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Pertussis outbreak in Central Australia 2010

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Abstract

Central Australia experienced a pertussis outbreak, peaking in October 2010. Using data from the Northern Territory Notifiable Diseases System and population data, the epidemiology of the outbreak is described. The majority of notifications were in children aged 5-9 years, and the majority of notifications in the 25-34 year age group were in females who are more likely to be mothers of young children. The absolute numbers and the rate of notifications in Indigenous patients was less than that in the non-Indigenous population. There were more notifications for younger Indigenous patients compared to the non-Indigenous patients, and only Indigenous children and infants aged under 5 years were hospitalised for pertussis. Of the 12 notifications of patients under 2 years of age, 6 were under 6 months of age and were not fully immunised, and of the 6 who were 6 months of age or over, 2 were not fully immunised. As a response to the outbreak, staff of the Centre for Disease Control in Alice Springs raised public awareness by distributing information to schools and through media interviews.

Key words: pertussis; Central Australia; outbreak

Introduction

An epidemic of pertussis has been reported all around Australia since mid 2008, with a peak in November 2010.[1] Central Australia has not been spared, with a peak of cases in October 2010. This paper describes the epidemiology of the outbreak and Centre for Disease Control's (CDC) response.

Methods

Data was extracted from the Northern Territory (NT) Notifiable Diseases System and also analysed from

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the data warehouse using Business Objects. The data obtained was for those cases of pertussis with diagnosis date in 2010 for notifications received in the Alice Springs and Barkly regions only. Population figures for the Alice Springs and Barkly regions were obtained from the NT Department of Health's Health Gains Planning population data.[2]

Results and discussion

Description of the outbreak over time

Pertussis notifications in Central Australia began to climb from May 2010 onwards (Figure 1), with an increasing number of notifications being received from general practitioners who diagnosed the infection mostly in school aged children. The outbreak reached a peak in October 2010 with 35 cases notified that month, with a decreasing number of cases per month thereafter. No deaths from pertussis were recorded.

The number of cases notified to CDC is likely to be 'the tip of the iceberg'. This is because many people with pertussis might not seek formal medical attention, and those who present may not be tested or if tested the result may be negative (a 'false negative' result).

Age and sex distribution of pertussis notifications

Large numbers of notifications were in children aged under 14 years, and especially in the 5-9 year age group (Figure 2).

This is consistent with the epidemiology of disease across Australia, where in 2010 up to the beginning of December, 15% of notifications were in the 5-9 year age group and 12% of all notifications were in the 10-14 year age group (Table 1).

Table 1. Age distribution of pertussis notifications to the National Notifiable Diseases Surveillance System, from 1 January 2010 to 3 December 2010[3]

Age group	% of notifications
0-4 years	7
5-9 years	15
10-14 years	12
15-19 years	4
20-24 years	3
25-44 years	22
45-64 years	22
65+ years	11
Total	100

Figure 1. Pertussis notifications in the Alice Springs and Barkly districts per month since January 2007

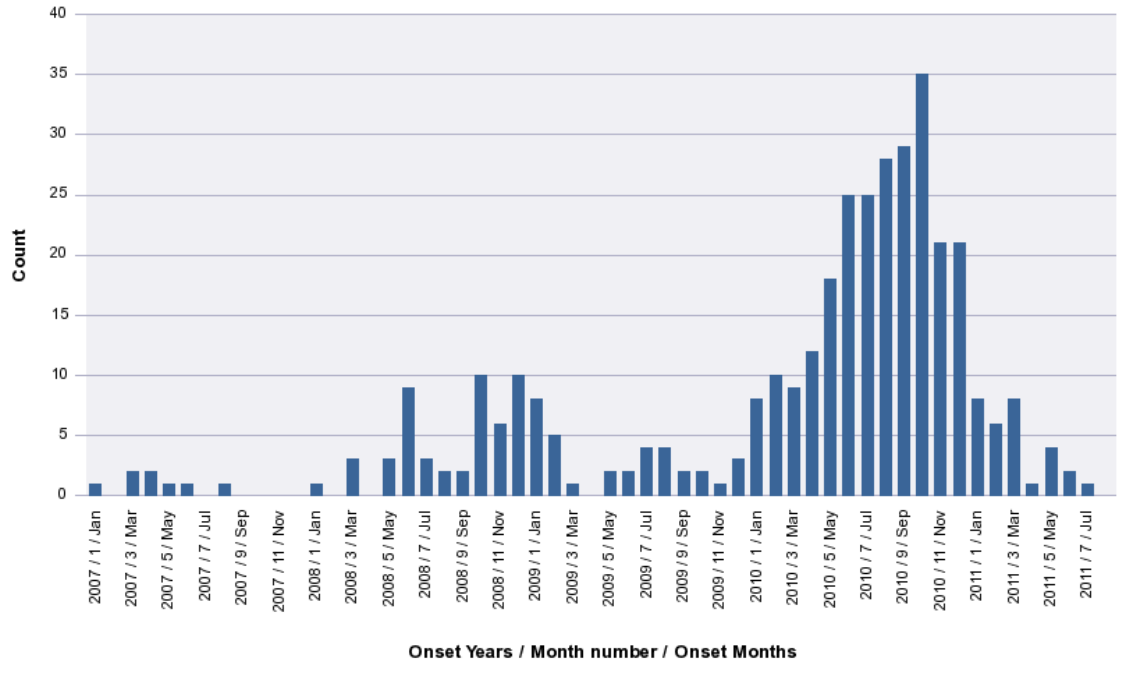
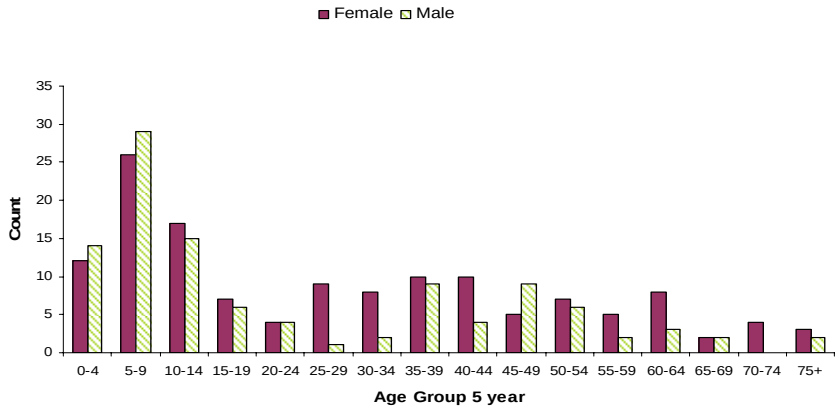


