia and neutropenia rates were noted in the prophylaxis group. These did not warrant treatment stoppage. There was no difference in liver function. Three patients (1.8%) withdrew from the treatment because of side effects.

**Discussion:** Daily dosing was effective and safe. Post-hemodialysis dosing in the subsequent seasons was effective and safer. We recommend this approach in melioidosis-prevalent regions.

Molecular antimicrobial resistance surveillance for *neisseria gonorrhoeae*, Northern Territory, Australia

Whiley D, Trembizki E, Buckley C, Freeman K, Baird R, Beaman M, Chen M, Donovan B et al

*Emerg Infect Dis,* www.cdc.gov/eid, 23(9), Sept 2017, doi:https://doi.org/10.3201/eid2309.170427

*Neisseria gonorrhoeae* antimicrobial resistance (AMR) is a globally recognized health threat; new strategies are needed to enhance AMR surveillance. The Northern Territory of Australia is unique in that 2 different first-line therapies, based primarily on geographic location, are used for gonorrhea treatment. We tested 1,629 *N. gonorrhoeae* nucleic acid amplification test-positive clinical samples, collected from regions where ceftriaxone plus azithromycin or amoxicillin plus azithromycin are recommended first-line treatments, by using 8 *N. gonorrhoeae* AMR PCR assays. We compared results with those from routine culture-based surveillance data. PCR data confirmed an absence of ceftriaxone resistance and a low level of azithromycin resistance (0.2%), and that penicillin resistance was <5% in amoxicillin plus azithromycin regions. Rates of ciprofloxacin resistance and penicillinase-producing *N. gonorrhoeae* were lower when molecular methods were used. Molecular methods to detect AMR can increase the evidence base for treatment guidelines, particularly in settings where culture-based surveillance is limited.
Active SMS-based influenza vaccine safety surveillance in Australian children

Pillsbury A, Quinn H, Cashman P, Leeb A, Macartney K on behalf of the AusVaxSafety consortium


NT Centre for Disease Control (CDC) has contributed data to this report.

Introduction: Australia’s novel, active surveillance system, AusVaxSafety, monitors the post-market safety of vaccines in near real time. We analysed cumulative surveillance data for children aged 6 months to 4 years who received seasonal influenza vaccine in 2015 and/or 2016 to determine: adverse event following immunisation (AEFI) rates by vaccine brand, age and concomitant vaccine administration.

Methods: Parent/carer reports of AEFI occurring within 3 days of their child receiving an influenza vaccine in sentinel immunisation clinics were solicited by Short Message Service (SMS) and/or email-based survey. Retrospective data from 2 years were combined to examine specific AEFI rates, particularly fever and medical attendance as a proxy for serious adverse events (SAE), with and without concomitant vaccine administration. As trivalent influenza vaccines (TIV) were funded in Australia’s National Immunisation Program (NIP) in 2015 and quadrivalent (QIV) in 2016, respectively, we compared their safety profiles.

Results: 7402 children were included. Data were reported weekly through each vaccination season; no safety signals or excess of adverse events were detected. More children who received a concomitant vaccine had fever (7.5% versus 2.8%; p < .001). Meningococcal B vaccine was associated with the highest increase in AEFI rates among children receiving a specified concomitant vaccine: 30.3% reported an AEFI compared with 7.3% who received an influenza vaccine alone (p < .001). Reported fever was strongly associated with medical attendance (OR: 42.6; 95% Confidence Interval (CI): 25.6–71.0). TIV and QIV safety profiles included low and expected AEFI rates (fever: 4.3% for TIV compared with 3.2% for QIV (p = .015); injection site reaction: 1.9% for TIV compared with 3.0% for QIV (p < .001)). There was no difference in safety profile between brands.

Discussion: Active participant-reported data provided timely vaccine brand-specific safety information. Our surveillance system has particular utility in monitoring the safety of influenza vaccines, given that they may vary in composition annually.

