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Fireworks-related injury survey report 2018

Priya Darshene Janagaraj, Centre for Disease Control, Darwin

Abstract

Background: *The Northern Territory (NT) is the only jurisdiction in Australia that allows public purchase of fireworks, this is permitted annually on Territory Day. Since 1998, the Centre for Disease Control has conducted a yearly survey of the patients presenting to acute care health facilities with fireworks-related injuries (FWRI). The aim of the survey is to monitor FWRI in the NT and provide an evaluation of the effectiveness of the fireworks safety campaign and legislative regulations in promoting harm minimisation associated with fireworks.*

Methods: *The survey facilities included NT public hospital emergency departments, the Australian Defence Force Health Centre and the Palmerston General Practice Superclinic. Data were collected on FWRI between 30 June and 6 July 2018, including the clinical information and severity of the injury along with time, place and circumstances surrounding the injury event.*

Results: *There were 38 FWRI in people aged between 18 months and 74 years old. 13 people were admitted to hospital for further treatment. 71.1% of the injured were bystanders. Severity of FWRI were mild 26.3%, moderate 39.5% and severe 34.2%. A total of 11 children presented to the various health facilities with 45.5% of children requiring admission to hospital in comparison to 30.8% of adults. Multi-shot fireworks were responsible for 21.1% of FWRI. Time to first aid administration for FWRI was delayed for 85.7% of injuries occurring at public facilities compared to 12.5% in private facilities ($p<0.009$).*

Conclusion: *Harm minimisation of FWRI is important. Targeted approaches including increasing first aid knowledge in the community and providing safety messages for bystanders should be implemented to reduce the number and severity of harms associated with fireworks.*

Key words: Fireworks; burns; injuries; children; Territory Day

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Centre for Disease Control
PO Box 40596
Casuarina
Northern Territory 0811

Website:http://www.nt.gov.au/health/cdc/cdc.shtml

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Introduction

On 1 July 1978, the Northern Territory (NT) was awarded self-governance from the Commonwealth of Australia.[1] In recent times July 1 has come to be known as 'cracker night' and is a day, and night, of celebration of the people, culture and heritage of the Territory. The NT is the only jurisdiction in Australia that allows the private purchase and use of fireworks. Since 1980 there have been restrictions of varying degrees on the sale of fireworks to the public for celebrating on this day.[1]

Currently it is legal for persons aged 18 years and older to purchase fireworks between the hours of 9 am and 9 pm on 1 July and to set them off between the hours of 6 pm and 11 pm.[2] Legislation for the purchase, transport, storage and use of fireworks is governed under the Dangerous Goods Act administered by the NT Work Safe, with oversight by the Chief Minister.[2]

In the lead up to Territory Day, the Centre for Disease Control (CDC) collaborates with NT Work Safe, NT Fire and Rescue Services and the Burns Unit at Royal Darwin Hospital (RDH) to implement the annual fireworks safety campaign. The campaign involves providing safety messages through brochures and posters in schools, health centres, hospitals, sales outlets and the media, including print and radio. In 2018 all outlets selling fireworks were encouraged to display the "Let's keep it safe on Territory Day" poster and provide fireworks safety brochures with individual sales of fireworks.

Various stakeholders were engaged to ensure broader coverage of health promotion messaging. The NT Department of Education and private school principals included the electronic version of the "Let's keep it safe on Territory Day" poster and brochure in their school newsletters a week prior to Territory Day. This allowed parents to be informed on safety precautions while using fireworks. Social media messaging was also included this year to promote the safe use of fireworks on Territory Day.

Since 1998, the CDC has conducted an annual survey of fireworks-related injuries (FWRI) to monitor injury trends to inform public health campaigns.[1,3] The purpose of this study is to evaluate the impact of the fireworks safety campaign in reducing FWRI and assess trends to inform the 2019 Fireworks Safety Campaign.

Methods

The aim of the survey is to identify details of these injuries to inform future Firework Safety Campaigns. Basic demographic and medical data were collected from people presenting with FWRI and they were invited to take part in the survey.

Setting

The survey was conducted across all emergency departments in the NT; RDH, Katherine District Hospital, Gove District Hospital, Tennant Creek Hospital, Alice Springs Hospital, along with the Palmerston General Practice Super Clinic and the Defence Force Health Centre. All facilities were invited to take part in the 2018 survey prior to Territory Day. All patients presenting to these facilities with a FWRI between 00:01 am on 30 June and 11:59 pm on 6 July with a FWRI were eligible to participate in the survey.

Data collection

Each health facility nominated a central delegate to coordinate the FWRI survey in their respective facility. A system was in place to provide preliminary data on the morning of 2 July at 6 am, with facilities emailing and/or faxing results to the CDC lead investigator.

Basic demographic details including gender, age and NT residency status were collected. Brief details of the injury sustained were collected with the date of injury, location of injury, type of injury, severity, type of firework and whether the person injured was a bystander.

Patients were also invited to consent to participate in an extended survey describing the mechanism and nature of injury, alcohol usage (within 3 hours of the injury) and first aid management.

Severity of injury was defined as 1) mild: requiring only a single visit to a health practitioner; 2) moderate: requiring 2 or more reviews by a health practitioner or 3) severe: requiring hospital admission.

Patients who were referred to another health facility had only their secondary presentation

included as it provided a more detailed summary of their injury status. If a person sustained an injury at 2 or more anatomical sites it was coded as multiple. Location of firework usage was further coded as private if it was at home including the backyard. Locations such as parks, ovals, beaches and airstrips were coded as public areas. Delay in first aid cooling was defined as at least 30 minutes between the time of injury to initiation of first aid management. All patient log lists, consent forms and surveys were returned via email, fax or hardcopy to CDC.

Data from previous years were available from a securely stored CDC database.

Statistical Analysis

Data were manually entered into Microsoft Excel and analysed using SPSS v25. Incidence of FWRI was calculated using population statistics data from Australian Bureau of Statistics.[4] A further subgroup analysis was performed to identify if there were differences in injuries and first aid management of people using fireworks in public facilities versus private residences. Fisher's exact test was used to assess statistical significance. A p value <0.05 was considered statistically significant.

Results

There were 38 people who presented with FWRI to the various health facilities included in the survey between 30 June 2018 and 8 July 2018 (see Table 1). Of these 22 (57.9%) were males and 16 (42.1%) were females. The median age of presentation was 27 years (SD 17.6, range: 18 months–74 years). Darwin and Palmerston region had the highest number of presentations with FWRI. One person was transferred via Careflight to RDH from Katherine on 4 July 2018. Of the cases, 27 were bystanders and 11 were people who ignited the fireworks themselves. Incidence of FWRI in NT in 2018 was 16.6 per 100,000.

Table 1. Baseline characteristics of fireworks-related injuries in 2018

Baseline characteristics		n	%
Region			
	Alice Springs	8	21.1
	Defence	1	2.6
	Katherine	4	10.5
	Palmerston	8	21.1
	Darwin	17	44.7
	East Arnhem	0	0
	Barkly	0	0
Sex			
	Male	22	57.9
	Female	16	42.1
Ages			
	0-16 years	11	28.9
	17-59 years	24	63.2
	≥60 years	3	7.9
Severity			
	Mild	10	26.3
	Moderate	15	39.5
	Severe	13	34.2
Location			
	Public	19	50.0
	Private	17	44.7
	Unknown	2	5.3
NT Visitor			
	Visitors	4	10.5
	Resident	34	89.5
Bystanders			
	Bystanders	27	71.1
	Not-Bystanders	11	28.9
Location			
	Unknown	2	5.3
	Air Strip	1	2.6
	Backyard	4	10.5
	Beach	11	28.9
	Home	8	21.1
	Oval	1	2.6
	Park	6	15.8
	Station	1	2.6
	Street (Home)	4	10.5

Children

A total of 11 children below the age of 16 years presented to the various health facilities with FWRI. 45.5% of children required hospital admission in comparison with 30.8% of adults requiring hospital admission for management of injuries. Reports of injury severity among children were 18.2% (n=2) mild, 36.4% (n=4) moderate and 45.5% (n=5) severe. Among children who were injured, a higher proportion sustained injuries as result of igniting the fireworks themselves (45.5%) compared to 23.1% among adults.

Injuries

The majority of injuries, 33, occurred on 1 July with a further 2 injuries on the 2 July and 3 FWRI on 3 July 2018. The most common injuries were burns at 68.4 % (n=26) with 22 people sustaining burns of less than 3% of total body surface area. One person sustained a burn

injury of 17.5% of total body surface area. There were 4 people presenting with hearing loss and 2 with shortness of breath (Table 2). No life-threatening injuries were reported. Hand and forearm were the most common sites of injury at 26.3% followed by face at 21.1%. There were 6 people who suffered injuries at 2 or more anatomical sites.

Mechanism of injury

Only 44.7% (n=17) people with sustained injuries completed the survey. The most frequent mechanism of injury described by patients who completed the survey was being hit by a multi-shot that fell over or was inappropriately launched. One person had a phone explode in the palm of his hand while standing next to a person lighting a multi-shot, while 2 people were injured when checking a firework that did not fire. One person was injured due to inappropriate disposal of powder from a firecracker in an ash tray.

"Powder from cracker was put in an ash tray. I did not realise and put my cigarette out in the same ashtray and the powder exploded."

Of the 17 respondents who completed the extended survey forms, 4 people reported having consumed alcohol; 2 were bystanders and 2 were individuals igniting the fireworks.

Multi-shot fireworks were responsible for 21.1% of FWRI (Figure 1). Complications for FWRI in 2018 included distal fingertip amputation, tympanic membrane perforation and extensive burns requiring surgical debridement.

First Aid Management

The section on first aid management in the survey questionnaire was completed by 15 people. Median of duration of first aid was 20 minutes with a range between 1 minute and 35 minutes. Time to initiation of first aid ranged from immediately to up to 4 hours. Type of first aid used was predominantly cool running water but 1 person used a bag of frozen vegetables for first aid cooling. Time to first aid administration for FWRI was delayed (>30 minutes) for 85.7 % of injuries occurring at public facilities compared to 12.5% in private facilities (p=0.009) (Table 3).

Summary of Fireworks Related Injuries 1998-2018

Since 1998, there have been 444 cases of FWRI reported in the NT (Figure 2). In 2018, there was a higher proportion of bystanders injured at 71.1% compared to 8.3% in 1999 (Figure 3). There has been a reduction in the proportion of children under 10 years old being injured dropping from 40.9% in 1998 to 15.8% in 2018.