Figure 2. Pertussis notifications in the Alice Springs and Barkly regions in 2010 by age group and sex



This is also consistent with the epidemiology of other countries. For example, in a prospective cohort study of 172 children aged 5-16 years in the United Kingdom, 37.2% had serological evidence of a recent *Bordetella pertussis* infection, suggesting that pertussis is endemic in school-aged children.[4]

This is of concern because the 5-9 year age group should be benefiting from their vaccination against pertussis prior to 6 months of age, and then boosted at 4 years of age. Acellular pertussis vaccines are estimated to provide protection for about 6 years,[5] but the data here suggests that the immunity wanes more quickly.

A booster vaccine for pertussis is given at the age of 13 years, so the decreased incidence in adolescents aged 15 years and above may be due to immunisation. A decreased number of notifications in the 15-24 year age group may also be due to symptomatic cases who do not seek medical attention.

The 5-9 year age group presumably have close interaction with their peers at school and other activities where they are likely to be spreading the infection. Their personal hygiene practices are possibly less rigorous than children aged 10 years and above who are presumably more aware of personal hygiene (e.g. less likely to cough directly on another person).

From the age of 10 years onwards, more females than males are affected (except the 40-44 year and 65-69 year age groups) (Figure 2). Females aged 25 to 34 years are more likely to be mothers or care givers of young children and therefore in contact with a more highly infected group. This may also simply reflect the greater health-seeking behaviour of women.

Pertussis in the Indigenous population compared to the non-Indigenous population

In all age groups, there were more notifications for pertussis in the non-Indigenous population than in the Indigenous population, especially in the 5-9 year age group (Figure 3). The distribution of pertussis notifications is different in the Indigenous compared to non-Indigenous populations. In the Indigenous population the mode is in the 0-4 year age group, whereas in the non-Indigenous population the mode is in the 5-9 year age group. Pertussis affecting lower age groups in the Indigenous population is concerning because that age group is more at risk of serious complications; hospitalisation of Indigenous children in that age group is discussed below.

The absolute numbers (Figure 3) and the rates of pertussis notifications (Figure 4) were greater for the non-Indigenous population in all age groups. The difference is particularly dramatic in the 5-9 year age group, where the non-Indigenous children had a notification rate of 31 per 1000, compared to Indigenous children with a rate of only 3 per 1000.

Especially of concern is the percentage of Indigenous children aged under 5 years who are hospitalised because of pertussis (Table 2) compared to non-Indigenous.