The rationale for action to end new cases of rheumatic heart disease in Australia

Wyber R, Katzenellenbogen J, Pearson G, Gannon M


A summary of this article is provided here by Kate Hardie, Section Head Rheumatic Heart Disease, CDC:

The Perspective note in October 2017’s MJA outlines the rationale for action to end new cases of Rheumatic Heart Disease (RHD) in Australia. This follows on from the AMA using their 2016 annual Report Card on Indigenous Health to focus, for the first time ever, on a single pathology – RHD.1 (https://tinyurl.com/yderult9).

The authors state that "it is the relative inequality of RHD, rather than the absolute magnitude, which should compel Australia to action." Northern Territory (NT) statistics certainly bear that out. In the NT in last 5 years, 99% of Definite and Probable Acute Rheumatic Fever (ARF) diagnoses in the <16 years age group have occurred in Aboriginal children. In the last 5 years 96% of the new RHD diagnoses have occurred in Aboriginal people.

The opinion piece goes on to outline that a stable and well-supported primary care workforce is required in order to ensure that "skin sores and throat sores are treated, ARF diagnosed, secondary prophylaxis delivered, anticoagulation monitored and health education provided".
Achieving a stable workforce in the NT to achieve these goals is an enormous challenge, as outlined in a recent paper which showed that there was on average a 50% turnover in Nursing and Aboriginal Health Worker staffing in remote NTG clinics every 4 months.

The piece then describes the activities of the National Health and Medical Research Council-funded END RHD Centre for Research Excellence (END RHD CRE) which has been tasked with delivering a set of costed, step-wise interventions by 2020 to end RHD in Australia.

The most stirring sentence in the paper? "Few outcomes are as confronting as the sternotomy scars of Indigenous children who, for want of acceptable housing, have had major surgery and face a lifetime of medical intervention."

References


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NT malaria notifications July-September 2017

Elizabeth Stephenson, CDC Darwin

There were 4 cases of malaria notified in the 3rd quarter of 2017. The following table provides details about where the infection was thought to be acquired, the reason exposed, the infecting agent, whether chemoprophylaxis was used and where the patient lived.

<table>
<thead>
<tr>
<th>No. cases</th>
<th>Origin of infection</th>
<th>Reason exposed</th>
<th>Agent</th>
<th>Chemoprophylaxis</th>
<th>NT region</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Indonesia (West Papua)</td>
<td>Visiting student</td>
<td><em>P. vivax</em></td>
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<tr>
<td>1</td>
<td>Burundi</td>
<td>Refugee</td>
<td><em>P. falciparum</em></td>
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<td>Darwin</td>
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<tr>
<td>1</td>
<td>Kenya</td>
<td>Refugee</td>
<td><em>P. falciparum</em></td>
<td>No</td>
<td>Darwin</td>
</tr>
</tbody>
</table>

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Ensure everyone has had 2 measles, mumps, rubella vaccines before they travel

Measles still occurs in many regions in the world including in South East Asian countries near the NT. It can be a serious disease and is very infectious. People need to be protected from measles and know that they are immune. Please ensure that all people born during or after 1966 have been vaccinated with 2 doses of measles mumps rubella vaccine.
## NT NOTIFICATIONS OF DISEASES BY ONSET DATE & DISTRICTS

**1 July–30 September 2017 and 2016**

<table>
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<th>Disease</th>
<th>Alice Springs</th>
<th>Barkly</th>
<th>Darwin</th>
<th>East Arnhem</th>
<th>Katherine</th>
<th>NT</th>
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<tbody>
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<td>Acute post-strep glomerulonephritis</td>
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<td>4</td>
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<td>Chlamydia</td>
<td>222</td>
<td>174</td>
<td>31</td>
<td>28</td>
<td>366</td>
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<tr>
<td><strong>Total</strong></td>
<td>1,208</td>
<td>782</td>
<td>231</td>
<td>168</td>
<td>1,528</td>
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</table>
Ratio of the number of notifications in the 3rd quarter 2017 to the 5 year mean (2012-16): selected diseases

Ratio of the number of notifications in the 3rd quarter 2017 to the 5 year mean (2012-16): sexually transmitted diseases
Comments on notifications

Shigelloides
Shigelloides notifications were 5.2 times the 5 year mean (121 vs 23). The majority of notifications were S. flexneri 2b (65 cases) which has been the dominant serotype notified year-to-date in 2017. There has been a sustained increase since May with cases predominantly occurring in Central Australia. There were also 44 notifications of untyped Shigella which is reflective of the increase in notifications due to culture independent testing methods (i.e nucleic acid testing).