Table 2. Anatomical site and type of fireworks-related injuries in 2018

Characteristic	n	%
Anatomical site of injuries		
Chest	1	2.6
Ear	2	5.3
Eye	2	5.3
Face	8	21.1
Foot	2	5.3
Hand & forearm	10	26.3
Multiple	6	15.8
Neck	2	5.3
Respiratory	2	5.3
Groin	1	2.6
Thigh	2	5.3
Type of injuries		
Burns	26	68.4
<3% total body surface area	22	
5% total body surface area	2	
8% total body surface area	1	
17.5% total body surface area	1	
Bruising and haematoma	4	10.5
Laceration	3	7.9
Hearing loss	4	10.5
Visual changes	1	2.6
Shortness of breath	2	5.3

Discussion

In 2018, there were 38 FWRI which was similar to the number reported in 2017.[4]

Darwin and Palmerston region had the highest number of presentations of FWRI with 25 people treated. There were no presentations of FWRI to emergency departments in East Arnhem and the Barkly. A total of 11 children (28.9%) were injured and 71.1% of people injured were bystanders. Only 4 people injured were non-residents of the NT. Injuries in 2018 included burns (68.4%), bruising (10.5%), lacerations (7.9%), hearing loss (10.5%), shortness of breath (5.3%) and eye injuries (2.6%). No life-threatening injuries were reported.

This year resulted in the highest number of people requiring admission to the hospital for further treatment (n=13) since 1998 with 2 people requiring surgical management of burns.

Figure 1. Severity of fireworks-related injuries by type of fireworks used

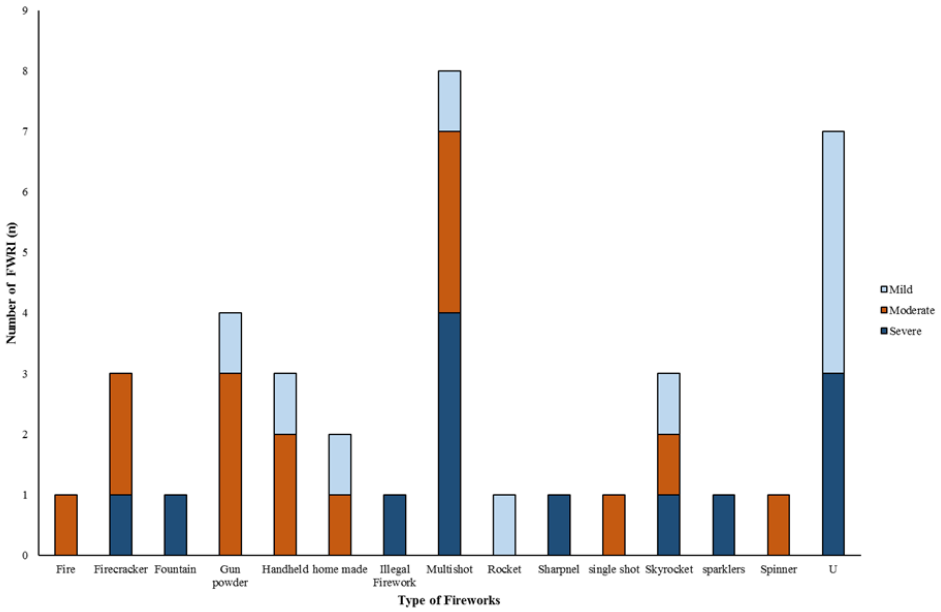
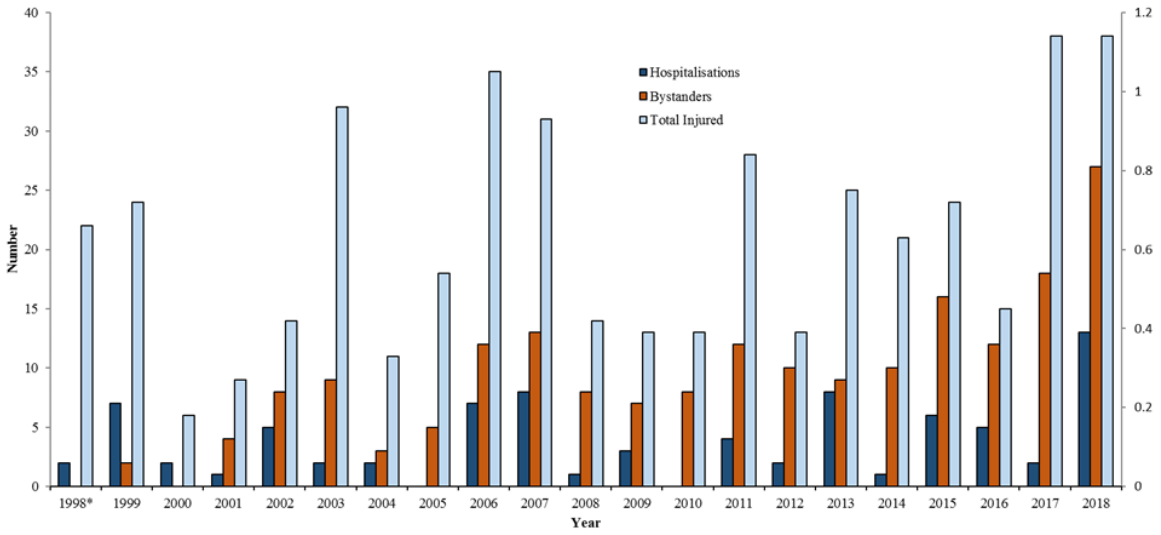


Table 3. Severity of fireworks-related injuries and time to first aid management based on place of injury

Characteristic	Private residence		Public facilities		p value
	Count	%	Count	%	
Total *	17	47.2	19	52.8	
Severity of Injuries *					
Mild	6	35.3	3	15.8	0.18‡
Moderate	5	29.4	9	47.4	0.28‡
Severe	6	35.3	7	36.8	0.92‡
Time to First Aid†					
Delayed (>30 minutes)	1	12.5	6	85.7	**0.009**
Immediate (<30 minutes)	7	87.5	1	14.3	

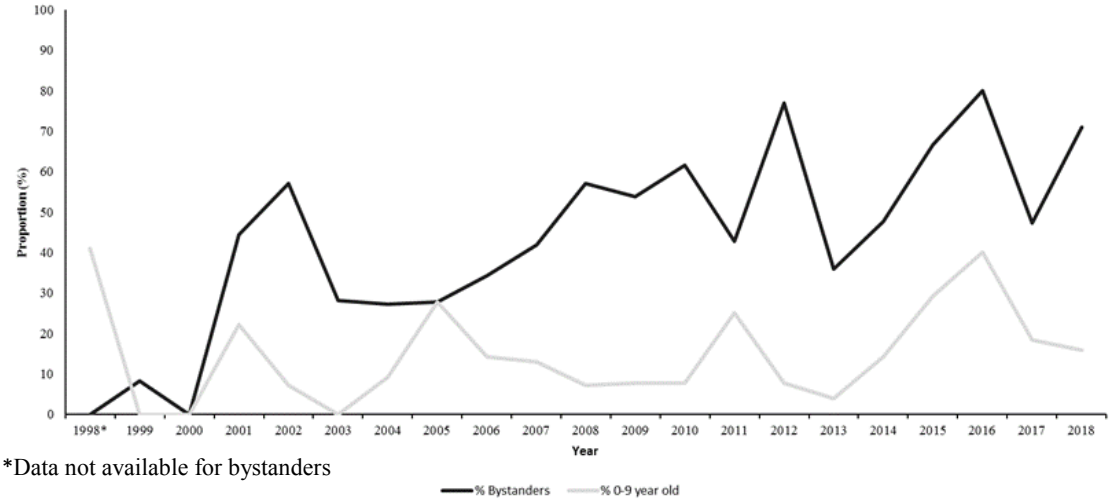
*2 FWRI occurred in unknown location
† Only 15 people completed the survey
‡ Comparing column proportions

Figure 2. Annual frequency of fireworks-related injuries in the NT (1998-2018) by hospitalisation, bystander status and total injured



*Data not available for bystanders

Figure 3. Annual firework-related injuries in the NT (1998-2018) by proportions injured who were bystanders and proportions of children between 0-9 years old



*Data not available for bystanders

The reasons for this remain unclear but nonetheless in 2018 the 40th year celebration of self-government saw a dramatic effect on the severity of FWRI.[5]

There were marked discrepancies for mechanism of injury between the children and adults with a higher proportion of children sustaining injuries as result of igniting the fireworks themselves at 45.5% compared to only 23.1% among adults. It emphasises that children are more susceptible to injuries and parents should ensure close supervision of children while using fireworks. Children are less likely to have the knowledge of safety and danger and parents have a critical role to play in ensuring safe use of fireworks among children.

This year, 2 people above 60 years old presented to the hospital with shortness of breath owing to inhalation of smoke. This could be attributed to the 370 tonnes of fireworks used and sold along with 679 secondary grassfires that occurred on cracker night.[6] It highlights the need to ensure patients with underlying respiratory conditions and the elderly take precautionary measures on Territory Day to avoid breathing difficulties.

The multi-shot was the most common cause of FWRI with 4 people requiring hospital admission for management of injuries sustained from a multi-shot as described in the previous years.

Despite the legislation banning the use of fireworks after 11 pm on 1 July, 5 people presented with injuries sustained after this time with 3 cases from 3 July.

There was a decrease in number of people reporting the use of alcohol and FWRI compared to 2017 which could indicate that the promotional campaign has had a positive impact.[4]

Territory Day is similar to the 4th of July celebrations in the United States (US) with private use of fireworks permitted to commemorate US Independence Day. Despite the similarity in the celebration, the incidence of FWRI in NT in 2018 is higher at 16.6 per 100,000 people FWRI versus 3.4 per 100,000 people in the US in those states that sell fireworks. These data are based only on presentations to the emergency departments, similar to the NT statistics.[7] The lower incidence is likely attributed to various legislative requirements on the sales of fireworks including the prohibition of private purchase of aerial or explosive (rockets or similar type) fireworks in several states in the US.[8]

First Aid Management

There was a statistically significant difference noted in time to first aid administration for FWRI with delays observed at 85.7% of injuries occurring at public facilities versus 12.5% in FWRI occurring private facilities (p=0.009). Of people who sustained injuries at public venues 85.7% waited until arrival at the nearest health facility before first aid cooling was initiated. This is concerning as first aid is an important

component of effective burns management for patients.

This delay to cooling potentially contributed to the higher proportion of moderate to severe injuries sustained at public facilities compared to private facilities, 84.2% and 64.7% respectively, but the current evidence is inconclusive. It is possible that the lack of access to running tap water and lack of signage to the nearest water tap could potentially lead to delays in first aid administration for injuries occurring at public places.