Figure 3. Pertussis notifications in the Alice Springs and Barkly regions in 2010: By age group and Indigenous status

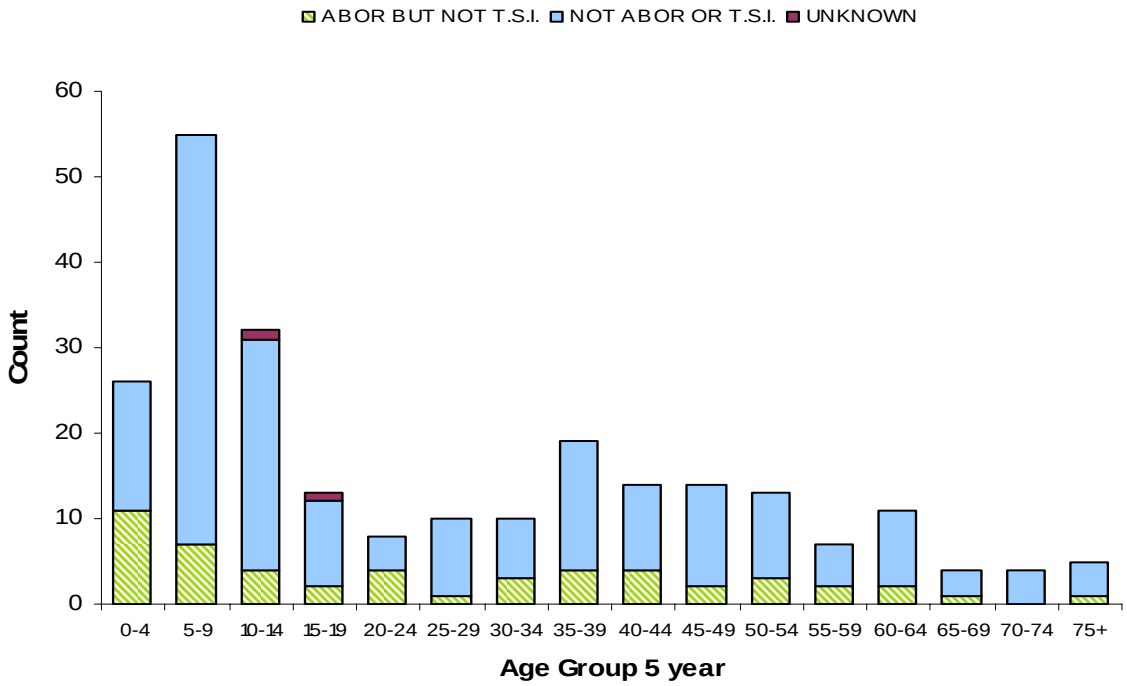


Figure 4. Rate of pertussis notifications (per 1000 population) in the Alice Springs and Barkly regions in 2010 by age group and Indigenous status

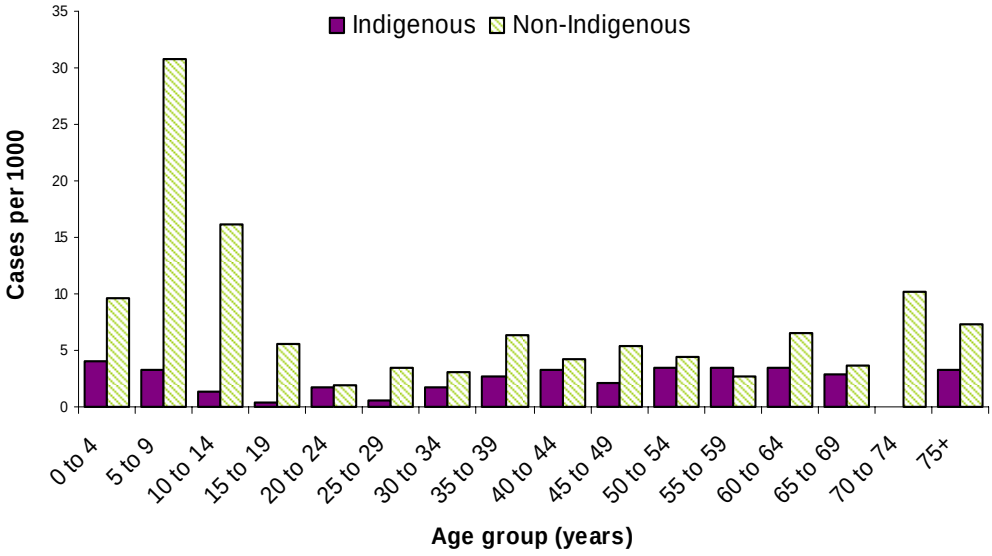


Table 2. Hospitalisation status of pertussis cases in Central Australia under the age of 5 years by Indigenous status in 2010

	Indigenous	Non-Indigenous
	N (%)	N (%)
Hospitalised	6 (60)	0 (0)
Not hospitalised	4 (40)	15 (100)
Total	10 (100)	15 (100)

Of Indigenous children notified with pertussis 60% were hospitalised, as compared to none of the non-Indigenous children with pertussis.