Meningococcal disease
There were 22 cases of invasive meningococcal disease notified in the 3rd quarter. Almost all of the cases were part of the outbreak of W strain in Central Australia. In recent years there have been 1 to 4 cases of any serogroup of meningococcal disease notified per annum. An ACWY quadrivalent meningococcal vaccination program for those aged 1-19 years is being implemented in Central Australia and the Katherine region. The ACWY quadrivalent meningococcal vaccine is being introduced to the NT Childhood Vaccination Schedule at 12 months of age, funded by the NT Government, to replace the C strain vaccine on the national schedule.

Influenza
There were 736 cases of laboratory-confirmed influenza notified in the 3rd quarter, which is almost 2.5 times the expected number of 312 cases, based on the 5 year mean. This may be reflective of an increase in the amount of testing being done but the numbers are consistent with national figures that indicate a very large flu season in most all jurisdictions. About half of the NT infections were due to influenza A/H3N2 and the other half B.

Pneumococcal disease
There were 38 cases of invasive pneumococcal disease (IPD) notified in the 3rd quarter of 2017. This was over twice the 5 year mean of 18.4 for the months July to September. Individual serotypes of IPD varied, however 20 (53%)were due to a serotype found in the 13 valent pneumococcal conjugate vaccine (13vPCV). This is an increase compared to previous quarters and has been primarily driven by an increase in serotypes 3 and 7F. Only 1 child (with increased risk factors for disease) who was fully vaccinated with 13vPCV developed disease due to a serotype found in the vaccine. Although the 3rd quarter is the typical season associated with an increase in cases, the large influenza season is likely to have contributed to a greater than usual increase and this is being further investigated.

Syphilis
There were 93 cases of infectious syphilis ofless than 2 years duration in the 3rd quarter which was 2.9 times the 5 year mean (32). This increase shows the ongoing outbreak affecting the Aboriginal and Torres Strait Islander population across Northern Australia is not abating. Cases in the 3rd quarter were mostly from Darwin Urban and Katherine region, followed by Darwin Rural and Alice Springs Rural.

Cases of late latent syphilis, which are of greater than 2 years duration or of unknown duration, were 1.7 times the 5 year mean (24 vs 14). The cases are most likely related to the ongoing outbreak as some are found due to increased and targeted testing efforts.

Hepatitis B unspecified
There were 23 cases of unspecified hepatitis B notified in the 3rd quarter which is about half the expected value. This category consists mainly of people who have not been tested in the NT before with the majority of cases in newly arrived residents or visitors. The other group is a reducing number of Aboriginal people who are not known to have been tested before in the NT and there were 5 in this category. Due to a focus on testing and promoting universal immunisation for hepatitis B, the number of unspecified hepatitis B notifications is expected to continue to fall.

Hepatitis C unspecified
There were 34 notifications of unspecified hepatitis C notified which is about 60% of the expected number. This reflects the decreasing trend in hepatitis C notifications possibly attributed to decreased transmission with the success of the needle and syringe program and cure of hepatitis C cases treated with the newly approved direct-acting antiviral medication.
### Immunisation coverage for children aged 12-<15 months at 30 September 2017

<table>
<thead>
<tr>
<th>SA3 Name</th>
<th>Number in district</th>
<th>%DTP</th>
<th>%Polio</th>
<th>%HIB</th>
<th>%Hep B</th>
<th>%Pneumo</th>
<th>% Fully vaccinated</th>
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<tbody>
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### Immunisation coverage for children aged 24-<27 months at 30 September 2017