In a study by Wood et al, reduction in severity of burn injury was noted with prompt first aid management prior to presentation to the burns centre.[9] The effectiveness of early first aid was sustained, as demonstrated by a 13% reduction in subsequent graft surgery, a 48% reduction in ICU admission and 2.27 days reduction in length of hospital stay (p=0.001).[9]

Members of the public using fireworks in public places need to know the location of the nearest tap for running water or bring along bottles of cool water. The latter option may not be a practical or adequate approach as 20 minutes of running water is required to provide effective first aid but the message that cooling water is needed may be conveyed. Alternative treatments such as aloe vera and hydrogels do not provide wound healing properties.[10]

Recommendations: Harm Minimisation

Territorians have been allowed to purchase and use fireworks on Territory Day since 1980.[1] Over the years, several changes have been made to the legislation to minimise inappropriate use and FWRI. As the debate continues as to whether or not the private purchase of fireworks should be here to stay, harm minimisation strategies should be maintained to promote safe and responsible use of fireworks. Regular quality control is required to ensure imported fireworks do not misfire resulting in injuries. Additionally, there should be stringent rules and regulations governing the making and use of homemade crackers. Safety features of fireworks should also include inability to dismantle fireworks to remove the gun powder in order to create "homemade" fireworks.

Despite increasing fines, currently at $1,540 for the possession and use of fireworks outside the approved period, FWRI continue to occur after Territory Day.[5] Regulation of sales limits of fireworks for individuals could potentially curb the oversupply and excess fireworks that may be available for use during the week after Territory Day.

Additionally, regulation could change to restrict the use of multi-shot fireworks to professional displays, as they are the most common cause of FWRI injury in the NT. Safety messaging could target the appropriate use and disposal of firework powder to prevent accidental injuries.

Furthermore, there needs to be careful consideration by the Fireworks Safety Campaign team on potential factors contributing to delay in the pre-hospital initiation of first aid for patients sustaining injuries in public areas. Improving access to first aid cooling with improved signage and safety messages and provision of water dispensers may reduce the severity of FWRI.

The elderly and those with chronic lung conditions should be encouraged to take appropriate precautions including staying indoors during the night of Territory Day.

It is important to note, since the institution of the safety messaging during Territory Day there has been a shift of those getting injured igniting fireworks to bystanders. The safety message has been focused around safe usage of fireworks, but given the changing demographics of FWRI it will be critical to address ways to keep bystanders, particularly children, safe from the dangers of fireworks.

The importance of first aid knowledge cannot be understated with evidence showing its benefits in reducing severity of burns.[9,11,12] CDC is currently working alongside the National Critical Care and Trauma Response Centre and NT Worksafe to ensure consistency in first aid messaging and to inculcate the 3 Cs of the burns first aid management mnemonic for consistency in messaging (Cool, Cover and Call) to increase the number of pre-hospital first aid administrations.

Limitations

There are several limitations in this study. The study does not include all healthcare facilities in the Territory and would likely be an under-representation of the absolute numbers of FWRI that occurred by excluding presentations at community clinics, private GP clinics and health services.

There is potential selection bias, as more people with moderate and severe injuries completed the extended survey than those with minor injuries. This could be due to the recurrent presentations to health facilities for burns care or extended hospital stay allowing for completion of survey forms.

Conclusion

In conclusion, the amateur use of fireworks continues to cause FWRI to Territorians. Despite the sustained health promotion efforts over the past 20 years, there has been an increase in the number of injuries observed with a shift towards a higher proportion of bystanders injured. Identifying opportunities for harm minimisation and promoting preventative methods to reduce the rate of FWRI in the NT is critical. In preparation for next year's campaign, the CDC along with other stakeholders will continue to strive to improve knowledge of first aid management for burns in the community and provide safety tips on protecting bystanders while watching the fireworks on 'cracker night'. It is hoped that targeted educational programs, the annual safety campaign and future regulatory changes will reduce FWRI in the NT while allowing Territorians to have an enjoyable celebration of Territory Day.

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Melissa Garde from NT Worksafe who delivered posters and brochures to the fireworks wholesalers for distribution across the Territory before cracker night. Dr. Charles Douglas for his guidance.

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Exotic mosquito detected in domestic port area in Darwin

Nina Kurucz, Medical Entomology, Centre for Disease Control, Darwin

Abstract

On 6 May 2018 an adult male mosquito was hand caught by the Commonwealth Department of Agriculture and Water Resources during a routine inspection of a vessel arriving at Darwin's Stokes Hill Wharf from Papua New Guinea. Following the inspection, the vessel was granted coastal status, and subsequently moved to Fisherman's Wharf to unload cargo and the Duck Ponds to await further domestic deployment. The mosquito was tentatively identified as the dengue mosquito, Aedes aegypti. The vessel having visited domestic wharf areas in Darwin, without the actual Ae. aegypti breeding site located, triggered precautionary mosquito surveillance and control measures at all 3 wharf areas, and a subsequent vessel inspection, during which a live female Ae. aegypti was collected on deck of the vessel. The situation was up-scaled to 'high risk', with the response escalated to a comprehensive detection response as per the Commonwealth Department of Health's 'Response Guide for Exotic Mosquito Detections at Australian First Points of Entry'. During insecticide treatment of the vessel, the cryptic mosquito breeding site was located and eliminated. No further exotic mosquitoes were detected during the 6 week enhanced surveillance period.

Key words: Dengue mosquito; mosquito surveillance; mosquito control; NT domestic ports.

Background

The Northern Territory (NT) is one of very few tropical areas in the world free of the dengue mosquito, *Aedes aegypti*.[1] However, routine exotic mosquito surveillance programs, including programs carried out at NT First Points of Entry by the Department of Agriculture and Water Resources (DAWR) in liaison with the Medical Entomology (ME) unit of the NT Department of Health (DoH), frequently detect and subsequently prevent the establishment of this mosquito. Since 2000/01, *Ae. aegypti* has been detected at NT sea and airports every year, except for 2013/14 and 2016/17, with the latest detection at the Darwin HMAS Coonawarra Naval Base in April 2018.[2,3] Dengue mosquito incursions, with established populations have also occurred in Tennant Creek in 2004 and 2011 and on Groote Eylandt in 2006, with elimination achieved by DoH, keeping the NT free of the dengue mosquito.[4-7]

In Australia, exotic mosquito detections at First Points of Entry are responded to following the Commonwealth Department of Health's 'Response Guide for Exotic Mosquito Detections at Australian First Points of Entry'.[8] The guideline outlines stakeholder's responsibilities, as well as protocols for enhanced mosquito surveillance and control inside the 400m quarantine zone, based on the circumstances of the detection.

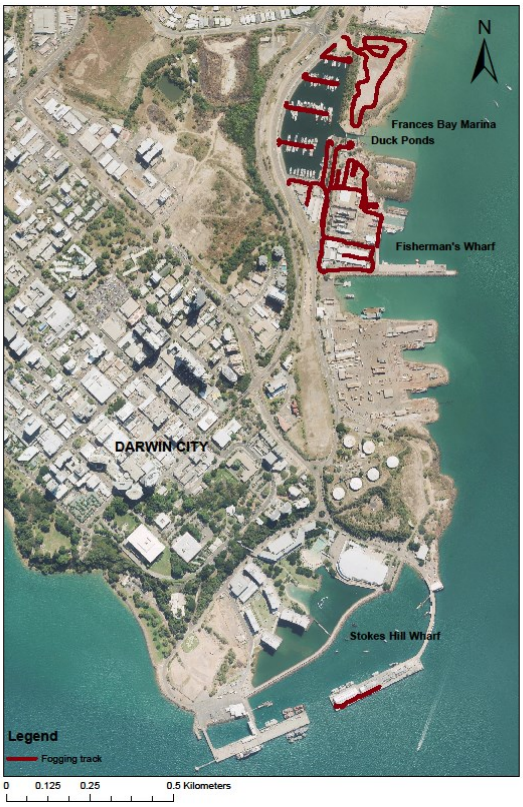
In May 2018, an adult *Ae. aegypti* male was caught by hand during a biosecurity inspection on a vessel arriving from Papua New Guinea, that docked at Darwin's domestic Stokes Hill Wharf. This article outlines the circumstances and response to the detection.

Exotic mosquito detection and identification

On 6 May 2018, a Darwin based vessel arrived at Darwin's Stokes Hill Wharf following 6 months work around Port Moresby, Papua New Guinea. On arrival it underwent a routine biosecurity inspection by DAWR. A live mosquito was detected and hand caught in a below deck cabin.

As no further mosquitoes or receptacles breeding mosquitoes were detected during the initial inspection, the vessel was granted coastal status, after which it moved to the domestic Frances Bay area in Darwin (Duck Ponds) overnight, before it relocated to Fisherman's Wharf on Monday to unload cargo, and returned to the Duck Ponds awaiting further domestic deployment (Figure 1). The unloaded cargo was delivered to a premise in Winnellie on Monday 7 May.

Figure 1. Darwin wharf areas where the vessel docked following its arrival on 6 May 2018 and where subsequent fogging was carried out on 10 May 2018



The mosquito was delivered to ME for identification on 6 May, with the identification process finalised on Tuesday 8 May. Due to the damaged state of the specimen, it was tentatively but with a high degree of certainty, identified as *Ae. aegypti.*

Initial response to exotic mosquito detection

As per the 'Response Guide for Exotic Mosquito Detections at Australian First Points of Entry' exotic mosquito detections on vessels only, do not require enhanced surveillance. However, to mitigate any risk of an undetected dengue mosquito having escaped the vessel in a Darwin domestic wharf area, precautionary measures were implemented on 9 May. These measures included; a larval mosquito survey, treatment of all receptacles holding water, mosquito barrier spraying and setting of mosquito traps. The work was carried out by ME and DAWR for a limited time at Stokes Hill Wharf, Fisherman's Wharf and the Duck Ponds using Biogents sentinel traps (BG), sticky traps and ovitraps and the insecticides Temprid 75® (active constituent: beta-cyfluthrin and imidacloprid), Bithor® (active constituent: bifenthrin and imidacloprid) and methoprene.

In addition to the surveillance and control measures, the unloaded cargo was re-inspected by DAWR in Winnellie, with the vessel also re-inspected by ME and DAWR on 9 May. While no issues were identified with the cargo a number of dead mosquitoes were found inside wooden storage containers found under the below deck cabin beds. These included a male *Ae. aegypti* mosquito, a female *Mansonia papuensis*, which occurs in Papua New Guinea but is not related to human disease, and a possible *Culex quinquefasciatus* (damaged).[9] The finding of most concern however, was a live mosquito, which was hand caught while hovering around the outside door on deck of the vessel. Following positive identification of the mosquito as a freshly hatched female *Ae. aegypti*, the situation was escalated to 'high risk' due to the possibility of additional dengue mosquitoes having escaped the vessel and a still undiscovered breeding site. In response to the detection, the precautionary measures in place were increased to a fully comprehensive response in line with the Commonwealth Department of Health's 'Response Guide for Exotic Mosquito Detections at Australian First Points of Entry.'