To try to understand this high hospitalisation rate on the background of an overall lower pertussis notification rate in the Indigenous population, possible contributing factors must be considered. The burden of chronic respiratory disease in the Australian Indigenous population is significant, with the prevalence of chronic respiratory disease in Indigenous children aged 0-14 years of age reported to be as high as 19%.[6] With such high rates it is possible that parents and carers of Indigenous children may be more tolerant of a coughing child and not readily seek medical attention (and thereby not be tested for pertussis). This may explain why the overall rate of pertussis notification in the Indigenous population is much lower than in the non-Indigenous population.

Regarding the hospitalisation rate, Indigenous children are documented to have a mortality rate from respiratory disease that is 11 times that of non-Indigenous children[6] and they also have a recognised higher rate of co-morbidities and socio-economic vulnerabilities.[7] Therefore clinicians may have a lower threshold to admit an Indigenous child with respiratory illness to hospital for in-patient care, as compared to a non-Indigenous child.

Figure 5 shows a timeline of the number of Indigenous children hospitalised with confirmed pertussis in 2010. The increased number of hospitalisations in October and November suggests that the increase in overall notifications seen at this time in the community (Figure 1) reflects a real increase in the rate of disease in the community and is unlikely to be simply an effect of more testing.

Pertussis in children under 2 years of age

Children under 2 years of age are most vulnerable to pertussis and special efforts are made to protect them with immunisations, contact tracing and treatment of the contacts. Special effort is also made to collect data regarding pertussis cases in this age group.

In 2010, 12 babies under 2 years of age were notified with pertussis (Table 3). Of the 12 babies, 7 were 6 months of age or less and therefore did not have the benefit of the primary course of pertussis vaccines. Of the 7, 6 were Indigenous, all of whom required hospitalisation; the only non-Indigenous infant had lab-confirmed disease but was not hospitalised. Of those who were over 6 months of age only 1 was not fully immunised.

CDC response to the outbreak

Following National Guidelines,[8] CDC wrote letters to the principals of schools where cases had been found; most letters were sent out in October 2010 when the number of cases peaked. The schools published the CDC fact sheets on pertussis in their school newsletters and the local newspaper also reported on the facts about pertussis.[9]

The increased communication from CDC raised awareness about pertussis in the community resulting in more telephone enquiries throughout the second half of 2010 from general practitioners as well as people who were concerned for themselves, their families or their colleagues. Even though hospitalisation rates suggest a real increase in incidence in October and November, some of the increased rates in the community may have been due to more testing as a result of awareness-raising and case finding.

Because of an increased number of Indigenous children aged under 5 years who were hospitalised with pertussis in October, CDC wrote to all remote clinics in Central Australia in November to encourage clinicians to immunise all parents and other carers of young children against pertussis. This is known as the 'cocoon strategy',[10] whereby preventing pertussis in parents and carers can decrease exposure of very young children to pertussis.[11]

A radio interview was done in May to educate the public about pertussis. In early December, in anticipation of the school holidays and the potential to spread the infection further as families dispersed, a media release was prepared, resulting in a local newspaper article.[12]

Conclusion

Like the rest of Australia, Central Australia experienced an epidemic of pertussis in 2010.

Figure 5. Number of Indigenous children under 5 years hospitalised with pertussis per month in the Alice Springs and Barkly districts in 2010

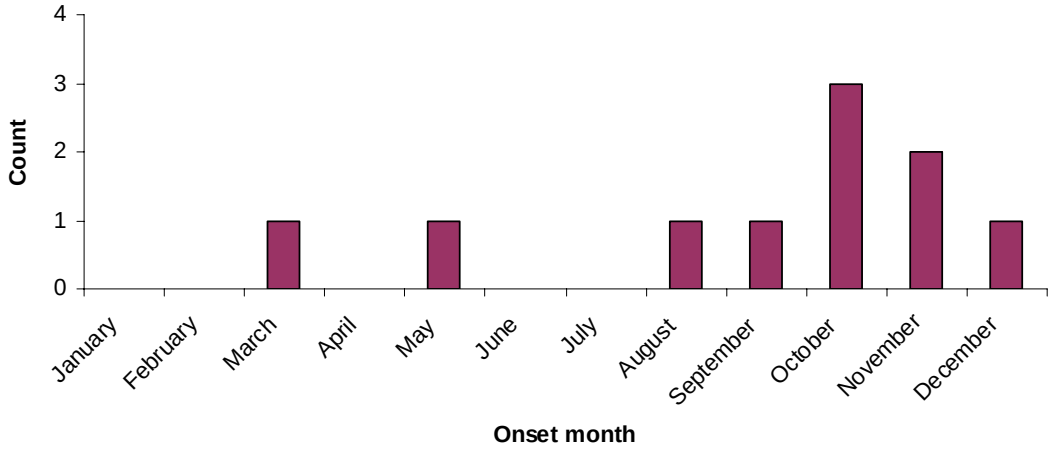


Table 3. Demographics, vaccination status and hospitalisation status of pertussis cases under 2 years of age in Central Australia in 2010