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<th>%Polio</th>
<th>%HIB</th>
<th>%Hep B</th>
<th>%MMR</th>
<th>%MenC</th>
<th>%Varicella</th>
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† Not mapped: Individual could not be mapped to a specific location. For example a PO Box cannot be mapped to a geographical area.
### Immunisation coverage for children aged 60-<63 months at 30 September 2017

<table>
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<th>SA3 Name</th>
<th>Number in district</th>
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<th>%MMR</th>
<th>% Fully vaccinated</th>
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</thead>
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</tbody>
</table>

† Not mapped: Individual could not be mapped to a specific location. For example a PO Box cannot be mapped to a geographical area

### Background information to interpret coverage

Immunisation coverage is reported by Australian Bureau of Statistics (ABS) Statistical Area Level 3 (SA3). SA3s are ABS standardised geographical areas to which children have been assigned based on their Medicare address as recorded on the Australian Immunisation Register (AIR). The region ‘Not Mapped’ captures the children whose residency could not be mapped to a specific location within the Northern Territory (NT), this includes PO Box addresses. Maps of these geographic area boundaries can be found at [http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/B0AC271BC8160338CA257801000E0692/$File/1270055001_asgs_2011_nt_maps.pdf](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/B0AC271BC8160338CA257801000E0692/$File/1270055001_asgs_2011_nt_maps.pdf)

The cohort of children assessed at 12 to <15 months of age on 30 September 2017 were born between 1 March 2016 and 31 June 2016 inclusive. To be considered fully vaccinated, these children must have received 3 valid doses of vaccines containing diphtheria, tetanus, pertussis, and poliomyelitis antigens, either 2 or 3 doses of PRP-OMP Hib or 3 doses of another Hib vaccine, 3 doses of hepatitis B vaccine and 3 doses of pneumococcal vaccine. All vaccinations must have been administered by 12 months of age.

The cohort of children assessed at 24 to <27 months of age on 30 September 2017 were born between 1 March 2015 and 31 June 2015 inclusive. To be considered fully vaccinated, these children must have received meningococcal C vaccination (given at the 12 month schedule point), and a second dose of measles, mumps, rubella (MMR) and the first dose of the varicella vaccination (given in combination as MMRV at the 18 months schedule point). All vaccinations must have been administered by 24 months of age.

The cohort of children assessed at 60 to <63 months of age on 30 September 2017 were born between 1 March 2012 and 31 June 2012 inclusive. To be considered fully vaccinated, these children must have received 4 or 5 valid
doses of vaccines containing diphtheria, tetanus, pertussis antigens, 4 doses of poliomyelitis vaccine and 2 valid doses of MMR vaccine. All vaccinations must have been administered by 60 months (5 years) of age.

**Interpretation and comment**

Immunisation coverage rates for NT children by SA3 and Aboriginal status, as estimated by the AIR, are shown on pages 46-47. Coverage for all Australian children is also provided.

Children in the NT were more likely to be fully immunised in the 12 to <15 months cohort (NT 95.2%, National 94.3%) and less likely in the 24 to <27 months cohort (NT 89.2%, National 91.2%) and the 60 to <63 months cohort (NT 93.40%, National 94%) to be fully immunised.

Aboriginal children were less likely to be fully immunised than non-Aboriginal children in the 12 to <15 month cohort (Aboriginal 94.2%, non-Aboriginal 95.8%) and in the 24 to <27 month cohort (Aboriginal 85.5%, non-Aboriginal 91.5%) but slightly more likely to be fully immunised in the 60 to <63 month cohort (Aboriginal 93.6%, non-Aboriginal, 93.2%).

Coverage by SA3 in the Table shows variation between high and low coverage areas. East Arnhem had the lowest coverage for Aboriginal 12 to <15 months and Aboriginal 60 to <63 months. Coverage of 100% was reported for non-Aboriginal children in the Katherine SA3 for 12<15 months age group and East Arnhem for 60 to <63 month age group.