Comprehensive response to additional dengue mosquito detection

While no further barrier control or larval surveys were required in the 3 wharf areas, the number of enhanced surveillance traps were increased and all ovitraps replaced with sticky traps as per protocol on 10 and 11 May. A total of 5 BG traps and 13 sticky traps were part of the enhanced surveillance (Figure 2).

On 9 May, port management were informed of the requirement to carry out adult mosquito control (fogging) on all 3 wharves the following night. To allow fogging to proceed, Stokes Hill Wharf was closed to the public. Commercial premises at Fisherman's Wharf, along with private and commercial vessel owners at the Duck Ponds were informed of the operation. Vessel owners received notification via e-mail

Figure 2. Location of enhanced surveillance traps in Darwin wharf areas

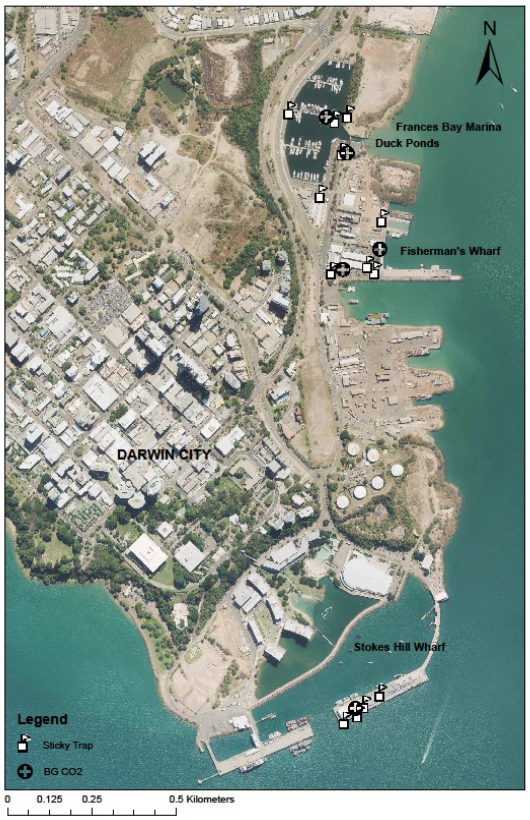


Figure 3. Tub on board of the vessel breeding *Ae. aegypti*

and through distribution of an information flyer. Fogging was carried out by ME between 6 pm and 9:30 pm on 10 May, using Twilight® (active constituent: phenothrin and piperonyl butoxide) (Figure 1).

To eliminate the vessel as a source for further exotic mosquitoes, it was accessed and insecticide treated on 10 May. Temprid® was applied externally to ensure any resting mosquitoes on treated surfaces would not survive. During the operation the cryptic mosquito breeding site on deck of the vessel was finally detected, with 29 x 4th instar, 3 larval skins, 22 pupae, 10 pupal skins (unidentifiable) and 11 larval mosquito capsules (unidentifiable) detected in an upside down tub with hidden indentations holding water (Figure 3). Of the specimens collected, 29 larvae, 2 larval skins and 14 pupae were confirmed as being *Ae. aegypti*, and another 7 pupae also highly likely *Ae. aegypti*. One pupae was identified as the endemic mosquito *Ae. notoscriptus*, while the 10 pupal skins collected were most likely *Ae. aegypti* considering the high number of *Ae. aegypti* pupae. Fumigation of the container was ordered by DAWR on 10 May. As fumigation with methyl bromide had not occurred immediately, a preliminary treatment of the container using a chlorine/detergent mix to kill potential mosquito eggs was undertaken followed by Temprid® to prevent further mosquito breeding.

To ensure that no female *Ae. aegypti* had deposited eggs in receptacles holding water on board any vessel moored at the Duck Ponds since 6 May, permission to inspect vessels from vessel owners was obtained with assistance from port management. The majority of vessels were inspected on 10 May, with the remaining vessels inspected over the next few days. No evidence of exotic mosquito breeding was found and only 1 vessel was breeding endemic mosquitoes.

Finally, to ensure that no *Ae. aegypti* had escaped the wharf areas and moved into adjacent residential areas, 9 ovitraps were established and serviced for 6 weeks at the outer parameter of nearby residential areas.

As per protocol, all enhanced surveillance traps were serviced daily for 1 week, every 2nd day the following week, and once a week for a period of 4 weeks.

Discussion

Following the initial detection of *Ae. aegypti* on board the vessel and the subsequent detection during the follow up inspection, no further exotic mosquitoes were detected. This exotic mosquito detection showed the importance of biosecurity inspections on international vessels, as without such inspections, exotic mosquitoes would remain undetected and could establish populations in the NT resulting in possible dengue outbreaks. This detection particularly emphasises the threat to the NT through importations of exotic mosquitoes breeding in cryptic, and thus undetected, breeding sites. If the initial adult mosquito had not been detected in the cabin, it is highly likely that subsequent hatches of dengue mosquitoes would have occurred in the Darwin domestic port areas, and the mosquitoes only detected much later in routine surveillance traps. In addition, undetected breeding around the port area could have led to receptacles with dengue mosquito eggs being transported to other areas in the NT, making dengue mosquito elimination very costly and difficult, or potentially impossible.

Following this detection, the cooperation between all stakeholders needs to be commended, as it enabled an immediate response to the threat. Of note was the positive response of all private and commercial vessel owners in granting permission for timely vessel inspections, and the support and assistance of port management and businesses. As the exotic detection breached the 400m quarantine zone the close collaboration between DAWR and ME was a vital component in the success of the response.

Acknowledgements

We would like to acknowledge and thank all ME and DAWR staff, port authorities, business and vessel owners involved in the exotic mosquito surveillance and control response for their support at Stokes Hill Wharf, Fisherman's Wharf and the Duck Ponds.

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Community engagement fundamental for effective delivery of care

Article courtesy of RHDAustralia. Read more at the www.rhdaustralia.org.au/news

23 July 2018

Excerpts from this story were taken from the Preventing RHD through community-driven activities article available on the Telethon Kids Institute website.

A research project in the Northern Territory (NT) is looking to minimise the transmission of Group A Streptococcus (GAS or 'strep') – the bacteria responsible for acute rheumatic fever (ARF) and rheumatic heart disease (RHD) – by employing local Aboriginal Community Workers to help establish 'Strep-free zones' in homes of people living with ARF and RHD.

The *Secondary Prophylaxis (SP) Plus* project is a collaborative project between Menzies, the NT Centre for Disease Control RHD Control Program, the NT Department of Housing and the End RHD Centre of Research Excellence. Aboriginal Community Workers are being employed to help monitor health hardware (washing machines, sinks, refrigerators, toilets, etc…) in peoples' homes, educate people on the importance of early detection and treatment of sore throats and skin sores, and assist in efforts to encourage patient adherence to treatment.

"Our research to date shows how fundamental community engagement is for effective delivery of care. It's often not possible to do this effectively by reaching out from the clinic, it needs to be a grass-roots initiative driven by community members themselves. We want to add a 'plus' to the standard secondary prophylaxis by adding primordial and primary prevention at the household level and employing people within the community," said lead investigator Associate Professor Anna Ralph.

Children and young adults with rheumatic fever need long-term penicillin injections, called secondary prophylaxis (SP).

However, this is not enough to stop rheumatic fever recurrences that may lead to permanent heart damage, because not everyone can get every needle on time every 28 days for years on end.

Employing Aboriginal people within their communities can support families affected by rheumatic fever at the household level.

RHDAustralia spoke with 1 of the Aboriginal Community Workers employed on the project.

Photo. (L to R) Angela Kelly, SP Plus project manager; Bianca Cotter, Remote Area Nurse; Crystal AhFat, Aboriginal Health Practitioner; Peter Wordsworth, Clinic Manager; Anne Marie Lee, SP Plus Community Worker; Desleigh Shields, Aboriginal Health Practitioner

She explained the importance of having local people working on the ground liaising between clinics and community members;

"It's important to employ local Indigenous people in the community. We know these people, we know these kids, we know the parents, we know the health workers at the clinic. If someone from outside the community tried to come in and do this role, they wouldn't know any of the families we're working with – it just wouldn't work. Because I'm part of the community and know the people they trust me."

Project manager Angela Kelly travels frequently to the communities involved in the study to provide training and support and collect oversee collection of data on strep infections, health-seeking behaviours and health hardware. She noted that the Aboriginal Community Workers were instrumental to bridging the gap between western medicine and traditional Aboriginal culture.

"Take for example, complexities around local language," she said. "Germ theory as causation of disease is a difficult concept to translate, so Aboriginal Community Workers play the critical role of being able to explain the best way to prevent contracting a Strep A infection in the local context."

Research has shown that for prevention and treatment of chronic diseases to be effective in Aboriginal and Torres Strait Islander communities, the provision of care must include a chronic care model that is culturally appropriate and carried out by, or at the very least supported by, local Aboriginal and Torres Strait Islander people from the community.

Two recently published papers from the *Improving delivery of Secondary Prophylaxis for Rheumatic Heart Disease* (RHDSP) study, have concluded there must be a more holistic and community driven approach to chronic care models if rates of ARF and RHD are to be reduced.

"Our findings indicate the critical importance of improving engagement between healthcare services and Aboriginal patients. The ongoing challenges in delivery of secondary prophylaxis make a compelling case to broaden the scope of ARF prevention activities, with particular emphasis on primordial and primary prevention both among individuals with existing ARF or RHD and among whole communities," said Associate Professor Anna Ralph.

The RHDSP project showed that community engagement and self-management support aspects of the chronic care model were not well implemented. Results from this study were used to guide the design and implementation of the SP Plus project, with special attention paid to ways in which community engagement can be done in an effective and appropriate manner.

The SP Plus project is led by RHDAustralia's Clinical Director and Head of Global and Tropical Health Division at Menzies School of Health Research, Associate Professor Anna Ralph through funding provided by the End Rheumatic Heart Disease Centre of Research Excellence (END RHD CRE) at Telethon Kids Institute and the Heart Foundation (Vanguard Grant).

ARF and its complication RHD lead to premature morbidity and mortality, and occur at unacceptably high rates in Aboriginal communities. Yet ARF/RHD is almost entirely preventable by stopping transmission of streptococcal infection and by ensuring adherence to secondary prophylaxis treatment.