Indigenous status	Sex	Resident Location	Age at diagnosis	Hospitalised	Length of admission	Vaccination status	Up to date with immunisations?
Aboriginal	M	Remote	<1 month	Yes	6 days	not vaccinated	too young
Aboriginal	F	Alice Springs	2 months	Yes	3 days	Infanrix® Hexa x1	Yes *
Aboriginal	M	Alice Springs	2 months	Yes	3 days	not vaccinated	No
Aboriginal	F	Remote	2 months	Yes	5 days	Infanrix® Hexa x1	Yes
Non-Aboriginal	F	Alice Springs	3 months	No	-	Infanrix® Hexa x1	Yes
Aboriginal	F	Remote	3 months	Yes	8 days	Infanrix® Hexa x1	Yes
Aboriginal	M	Remote	6 months	Yes	2 days	Infanrix® Hexa x2	No †
Aboriginal	F	Alice Springs	11 months	No	-	Infanrix® Hexa x2	No
Non-Aboriginal	M	Remote	11 months	No	-	Infanrix® Hexa x3	Yes
Non-Aboriginal	M	Alice Springs	1 year 2 months	No	-	Infanrix® Penta x3	Yes
Aboriginal	F	Remote	1 year 4 months	Yes	4 days	Infanrix® Hexa x3	Yes
Non-Aboriginal	M	Alice Springs	1 year 8 months	No	-	Infanrix® Penta x3	Yes ‡

* Onset of symptoms 1/3/10, given 2 month immunisations on time on 3/3/10, admitted to hospital on 8/3/10
† Diagnosis at 6 months of age; 6 month vaccinations given two days after diagnosis of pertussis
‡2 month immunisation given too early at 1 month and 3 days of age

Children under the age of 14 years were most affected in the highest numbers and via notification numbers the non-Indigenous population was disproportionately affected. The hospitalisation of Indigenous children was of particular concern.

Strategies to control pertussis include:

- Encouraging the 'cocoon strategy' to protect parents and carers of young children against pertussis.
- Ensuring good vaccine coverage of 4 year old children prior to starting school.
- Considering adding another pertussis booster.
- Promoting cough etiquette.

Acknowledgements

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National Pertussis Workshop

Strategies to prevent severe pertussis in the next decade 25-26 August 2011, Sydney.

Copies of presentations can be accessed via the presentation title links below - Please note files are large and may take a couple of minutes to download.

http://www.ncirs.edu.au/news/archive.php

Presentations available include:

Day 1 - 25/8/2011

Is Australia the world capital of pertussis? - by Peter McIntyre
Pertussis control - has Canada got it right? - by Scott Halperin
Risk factors for death from pertussis (California)? - by Kath Harriman
Severity of pertussis in hospitalised children - by Helen Marshall
What do we know about source of infant infection? - by Kristine Macartney
Pertussis strains - do they matter? - by Ruiting Lan
Vaccine efficacy and surrogate markers - by Peter McIntyre
Vaccine effectiveness & duration of immunity - US overview - by Tom Clark
Vaccine effectiveness & duration of immunity - Australia - by Helen Quinn
What do we know about impact of vaccines on transmission? - by Patricia Campbell
Pertussis vaccine schedules - what can serosurveillance and modelling tell us - by Jodie McVernon

Day 2 - 26/8/2011

Experience with cocoon implementation and impact -
California - by Kath Harriman
US overview - by Tom Clark
Australia - by Stephen Lambert
Maternal immunisation - can we do it, what can we expect? - by Scott Halperin
Neonatal immunisation - can we do it, what can we expect? - by Nick Wood
Live attenuated pertussis vaccines - are they the future of pertussis control? - by Camille Locht

Have you had a recent pertussis vaccine?

Diphtheria/tetanus/pertussis (dTpa) vaccine is recommended for health care workers (HCWs), especially those in contact with very young infants or those working with patients with respiratory compromise, such as those working in maternity, emergency departments, paediatrics and the special care and general nursery.

Protective efficacy from both natural infection and pertussis vaccine wane over time and a booster dose of vaccine is recommended to provide ongoing immunity. HCWs should be provided with a single booster dose of dTpa.

For more information go to the Pertussis fact sheet on page 11.

Northern Territory Government

DEPARTMENT OF **HEALTH**

INFORMATION ABOUT PERTUSSIS FOR GPs

TESTING FOR PERTUSSIS

Testing for pertussis is best done by PCR on nasopharyngeal swab/aspirate in the first 2-3 weeks of the cough and by serology (IgA) thereafter.

TREATMENT OF PERTUSSIS

Antibiotics are useful to reduce the patient's infectiousness and may reduce symptoms if given early. Antibiotics will not reduce transmission if more than 3 weeks has elapsed since the onset of coughing.

The following table and notes are an extract from *The Australian Immunisation Handbook* 9th Edition p236 for antimicrobial therapy and chemoprophylaxis regimens for pertussis in infants, children and adults.