The Centre for Disease Control (CDC) continue to review the reasons for the lower coverage in both Aboriginal and non-Aboriginal children. CDC is working with the AIR to review data quality and processing of vaccine recording, and assessing other strategies to improve childhood immunisation coverage. Further information about the Australian Childhood Immunisation Register coverage may be found at: http://ncirs.edu.au/immunisation/coverage/index.php

<table>
<thead>
<tr>
<th>Age group</th>
<th>Lowest SA3</th>
<th>Highest SA3</th>
<th>Lowest SA3</th>
<th>Highest SA3</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 &lt; 15</td>
<td>81.8%</td>
<td>100%</td>
<td>91.1%</td>
<td>100%</td>
</tr>
<tr>
<td>months</td>
<td>East Arnhem</td>
<td>Alice Springs</td>
<td>Darwin City</td>
<td>Katherine</td>
</tr>
<tr>
<td>24 &lt; 27</td>
<td>79.6%</td>
<td>94.6%</td>
<td>89.7%</td>
<td>95.5%</td>
</tr>
<tr>
<td>months</td>
<td>Darwin Suburbs</td>
<td>Daly-Tiwi-West Arnhem</td>
<td>Darwin City</td>
<td>Katherine</td>
</tr>
<tr>
<td>60 &lt; 63</td>
<td>85.2%</td>
<td>100%</td>
<td>90.7%</td>
<td>100%</td>
</tr>
<tr>
<td>months</td>
<td>East Arnhem</td>
<td>Darwin City</td>
<td>Alice Springs</td>
<td>East Arnhem</td>
</tr>
</tbody>
</table>

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Disease Control staff updates October-December 2017

Top End

Farewell to Philippa Binns who worked part-time as the Co-Section Head of Immunisation and has moved to Canberra. Brooke Budge has joined the Darwin Immunisation team as a Clinical Nurse Specialist (CNS). Brooke was previously working with the Infection Prevention Management team at Royal Darwin Hospital.

Marea Fittock has left the Rheumatic Heart Disease (RHD) program and is working with the Top End Health Service. Maria Chandler, RHD Register Coordinator in Katherine, recently received an award at Parliament House for 35 years of service to the Northern Territory Government (NTG).

Suzanne Connor, Manager Clinic 34 Darwin, has resigned and has moved interstate. Recruitment for her replacement is underway. Padaila Mudu, Clinic 34 Darwin Receptionist, has resigned and her replacement is being recruited. Farewell to Matthew Thalanany, Section Head SHBBVU, who has resigned and moved back to the UK after 3 years working with Centre for Disease Control (CDC).

Manoji Gunathilake is the temporary acting Section Head as well as remaining the active Sexual Health Specialist Physician for CDC. Karen Kirkham, Top End Remote Sexual Health Nurse, will be taking leave from December until May 2019 to live in Samoa.

Chunya Rae has completed her contract after 19 months in various administrative positions in Darwin CDC. Chunya is now travelling around the world for 12 months.

One Disease has provided funding to CDC for 2 Healthy Skin Nurses who have started this past quarter. Tarrant Tolotta started in Katherine, following working in the Emergency Department at Katherine Hospital. Emma Childs has taken the position in Gove after working with the CDC RHD team in Darwin in the past.

Joy Pascall has left Gove CDC for 12 months to work as the Manager of Gapuwiyak clinic. Kathy Shields recently received recognition at Parliament House for 35 years of service to the NTG.

Public Health Nurse Michelle Daly has left Katherine CDC and returned to Townsville following the return of Judy Creighton from long service leave. Heather Woods started with Katherine CDC on a short-term contract in December as a CNS Sexual Health. Heather was previously in Adelaide and had worked in the Women's and Children's Health Network in the Primary Health Division.

Central Australia

Jacqui Arnold returned to CDC as a CNS Immunisation following a 6 month working holiday in New Zealand working with a nursing agency doing casual shifts across a variety of acute care settings.

Rahni Armstrong started working at CDC in December on a 3 month contract as a CNS Immunisation to help with the rollout of the meningococcal ACWY vaccination program.

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