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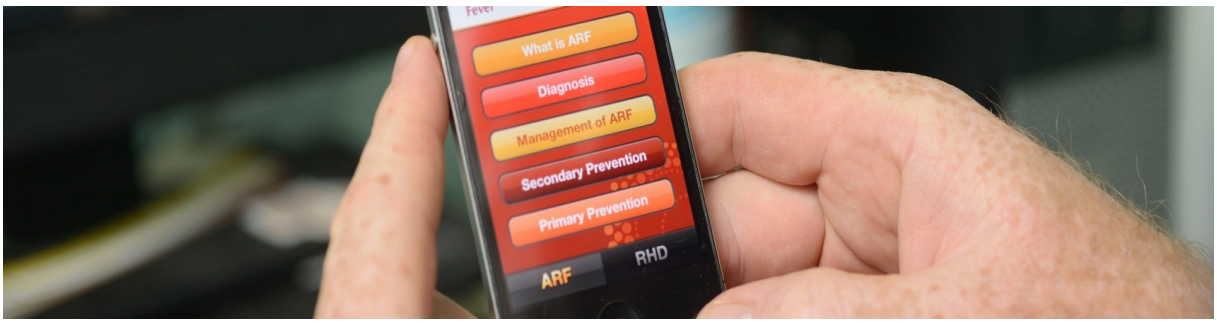

Polio outbreak in Papua New Guinea

On 22 June 2018 the Government of Papua New Guinea (PNG) notified the World Health Organization of an outbreak of circulating vaccine-derived polio virus infection. As a result, a large-scale outbreak response and immunisation campaign is now underway in PNG.

What is polio?

Polio is short for poliomyelitis. It is a viral disease that is only present in a few countries around the world. Polio virus infection can cause paralysis and death.

Anyone can develop polio if they are not vaccinated and travel to a part of the world where the virus still exists and they are exposed. Vaccination is the best protection against polio.

As PNG is our close neighbour, people from the Northern Territory (NT) may visit the country for work or travel or to visit friends or family. Anyone travelling to PNG should ensure they are vaccinated as per current recommendations against this disease. People may think they are vaccinated if they have had their routine childhood vaccinations, but more is needed if travelling to PNG. To be protected from polio visitors will need a booster dose of inactivated poliomyelitis vaccine (IPV) if they have not had one during the last 10 years, before travelling to PNG.

I plan to travel to or from PNG – what should I do?

Travellers to PNG should be fully vaccinated against polio to ensure their protection.

Recommendations:

- Travellers to PNG should have a booster IPV polio vaccine if they have not had one in the last 10 years.
- Travellers from PNG should have a booster polio vaccine within 4 weeks to 12 months of travel to Australia to boost immunity.
- Travellers to and from PNG are recommended to carry a hand held vaccination record of polio vaccines received.

What does this polio outbreak in PNG mean for NT residents?

Australia has been officially polio-free since 2000. The NT has high immunisation coverage of 92% at 4 years of age when the 4th dose of polio vaccination is given.

Because of our high vaccination rate, good sanitation and the ability of our health care system to respond to cases, polio is very unlikely to spread in Australia.

More information about polio in PNG and vaccination is available at the following links:

- https://smartraveller.gov.au/countries/pacific/pages/papua_new_guinea.aspx
- http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-polio-PNG.htm
- https://beta.health.gov.au/services/polio-poliomyelitis-immunisation-service
- http://www.wpro.who.int/papuanewguinea/en/
- http://polioeradication.org/where-we-work/papua-new-guinea/

What is vaccine-derived polio?

Polio vaccines have been available for over 50 years. It is estimated that more than 10 million cases of polio have been prevented since the administration of polio vaccines began.

There are 2 polio vaccines available:

1. The oral polio vaccine (OPV) - a 'live attenuated vaccine' that contains a weakened form of virus. This is the vaccine used in PNG.
2. The inactivated poliomyelitis vaccine (IPV) - this is a more expensive vaccine and is now used in Australia and given intramuscularly (as an injection). This vaccine cannot cause vaccine-derived polio.

OPV contains an attenuated (weakened) vaccine-virus, which activates the immune

system in the body. When a person is immunised with OPV, the weakened vaccine virus multiplies in the gut for a limited period, thereby developing immunity by building up antibodies in the gut and in the body. During this time the vaccine-virus is also excreted in the faeces. In areas of inadequate sanitation, this excreted vaccine-virus can spread in households and the immediate community.

On rare occasions, if a population is very under-immunised, an excreted vaccine-virus can continue to circulate for an extended length of time. In very rare instances, the vaccine-virus can genetically change into a form that can cause polio disease and paralysis in people who are not vaccinated against polio. This form is known as circulating vaccine-derived polio virus (cVDPV).

The risk of vaccine-derived polio virus developing is very small in comparison to the tremendous public health benefits of polio vaccination. Both OPV and IPV provide protection against cVDPV.

How is a vaccine-derived polio outbreak managed?

Vaccine-derived polio virus transmission can be rapidly stopped through a high-quality polio vaccination campaign. The solution is the same for all polio outbreaks:

- Immunise each individual to stop polio transmission, whether the virus is vaccine-derived or wild polio virus.
- By making sure that every individual is vaccinated with either IPV or OPV we can eradicate all types of polio.

The above information has been sent out to Northern Territory clinicians, boarding schools, universities, and travel agents.

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An outbreak of suspected food poisoning after eating street food, Dili, Timor-Leste, July 2018.

Mario Pinto,[1] Ana Fatima[1] Alvaro dos Reis[1] Maria A.Varela Niha,[1] Ali Russly,[1] Natalino Alexio,[2] Joshua R Francis,[3] Anthony DK Draper[1,3,4]

[1] Departemento Vijilansia Epidemiolojia, Ministerio da Saude, Dili, Timor-Leste; [2]Departamento de Saude Ambiental, Ministerio da Saude, Dili, Timor-Leste; [3] Menzies School of Health Research, Darwin; [4] Centre for Disease Control, Darwin

Short Outbreak Report

On 31 July 2018, the *Departemento Vijilansia Epidemiolojia* (Surveillance and Epidemiology Department) in the *Ministerio da Saude de Timor-Leste* (Timor-Leste Ministry of Health) was notified of an outbreak of suspected food poisoning among people presenting to an urban health centre in Dili. This short report describes the outbreak investigation.

At approximately 8 am on 31 July, a single family group of 15 people, purchased vegetable fritters (Tetum = *dosi sona*, Indonesian = *bakwan*) from a street vendor. *Dosi Sona/ bakwan* (Figure 1) is a common fried food in Timor-Leste and Indonesia.[1,2] Approximately 30 minutes after eating, the entire family experienced symptoms of dizziness, fever, dry mouth and itchiness. Six members of the family presented to the local health centre where their symptoms resolved without treatment, within 1 hour. The doctor at the health centre notified the Surveillance and Epidemiology Department in Dili and an outbreak response was mounted.

At approximately 10 am on 31 July, staff from Surveillance and Epidemiology went to the health centre and administered a standard questionnaire to 6 of the 15 family members who had presented to the health centre, collecting details about symptoms and common foods consumed. The outbreak affected 15 out of 15 people in a single family (attack rate = 100%). Of those interviewed, the median age was 9 years (range 4-50 years) and 4 of the 6 (67% of cases) were male. The main symptoms were dizziness (100%), sweating (100%), dry mouth (100%) and itchiness (50%). There was no vomiting or diarrhoea. No stool samples were collected for testing. All cases interviewed reported eating *dosi sona/bakwan* from a single street vendor, 30 minutes before onset of symptoms.

Figure 1. ***Dosi sona/bakwan***

At approximately 10:30 am on 31 July, officers from the *Departamento de Saude Ambiental* (Environmental Health Department) visited the street vendor reported by the cases and conducted an inspection. The street vendor was preparing food in her home and selling it in the street front. They reported the home area to be unclean and inappropriate for food preparation with animals also observed in the food preparation areas (Figure 2).

Additionally, the person preparing the *dosi sona/ bakwan* was observed to have a skin condition on her arms and hands. She used her hands to mix the batter prior to frying. The vendor usually made the mixture the previous evening, stored it on a table at room temperature, and then fried it in the morning. No handwashing facilities were observed in the food preparation area.

The vendor was immediately prohibited by the Environmental Health officers from selling foods prepared at the premises.

The rapid onset and short duration of illness indicates that this outbreak could have been due to a pre-formed bacterial toxin present in the food[3] which is consistent with the environmental health findings. Monosodium glutamate poisoning cannot be ruled out as it also consistent with the symptoms reported.[4]

Figure 2. Environmental health inspection of food vendor's premises (Clockwise from left: kitchen, *dosi sona/bakwan* mixture, animals observed in food preparation area, area where frying occurred.

The investigation was limited because no cases reported diarrhoea and as a result no stool specimens were submitted for microbiological testing. Additionally, laboratory capacity to test food for microbiological agents in Timor-Leste is non-existent. The ability of the outbreak team to interview cases and inspect premises within 2 hours however, resulted in swift public health action and the risk being removed from the community.

This outbreak investigation highlights the importance of investigating outbreaks of foodborne disease in order to detect and remove implicated foods, control ongoing risk to the community, provide education and prevent similar outbreaks in the future.

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Response to the CDC article - *TB in animals. Transmission at the human-animal interface,* by Nick Georges and Vicki Krause, Centre for Disease Control, Darwin[1]

Kevin de Witte, Chief Veterinary Officer, NT Department of Primary Industry and Resources, Chair NT Zoonoses Committee

This case report of a human *Mycobacterium tuberculosis* (MTB) case and review of TB epidemiology and global human health impacts is a salient reminder of the risks of tuberculosis including the possible re-emergence of *Mycobacterium bovis* (*M. bovis*).

The most relevant animal health reference on TB is:
Animal Health Australia. Bovine Tuberculosis Case Response Manual, Edition 2, 2009. Primary Industries Ministerial Council, Canberra, ACT. ISBN 978-876714-71-0

The manual is available on the internet at: https://www.animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/

The manual captures the consolidated Australian animal health learnings in the eradication of *M. bovis* from animals over a 40 year period to 2009 and provides the policy basis for a biosecurity response to a detection in animals.

M. bovis has the widest host range of any of the *M. tuberculosis* complex. The understanding of the evolution of microorganisms facilitated by molecular technology is fascinating in the broader epidemiological sense with *M. bovis* being a relatively recent creation. Another epidemiological feature to note is the differences in disease ecology between different continents. For instance – studies in the Northern Territory (NT) have shown *M. bovis* TB has been an end-stage, non-transmitting (spill-over) infection in pigs in Australia but pigs are responsible for transmission back to ruminants in New Zealand (NZ) and Europe. Australian brush-tail possums as a feral animal pest have been a dominant feature of TB cycling in NZ, but never proven in Australia. This species of possum has been used as a model to study TB transmission and pathology at the Australian Animal Health Laboratory. This laboratory now maintains a TB organism reference collection.