Cases should be treated with

Table 3.14.1: Recommended antimicrobial therapy and chemoprophylaxis regimens for pertussis in infants, children and adults[47-54]

Age group	Azithromycin	Clarithromycin	Erythromycin	TMP-SMX*
<1 month	10mg/kg single dose for 5 days†	Not recommended	If azithromycin is unavailable; ≤7 days old: 10mg/kg/ dose 12-hourly for 7 days; ‡ 8–28 days old: 10mg/kg/ dose 8-hourly for 7 days	Not recommended in infants <2 months of age unless macrolides cannot be used
1–5 months	10mg/kg single dose for 5 days	7.5mg/kg/ dose twice daily for 7 days	10mg/kg/ dose 6-hourly for 7 days	≥2 months of age; TMP: 4mg/kg twice daily, SMX: 20mg/kg twice daily for 7 days
Infants (≥6 months) and children	10mg/kg single dose on day 1, then 5mg/kg single dose for days 2–5 (maximum 250mg/day)	7.5mg/kg/ dose (up to a maximum dose of 500mg) twice daily for 7 days (maximum 1g/day)	10mg/kg/ dose (up to a maximum dose of 250mg) 6-hourly for 7 days (maximum 1 g/day)	TMP: 4mg/kg, SMX: 20mg/kg twice daily for 7 days (maximum 160mg TMP and 800mg SMX 12-hourly)
Adults	500mg single dose on day 1, then 250mg single dose for days 2–5	500mg twice daily for 7 days	Erythromycin: 250mg 6-hourly for 7 days; Erythromycin ethyl succinate (EES): 400mg 6-hourly for 7 days	TMP: 160mg twice daily, SMX: 800mg twice daily for 7 days

* Trimethoprim-sulfamethoxazole

† Preferred for this age; refer to '(a) Pertussis in pregnancy' and '(b) Use in infants and infantile hypertrophic pyloric stenosis' below.

‡ Please refer to '(b) Use in infants and infantile hypertrophic pyloric stenosis' below. (see Australian Immunisation Handbook p236)

(a) Pertussis in pregnancy

Treatment of pregnant women with pertussis onset within a month of delivery is important for the prevention of neonatal pertussis and, if the onset is within 3 weeks of delivery, their newborn babies should also be given antibiotic therapy (Table 3.14.1). Erythromycin use earlier in pregnancy has well documented safety (Category A). There are only limited data on the use of azithromycin in pregnancy (Category B1).

(b) Use in infants and infantile hypertrophic pyloric stenosis

Several studies have shown an increased risk of infantile hypertrophic pyloric stenosis (IHPS) when erythromycin is given for prophylaxis following exposure to pertussis, especially in the first 2 weeks of life.[56, 57] While there are, as yet, no data available on the effectiveness of azithromycin use in infants <1 month of age, published case series report fewer adverse events following azithromycin use when compared with erythromycin and, to date, there have been no reports of IHPS in infants following use of azithromycin, although the size and number of these studies is limited.[58,59] Therefore, on currently available evidence, and because of the risks of severe pertussis in this age group, azithromycin is preferred to erythromycin for treatment and prophylaxis in infants aged <1 month by US authorities. Azithromycin is available as a suspension and approved for use in Australia, but treatment and prophylaxis of pertussis are not currently referred to in the product information. Parents of newborns prescribed either erythromycin or azithromycin should be informed about the possible risks for IHPS and counseled about signs of developing IHPS.

EXCLUSION

Cases should be excluded from childcare facilities and school until they have taken 5 days of antibiotic treatment. If cases do not take antibiotics they need to be excluded for 21 days after the onset of the cough.

NOTIFICATION

Please notify the Centre for Disease Control of all confirmed and suspected pertussis cases (numbers below).

CONTACT TRACING

The Centre for Disease Control will trace the contacts of all pertussis cases.

Antibiotic prophylaxis may be recommended for close contacts including:

- Children under the age of 2 years (for example if the case attended child care).
- Women in the last month of pregnancy.
- People who work in a health care or child care.

Close contact is defined a household contact or contact of < 1 metre for > 1 hour during the infectious period (until 3 weeks after onset). CDC will be happy to follow up contacts and arrange appropriate prophylaxis.

VACCINATION

Immunisation is the mainstay of pertussis control. Babies can be protected with vaccine given at 6-8 weeks after birth and then at 4 and 6 months of age. A booster dose of vaccine should be given at 3½ - 4 years of age. An additional booster dose should be given as part of a school based program at age 13 years (Year 8).

Immunity following vaccination or disease is not life-long.

Free dTPa vaccine can be offered to the following groups:

- All fathers and carers in the same household of an infant under the age of 7 months. The vaccine can be given to this group from the time the expectant mother has reached the 28th week of pregnancy.
- All new mothers after delivery of the baby if they have not received the vaccine in hospital prior to discharge (the vaccine is contra indicated in pregnancy).