In another area of mycobacterial management, Australia has recently deregulated the approach against *Mycobacterium avium* subspecies *paratuberculosis* (Johnes disease - JD). This infection has the potential to devastate livestock production and is actively managed in infected Merino sheep flocks through vaccination and in dairy cattle by a combination of measures including calf separation and hygiene. Whilst a related organism, the ecology is different and the ability of the organism to survive in temperate environments is one of the key factors relegating efforts to control tactics only. The NT maintains livestock disease control restrictions to protect our enviable JD free status.

As the years roll on from the last livestock cases - there have been no cases of TB in cattle since December 2000 and no cases in buffalo since January 2002, we continue to celebrate the massive investment (exceeding $1B) that was undertaken to achieve *M. bovis* eradication in Australian animals (principally cattle and buffalo) whilst remaining vigilant for re-emergence, and as the review highlights – this may be in zoos, people or some other unusual pathway. *M. bovis* TB remains a notifiable disease under the NT Livestock Act. Be vigilant! Lest we forget!

Reference

1. Georges N, Krause V. TB in animals. Transmission at the human-animal interface. *NT Dis Control Bull* 2018;25 (2,):1-7.

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NT Centre for Disease Control Conference – *Partnerships in Public Health* 12-14 September 2018

The annual Northern Territory (NT) Centre for Disease Control (CDC) Conference focused this year on 'Partnerships in Public Health'. We aimed to highlight how successful partnerships across the spectrum of health organisations, systems of care and with individuals and their families resulted in the best outcomes in public health for Territorians.

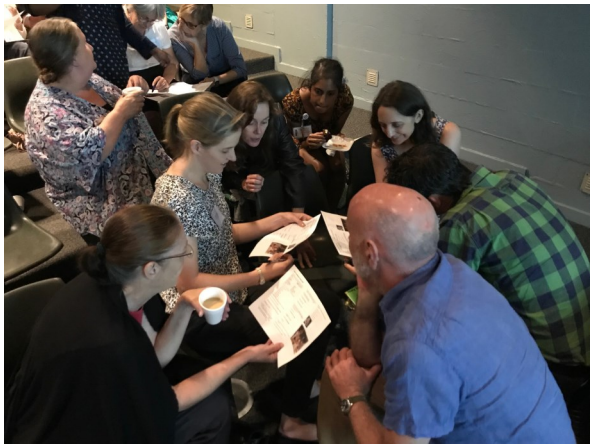
The program featured presenters from the NT and interstate, from government and non-government organisations, clinicians and policy makers, program directors, laboratory experts, community workers, researchers and more. There were highlights from the recent meningococcal outbreak and response in Central Australia, featuring many partners and supporting individuals and organisations, who contributed generously and expertly to the response. The challenges in the areas of sexual health, specifically syphilis and gonorrhoea, and programs addressing vaccine preventable diseases and the progress being made were featured.

Presenters from NT Health, Aboriginal Medical Services, Melaleuca Refugee Centre and Menzies School of Health Research discussed a broad range of public health topics including community development, tobacco control, rheumatic heart disease, scabies, TB, malaria, medical entomology and community infection control.

Speakers at the Conference. Dr Keshan Satharasinghe, Felicity Marwick, Prof Monica Lahra, Dr Ros Webby, Dr Priya Janagaraj, Dr Jeff Brownscombe.

The conference attracted 90 people each day over 3 days at the Museum and Art Gallery NT theatrette. It was a great opportunity for networking, education and professional development in public health.

CDC Conference Organising Committee. Dr Peter Markey, Desley Williams, Christian James, Meredith Neilson, Mary Verus, Dr Ros Webby, Dr Manoji Gunathilake, Dr Vicki Krause. Not pictured Dr Belinda Greenwood-Smith, Dr Charles Douglas, Roxanne Sherry



Conference attendees completing the CDC Quiz.

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Abstracts from peer reviewed published articles related to the Northern Territory

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

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

Commun Dis Intell 2018;42 (PII:CDI.2018.42.2/issn.2209-6051) Epub 12/09/2018

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

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

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

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

Qualitative evaluation of a complex intervention to improve rheumatic heart disease secondary prophylaxis

Read C, Mitchell A, de Dassel J, Scrine C, Hendrickx D, Bailie R, Johnston V, Maguire G, Schultz R, Carapetis J, Ralph A,

J Am Heart Assoc. 2018;7:e009376. DOI: 10.1161/JAHA.118.009376

Background Rheumatic heart disease is a high-burden condition in Australian Aboriginal communities. We evaluated a stepped wedge, community, randomized trial at 10 Aboriginal communities from 2013 to 2015. A multifaceted intervention was implemented using quality improvement and chronic care model approaches to improve delivery of penicillin prophylaxis for rheumatic heart disease. The trial did not improve penicillin adherence. This mixed-methods evaluation, designed a priori, aimed to determine the association between methodological approaches and outcomes.

Methods and Results An evaluation framework was developed to measure the success of project implementation and of the underlying program theory. The program theory posited that penicillin delivery would be improved through activities implemented at clinics that addressed elements of the chronic care model. Qualitative data were derived from interviews with health-centre staff, informants, and clients; participant observation; and project officer reports. Quantitative data comprised numbers and types of "action items," which were developed by participating clinic staff with project officers to improve delivery of penicillin injections. Interview data from 121 health-centre staff, 22 informants, and 72 clients revealed

barriers to achieving the trial's aims, including project-level factors (short trial duration), implementation factors (types of activities implemented), and contextual factors (high staff turnover and the complex sociocultural environment). Insufficient actions were implemented addressing "self-management support" and "community linkage" streams of the chronic care model. Increased momentum was evident in later stages of the study.

Conclusions The program theory underpinning the study was sound. The limited impact made by the study on adherence was attributable to complex implementation challenges.

Improving Delivery of Secondary Prophylaxis for Rheumatic Heart Disease in a High-Burden Setting: Outcome of a Stepped-Wedge, Community, Randomized Trial

Ralph A, de Dassel J, Kirby A, Read C, Mitchell A, Maguire G, Currie B, Bailie R, Johnston V, Carapetis J

J Am Heart Assoc. 2018;7: e009308. DOI: 10.1161/JAHA.118.009308.)

Background Health system strengthening is needed to improve delivery of secondary prophylaxis against rheumatic heart disease.

Methods and Results We undertook a stepped-wedge, randomized trial in northern Australia. Five pairs of Indigenous community clinics entered the study at 3-month steps. Study phases comprised a 12 month baseline phase, 3 month transition phase, 12 month intensive phase and a 3 to 12-month maintenance phase. Clinics received a multicomponent intervention supporting activities to improve penicillin delivery, aligned with the chronic care model, with continuous quality-improvement feedback on adherence. The primary outcome was the proportion receiving ≥80% of scheduled penicillin injections. Secondary outcomes included "days at risk" of acute rheumatic fever recurrence related to late penicillin and acute rheumatic fever recurrence rates. Overall, 304 patients requiring prophylaxis were eligible. The proportion receiving ≥80% of scheduled injections during baseline was 141 of 304 (46%)-higher than anticipated. No effect attributable to the study was evident: in the intensive phase, 126 of 304 (41%) received ≥80% of scheduled injections (odds ratio compared with baseline: 0.78; 95% confidence interval, 0.54–1.11). There was modest improvement in the maintenance phase among high-adhering patients (43% received ≥90% of injections versus 30% [baseline] and 28% [intensive], P<0.001). Also, the proportion of days at risk in the whole cohort decreased in the maintenance phase (0.28 versus 0.32 [baseline] and 0.34 [intensive], P=0.001). Acute rheumatic fever recurrence rates did not differ between study sites during the intensive phase and the whole jurisdiction (3.0 versus 3.5 recurrences per 100 patient-years, P=0.65).

Conclusions This strategy did not improve adherence to rheumatic heart disease secondary prophylaxis within the study time frame. Longer term primary care strengthening strategies are needed.

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NT malaria notifications April-June 2018

Elizabeth Stephenson, CDC Darwin

There were 5 cases of malaria notified in the 2nd quarter of 2018. 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.

No. of cases	Origin of infection	Reason exposed	Agent	Chemoprophylaxis	NT region
2	Uganda	Refugee	*P. falciparum*	No	Darwin
2	Uganda	Refugee	*P. ovale*	No	Darwin
1	Uganda	Refugee	*P. malariae*	No	Darwin

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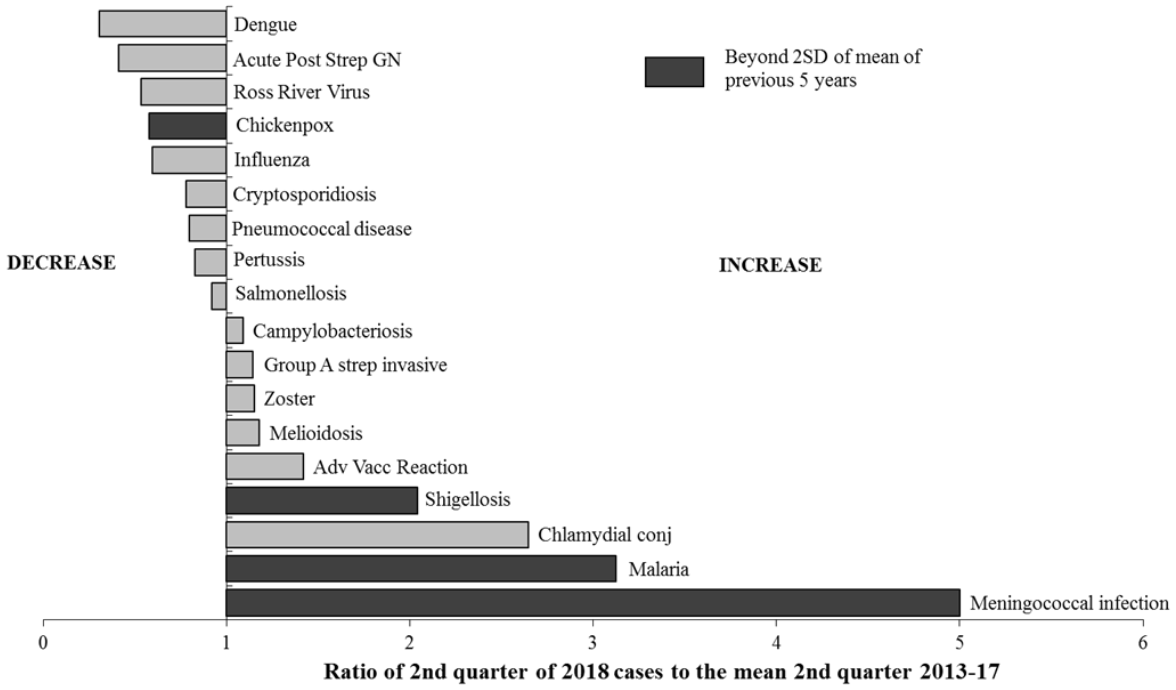
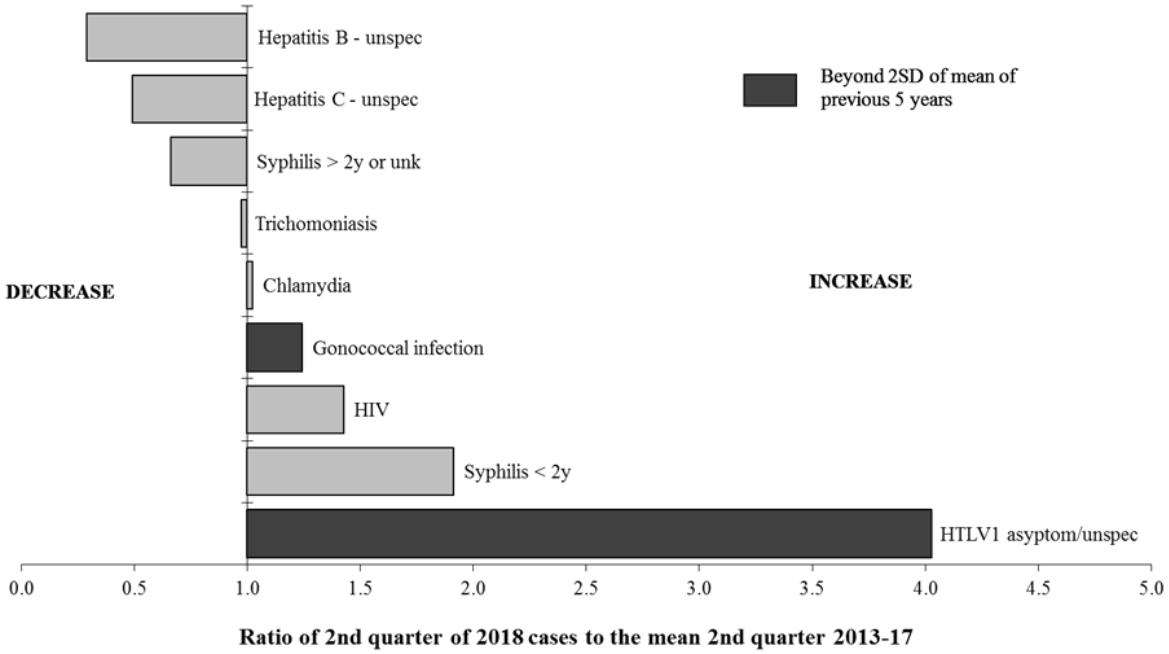
NT NOTIFICATIONS OF DISEASES BY ONSET DATE & DISTRICTS
1 April—30 June 2018 and 2017

	Alice Springs		Barkly		Darwin		East Arnhem		Katherine		NT	
	2018	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**
Acute post strep glomerulonephritis	2	4	1	0	1	5	0	2	1	3	5	14
Adverse vaccine reaction	2	7	0	1	21	8	2	0	0	1	25	17
Barmah Forest	0	1	0	0	0	7	0	0	0	0	0	8
Campylobacteriosis	31	18	3	0	57	85	4	6	8	23	103	132
Chickenpox	1	1	0	0	8	10	1	1	1	4	11	16
Chlamydia	215	202	28	24	331	308	73	44	80	75	727	653
Chlamydial conjunctivitis	10	1	5	0	3	1	0	0	0	0	18	2
Cryptosporidiosis	18	5	2	2	11	21	1	3	5	3	37	34
Dengue	0	1	0	2	7	11	0	0	0	0	7	14
Gonococcal conjunctivitis	0	0	1	0	1	0	0	0	0	0	2	0
Gonococcal infection	316	235	42	39	106	77	53	24	73	63	590	438
Group A strep invasive	9	13	1	1	4	6	2	1	3	2	19	23
Hepatitis A	0	0	0	0	2	0	0	0	0	0	2	0
Hepatitis B - chronic	3	0	0	1	2	5	1	0	0	0	6	6
Hepatitis B - new	0	1	0	0	1	1	0	0	0	0	1	2
Hepatitis B - unspecified	1	4	0	0	15	17	0	1	1	0	17	22
Hepatitis C - new	0	0	0	0	0	4	0	0	0	0	0	4
Hepatitis C - unspecified	5	5	0	0	20	34	0	0	3	6	28	45
H Influenzae non-b	0	2	0	1	1	0	0	0	0	1	1	4
HIV	2	0	1	0	5	3	0	0	0	0	8	3
HTLV1 asymptomatic/unspecified	25	4	1	0	2	0	0	0	1	1	29	5
HTLV1 TSP	1	0	0	0	0	0	0	0	0	0	1	0
HUS	1	0	0	0	0	0	0	0	0	0	1	0
Influenza	1	27	0	0	31	45	1	10	1	1	34	83
Leptospirosis	0	0	0	0	1	1	0	0	0	1	1	2
Malaria	0	1	0	0	5	2	0	0	0	0	5	3
Melioidosis	0	0	0	0	13	7	2	1	1	1	16	9
Meningococcal infection	3	0	0	0	0	0	1	0	0	0	4	0
Mumps	1	19	0	5	0	1	1	0	9	12	11	37
Non TB Mycobacteria	0	0	0	0	1	3	0	0	0	0	1	3
Pertussis	3	1	1	0	13	23	0	0	6	1	23	25
Pneumococcal disease	5	11	1	0	2	5	1	1	2	0	11	17
Rheumatic Fever	16	18	1	0	5	8	5	11	5	8	32	45
Ross River Virus	3	6	1	1	24	30	2	1	4	1	34	39
Rotavirus	61	126	22	9	11	68	0	23	4	50	98	276
Salmonellosis	20	15	5	4	114	115	5	18	20	27	164	179
Shigellosis	62	64	3	19	14	19	8	8	27	38	114	148
STEC/VTEC	1	0	0	0	1	1	0	0	0	0	2	1
Strongyloidiasis dissem	0	0	0	0	0	0	0	0	1	0	1	0
Syphilis < 2 years duration	14	11	3	1	36	46	13	8	9	19	75	85
Syphilis > 2years or unknown	6	11	1	1	6	22	4	3	1	5	18	42
Trichomoniasis	275	259	39	52	245	275	146	129	135	160	840	875
Tuberculosis	1	1	0	0	8	2	0	0	0	1	9	4
Typhus	0	0	0	0	1	0	0	0	0	0	1	0
Varicella - unspecified	4	0	0	0	0	0	0	0	0	0	4	0
Vibrio food poisoning	0	0	0	0	0	1	1	0	0	0	1	1
Yersiniosis	2	1	0	0	0	2	0	0	0	0	2	3
Zoster	19	17	2	3	68	76	4	5	6	5	99	106
Total	**1,139**	**1,092**	**164**	**166**	**1,197**	**1,355**	**331**	**300**	**407**	**512**	**3238**	**3425**

Ratio of the number of notifications in the 2nd quarter of 2018 to the 5 year mean (2013-17): selected diseases



Ratio of the number of notifications in the 2nd quarter of 2018 to the 5 year mean (2013-2017): sexually transmitted diseases



Comments on notifications

Shigellosis

Shigellosis notifications were 2 times the 5 year mean. The majority of notifications were again *S. flexneri* 2b (60 cases) which has been the dominant serotype in the NT since 2017. Numbers are slowly falling in Central Australia.

Meningococcal disease

There were 4 cases of meningococcal disease notified in the 2nd quarter. Two cases from Central Australia were Meningococcal serogroup W (MenW) and were of the same typing as the Central Australian MenW outbreak that began in late 2017. The third Central Australian case was non groupable. A case from East Arnhem was serogroup B. All children aged 1-19 years in the NT are recommended to receive and are eligible for FREE meningococcal ACWY vaccine from their vaccine providers.

Malaria

There were 5 cases of malaria notified among 4 people in the NT in the 2nd quarter. One person had both *Plasmodium falciparum* and *P.ovale* diagnosed on different specimens 2 months apart. All cases were imported and were acquired in Africa.

Gonorrhoea

There were 590 cases of gonococcal infection notified in the 2nd quarter which is 20% more than the 5 year mean and against the downward trend of recent years. This is in line with a national increase in gonorrhoea notifications.

HTLV1 asymptomatic/unspecified

There were 29 cases of asymptomatic/ unspecified human T-lymphotrophic virus 1 (HTLV1) notified in the quarter which is 4 times the expected value of 7. The increase is due to an increase in testing in Central Australia driven by increased awareness raised by research studies, forums on the topic and media coverage.

Chickenpox

In the 2nd quarter of 2018 there were 11 cases of chickenpox notified; 8 fewer than the 5 year mean of 19 cases. This follows on from a general downward trend in notifications of chickenpox in recent years following the introduction of the varicella vaccine on the national schedule in 2005.

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Vaccine providers

A FREE meningococcal ACWY vaccine is recommended for all NT 1 to 19 year olds.

Offer 1 to 19 year olds the ACWY vaccine and don’t let them miss out!

Meningococcal ACWY Vaccination program August 2018

DEPARTMENT OF HEALTH

LET'S STOP MENINGOCOCCAL DISEASE

Free meningococcal ACWY vaccine

is now available for all children aged 1 to 19 years living in the Northern Territory.

Protect your children and community now.
Go to your health centre or doctor to get vaccinated.

Meningococcal infection can make you very sick.

Go to the health clinic straight away if you have a fever.

Fever | Headache or neck stiffness | Drowsiness or confusion | Joint pain | Rash of purple spots | Dislike of bright lights | Vomiting

Babies might also be upset, screaming, hard to wake from sleep or not eat or drink.