Other high risk groups who should be offered vaccine via a private prescription include:

- Health care workers
- Parents planning a pregnancy
- Adults working with young children including child care workers and teachers.

Centre for Disease Control

Darwin	89228044	Katherine	89739041	Tennant Creek	89324259
Alice Springs	89517540	Nhulunbuy	89870357		

Northern Territory Government

DEPARTMENT OF HEALTH

Centre for Disease Control

April 2011

Pertussis (Whooping Cough)

What is pertussis?

Pertussis is a highly contagious disease of the respiratory tract (nose and throat) caused by the bacteria *Bordetella pertussis*.

How is it spread?

The bacteria are found in respiratory secretions of infected people. These people can pass the infection to other people by coughing or sneezing. Pertussis can also be spread by direct contact with infected mouth or nose secretions eg. by sharing eating utensils during a meal, sharing food or kissing.

What are the symptoms?

The symptoms generally develop 7 to 10 days after exposure, but may take up to 20 days.

Pertussis usually starts with cold-like symptoms and an irritating cough, or the cough may be the first symptom. The irritating cough gradually changes over 1-2 weeks into episodes of coughing bouts, often followed by dry retching or vomiting. These coughing bouts can be very severe and frightening.

In some people, particularly children, they may end with a crowing noise (the whoop) as air is drawn back into the chest, and the child may vomit.

Very young babies may hold their breath instead of whooping and may sometimes turn blue. Adolescents and adults may only have a persistent cough.

How serious is pertussis?

Pertussis kills about 295,000 children worldwide, each year and other children are left with brain damage. In Australia, between 1993 and 2005, 16 of the 18 people that died from pertussis were aged less than 1 year*. Death from pertussis is rare in children over 10 years of age. The most common complication of pertussis in infants is pneumonia that can be complicated by seizures and prolonged decreased oxygen to the head causing brain damage.

What is the infectious period?

A person is infectious during the cold-like symptoms in the early stages, through to 5 days after starting antibiotics or, if left untreated, for the first 3 weeks of coughing.

Who is at risk?

Pertussis can affect any age group, however, because of early childhood immunisation, pertussis now occurs mainly in adolescents and young adults. Adults can give the infection to young babies before they are fully protected by vaccination. These young babies are at risk of severe disease. One attack of the disease usually produces long-term immunity, though second attacks in the same individual have occurred.

What is the treatment?

An antibiotic called azithromycin (or erythromycin for pregnant contacts) is usually prescribed to prevent the disease from being passed on to others, however it has little effect on the course of the illness for the individual. The coughing may last for weeks or months.

How can pertussis be prevented?

Immunisation works to prevent a person contracting disease or can reduce the severity of the illness. The pertussis component is combined with diphtheria and tetanus vaccine (DTPa) (and sometimes hepatitis B, *Haemophilis influenzae* B (Hib) and polio vaccine) and is given as an injection.

The DTPa containing vaccine is given 6-8 weeks after birth and then at 4 and 6 months of age with a booster at 3 ½ to 4 years. Those

*Australian Immunisation Handbook, 9th Edition 2008 (NHMRC) http://immunise.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook-home

CENTRE FOR DISEASE CONTROL

few children who develop pertussis, even though they have been immunised, have a much milder infection with fewer complications than those children who do not receive the vaccine at all.

The series of 3 vaccines at 2, 4 and 6 months provide about 90% protection against pertussis but this falls to about 80% after 3 years.

A booster vaccine formulated for adults (dTpa vaccine consisting of adult diphtheria, tetanus and acellular pertussis) became available for use in Australia, in 2003. Because of waning immunity to pertussis during adolescence, this vaccine is given at 13 years.

The booster dose acts to ensure that protection lasts for as long as possible and to reduce the risk of infecting young infants.

Who is eligible to receive free adult diphtheria, tetanus, pertussis (whooping cough) (dtpa) vaccine?

- All Students in year 8 or children 13 years of age.
- All new mothers as soon as possible after delivery (vaccine is not to given to women during pregnancy).
- All fathers and carers in the same household of an infant under the age of 7 months (the vaccine can be given to this group from the time the expectant mother has reached 28 weeks in the pregnancy).

The booster vaccination is free for the above clients and can be obtained from a GP, remote health clinic or Community Care Centre.

Who is adult diphtheria tetanus and pertussis (whooping cough) recommended for?

- Adults planning a pregnancy.
- Any adults working with or caring for young children including health care workers and child care workers.
- Anyone who wants to be vaccinated.

The booster vaccination for these people will incur a cost and is available from a GP.

Minimum interval between dTpa and other tetanus containing vaccines

The dTpa vaccine can be administered at any time following a previously administered dose of tetanus toxoid containing vaccine.