For further information call the
Centre for Disease Control Immunisation team

Top End - **8922 8315**
Central Australia - **8951 6928**

NORTHERN TERRITORY GOVERNMENT

www.health.nt.gov.au

Immunisation coverage for children aged 12 to <15 months at 30 June

SA3 Name	Number in SA3	%DTP	%Polio	%HIB	%HEP	%Pneumo	% Fully vaccinated
Darwin City	105	93.33	93.33	93.33	93.33	93.33	93.33
Darwin Suburbs	213	91.08	90.61	90.14	92.49	92.02	89.67
Litchfield	58	93.10	93.10	93.10	94.83	93.10	93.10
Palmerston	183	94.54	94.54	94.54	96.17	94.54	94.54
Alice Springs	89	88.76	88.76	88.76	89.89	88.76	88.76
Barkly	18	100.00	100.00	100.00	100.00	94.44	94.44
Daly - Tiwi - West Arnhem	32	96.88	96.88	96.88	100.00	96.88	96.88
East Arnhem	50	96.00	96.00	94.00	96.00	96.00	92.00
Katherine	85	84.71	84.71	84.71	88.24	87.06	84.71
Not mapped*	83	93.98	92.77	95.18	93.98	92.77	91.57
Non-Aboriginal (NT)	583	92.60	92.30	92.10	93.10	92.80	91.60
Aboriginal (NT)	334	91.60	91.60	91.90	94.30	91.90	91.00
NT	**917**	**92.30**	**92.00**	**92.00**	**93.60**	**92.50**	**91.40**
Australia	**75709**	**94.60**	**94.50**	**94.40**	**94.50**	**94.20**	**93.80**

Immunisation coverage for children aged 24 to <27 months at 30 June

SA3 Name	Number in SA3	%DTP	%Polio	%HIB	%HEP	%MMR	%MenC	%Varicella	% Fully vaccinated
Darwin City	121	90.08	95.04	94.21	95.04	92.56	94.21	90.91	88.43
Darwin Suburbs	223	90.13	94.62	93.72	95.07	90.58	92.83	89.69	88.79
Litchfield	56	91.07	92.86	91.07	92.86	91.07	91.07	91.07	91.07
Palmerston	163	89.57	96.93	93.87	96.32	89.57	93.87	88.96	87.12
Alice Springs	98	90.82	95.92	93.88	96.94	91.84	95.92	90.82	86.73
Barkly	18	83.33	94.44	88.89	94.44	94.44	94.44	83.33	72.22
Daly - Tiwi - West Arnhem	34	94.12	97.06	97.06	97.06	97.06	97.06	97.06	94.12
East Arnhem	40	95.00	97.50	97.50	97.50	97.50	97.50	90.00	87.50
Katherine	86	84.88	96.51	91.86	95.35	88.37	94.19	80.23	74.42
Not mapped*	88	96.59	97.73	98.86	95.45	92.05	96.59	90.91	88.64
Non-Aboriginal (NT)	607	90.00	94.70	93.20	94.10	90.10	92.80	89.50	88.50
Aboriginal (NT)	320	91.60	97.80	95.90	98.40	93.80	97.20	89.10	83.80
NT	**927**	**90.50**	**95.80**	**94.20**	**95.60**	**91.40**	**94.30**	**89.30**	**86.80**
Australia	**79477**	**93.00**	**96.60**	**95.60**	**96.50**	**93.40**	**95.60**	**92.40**	**90.70**

* 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 to <63 months at 30 June

SA3 Name	Number in SA3	%DTP	%Polio	% Fully vaccinated
Darwin City	93	84.95	84.95	84.95
Darwin Suburbs	194	93.30	93.30	93.30
Litchfield	65	93.85	93.85	93.85
Palmerston	166	94.58	94.58	94.58
Alice Springs	86	87.21	87.21	87.21
Barkly	15	100.00	100.00	100.00
Daly - Tiwi - West Arnhem	26	96.15	96.15	96.15
East Arnhem	41	95.12	95.12	95.12
Katherine	82	97.56	96.34	96.34
Not mapped*	73	91.78	91.78	91.78
Non-Aboriginal (NT)	566	92.00	92.00	92.00
Aboriginal (NT)	275	93.80	93.50	93.50
NT	**841**	**92.60**	**92.50**	**92.50**
AUS	**80575**	**94.80**	**94.80**	**94.70**

* 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 at 30 June 2018

Holly Carmichael, Centre for Disease Control, Darwin

Background information to interpret coverage

Immunisation coverage will be 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

The cohort of children assessed at 12 to <15 months of age on 31 March 2018 were born between 1 January 2017 and 31 March 2017 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 31 March 2018 were born between 1 January 2016 and 31 March 2016 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 31 March 2018 were born between 1 January 2013 and 31 March 2013 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 27-28. Coverage for all Australian children is also provided.

Children in the NT were less likely to be fully immunised in all cohorts in comparison to Australia wide coverage rates; 12 to <15 months (NT 91.4%, National 93.8%), 24 to <27 month (NT 86.8%, National 90.70%) and 60 to <63 (NT 92.5%, National 94.7%) to be fully immunised.

Aboriginal children in the NT were less likely to be fully immunised than non-Aboriginal children cohorts; 12 to <15 month (Aboriginal 91%, non-Aboriginal 91.6%) and 24 to <27 month (Aboriginal 83.8%, non-Aboriginal 88.5%), however, more likely to be fully immunised in the 60 to <63 month cohort (Aboriginal 93.5%, non-Aboriginal, 92%).

Coverage by SA3 in the Table shows variation between high and low coverage areas. Katherine had the lowest Aboriginal coverage in the 24 to <27 month cohort. The highest Aboriginal coverage area was in the Darwin City region for the 12 to <15 month cohort as well as the Daly-Tiwi-West Arnhem Region for the 60 to <63 month cohort. The lowest coverage area for non-Aboriginal children was in Katherine for the 24 to <27 month cohort. The area that had the highest coverage for non-Aboriginal children was Katherine in the 60 to <63 month cohort.

CDC are currently reviewing the reasons for the lower coverage in both Aboriginal and non-Aboriginal children. CDC is working with the Australian Immunisation Register to review data quality and processing of vaccine recording, and reviewing other strategies to improve childhood immunisation coverage. Further information about the Australian Immunisation Register coverage may be found at: http://www.ncirs.edu.au/surveillance/immunisation-coverage/

Table. Variation between high and low coverage

	Aboriginal		Non-Aboriginal	
Age Group	**Lowest SA3**	**Highest SA3**	**Lowest SA3**	**Highest SA3**
12 to <15 months	Katherine 80.7%	Darwin City 100%	Alice Springs 88.7%	Palmerston 95.2%
24 to <27 months	Katherine 72.2%	Daly - Tiwi - West Arnhem 96.6%	Katherine 78.1%	Alice Springs 90.7%
60 to <63 months	Darwin City 87.5%	Daly - Tiwi - West Arnhem 100%	Darwin City 84.1%	Katherine 100%

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Disease Control staff updates July-September 2018

Top End

Welcome to the new Medical Officers who have commenced at CDC Darwin. **Bernadette Hader** is working in the Paediatric Outreach General Practice Registrar role on a 6 month rotation. **Olivia Rygorowicz, Hitti Bakshi, Haiyun Li** and **Jennifer Becker** completed their 6 month rotation as General Practice Registrars in July 2018. **Shanti Narayanasamy** has replaced **Tasnim Hasan** as the Infectious Diseases Registrar on a 6 month placement at CDC. **Johanna Warren** has replaced **Nick Georges** as the Public Health Registrar on a short-term contract.

Paediatrician **Dr Keith Edwards** has retired after working for the Department of Health for over 20 years. Keith worked at CDC as the Community Paediatrician and at Royal Darwin Hospital (RDH). **Dr Catherine Boyd** has replaced Keith and is a Paediatrician at RDH and also working for CDC.

Emma Childs, A/Manager Gove CDC, leaves in September after 15 months with CDC. Emma has a new position with the NT Primary Health Network (NTPHN) as the Policy and Research Integration Lead. **Helen Cleary** is leaving the Healthy Skin nurse position after a successful 6 months and is moving home to New Zealand to retire to the cooler climes.

Anthony Draper, OzfoodNet Epidemiologist, has taken up a part-time position supporting a project in Timor Leste working on disease surveillance and communicable disease control activities. **Rowena Boyd**, TB Clinical Nurse Specialist (CNS), is on secondment, sharing the part-time OzFoodNet Epidemiologist role and Timor-Leste surveillance and communicable disease control support with Anthony Draper.

Michelle Daly has returned to CDC covering Rowena Boyd as TB CNS. Michelle worked as the Katherine CDC Coordinator in 2017.

Central Australia

Youngsoo (Youngy) Son joined CDC as a Remote Sexual Health Nurse in September. Prior to his employment with CDC Youngy was working in the Primary Health Care team with Darwin Correctional Services. **Sara-Dane Reekie** transferred from Clinic 34 Darwin to Clinic 34 Alice Springs as a Sexual Health Nurse.

Jessica Harries, CNS Trachoma has left Alice Springs to work in Timor Leste as a nurse. **Lorraine Gepperth** joined the Trachoma team as the Trachoma Data and Administration Officer in August. **Kira Dick** resigned from the Receptionist position at CDC to study at university and **Jamie Maidment** has taken her position.

Vale Jan Holt

Long-term CDC staff member and Sexual Health and Blood Borne Virus Health Promotion Officer, Jan Holt, passed away on Thursday 6 September 2018.

Before joining CDC, Jan spent several years working at the WA AIDS Council then the NT AIDS Council, where she worked as a volunteer community development officer. While there, in addition to working with volunteers and delivering health promotion to schools, Jan set up a men's support line staffed by gay men to provide information on health and on Clinic 34. She coordinated monthly gay/ lesbian dance parties at the Darwin Bowls Club and Darwin Aviation Institute.

Jan started at NT CDC August 2001 as an STI/ AIDS educator and worked on many sexual health promotions and campaigns aimed at youth, remote indigenous communities, international travellers and the wider community. These included an HIV awareness campaign focussed on Timorese women during the 2002 conflict; she devised chlamydia and safe sex messages in 2 Darwin high schools that were delivered through the curriculum in Drama and English classes. She worked on a

number of travel campaigns raising awareness about HIV for people travelling outside Australia. 'Safe sex no regrets' is one of the most popular campaigns. Jan also organised billboard-sized ads at the Darwin airport, and banner ads along the overpassed on Bagot Rd to raise awareness about World Hepatitis Day and World AIDS Day. She chaired the Health Promotion Advisory Group for number of years and worked closely with many stakeholders delivering STI/BBV health promotion programmes. Jan was very committed to fight the current syphilis outbreak. She set up a social media platform on 'Divas Chat' to have health promotion messages delivered to young people in some remote communities. Talking posters developed by Jan and Terrance Guyula from CDC have been very popular in remote/regional areas.

Earlier this year Jan was diagnosed with cancer. Her legacy in health promotion will be remembered for many years and she will be greatly missed.

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Billboard ad at Darwin Airport