How can pertussis be controlled?

People with infectious pertussis (prior to and for the first 3 weeks of the cough) should stay away from work, school and child care until they have completed 5 days of appropriate antibiotics.

Preventive antibiotic treatment is recommended for the following household or institutional contacts of pertussis cases who have spent more than 1 hour with the infected person:

- all household members when the household includes an infant aged <24 months who has received less than 3 doses of pertussis vaccine
- any woman in the last month of pregnancy.

Further advice should be sought from your regional Centre for Disease Control regarding pertussis cases:

- that have attended school or child care centres
- in health care workers or in a maternity ward or newborn nurseries.

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
http//www.nt.gov.au/health/cdc

Firework-related injury survey report 2011

Padmasiri Eswara Aratchige, Vicki Krause and Steven Skov, CDC, Darwin

Abstract

Objective. *The Centre for Disease Control conducts an annual survey to determine the number of fireworks-related injuries in the Northern Territory (NT) surrounding Territory Day on the 1 July. This is the 13th survey in the series.*

Methods. *All public hospital Emergency Departments and Department of Defence health care facilities in the NT participated by completing survey forms for patients that presented with fireworks related injuries.*

Results. *In 2011 there were 28 injuries caused by fireworks. Of those injured 4 were classified as severe and required hospital admissions. The number injured in 2011 was more than double the 2010 figure.*

Conclusion. Persistent high rates of fireworks injuries in the NT signify the need for continued education and health promotion efforts to reduce fireworks related injuries and mitigate their impact.

Keywords: fireworks; Northern Territory; injuries; hospitalisation

Introduction

Territory Day in the Northern Territory (NT) of Australia has been celebrated annually on 1 July since 1978. This day marks the anniversary of self-government in the NT. Each year on this day, people in the NT are permitted to purchase and set off fireworks without a permit. With the Australian Capital Territory banning personal usage of fireworks without a permit in 2009[1] the NT remains the only jurisdiction in Australia that allows this practice. Despite some tighter restrictions on sale and usage time in recent years, injuries due to personal usage of fireworks continue to occur in the NT.[2]

The Centre for Disease Control (CDC) has conducted an annual survey of fireworks-related injuries in the NT since 1998. This is the 13th survey in the series. Since 2006 the CDC has also conducted analyses of the public discussion related to fireworks in the print and electronic publications of the *NT News*.[3] In addition to the annual surveys, the CDC, in conjunction with NT WorkSafe, the fire brigade and police force, work to promote the safe use of fireworks. This year the methods used to inform the public included media releases, newspaper advertisements and distribution of safety flyers to all points of sale of fireworks and to clinics and community centres in the NT. Each year there is considerable media and public debate over fireworks and the restrictions on their use. The objective of this survey is to describe the epidemiological features of the injuries associated with fireworks during Territory Day celebrations 2011.

Methods

All persons with firework-related injuries presenting during a period between 29 June 2011 and 4 July 2011 to the Emergency Departments of Royal Darwin Hospital, Alice Springs, Gove, Katherine and Tennant Creek hospitals and the Australian Defence Force Health Services clinics in the NT were asked to participate in this descriptive study. Data on patients consenting to participate in the survey were collected prospectively by the triage nurses using a pre-tested data collection form. Minor modifications were made to the data collection sheet that was used in previous years. These were questions on whether the participant was a visitor to the NT and had consumed alcohol prior to the accident. The type of firework implicated in the injury was identified from the patient's description. Severity of injuries was defined as follows:

- Severe: admitted to hospital for dressings, grafts or other procedures
- Moderate: an injury requiring greater than 1 review by a health practitioner
- Mild: requiring only 1 visit to a health practitioner.

Data were entered in Microsoft Access and analysed in STATA and Microsoft Excel softwares.

Results

There were 28 injuries recorded in 2011 across the NT. Most participants (25/28) were injured on the 1 July with 2 on 2 July and 1 on 3 July. Time of injury was recorded in 25 cases and 90% had occurred between 6.30 pm and 11.00 pm. Most cases (19/28) occurred in and around Darwin. The distribution of the injuries by hospital and severity is shown in Table 1. The majority of injuries (68%) and all severe injuries (4) presented to the Royal Darwin Hospital. One was initially classified as moderate but later reclassified as severe when the patient required admission to hospital for skin grafting.

More males (19) were injured than females (9). A total of 16 people (57%), 12 males and 4 females, were injured while lighting a firework and 12 people injured were bystanders, 6 male and 6 female. Figure 1 shows the severity of injuries by age group. The age of injured persons ranged from 10 months to 48 years with a mean of 22.2 years and SD of 12.9 years. All severe injuries were among adult males with 3 requiring skin grafts and 2 sustaining eye injuries. Both the patients with eye injuries had lacerations to eyelids requiring surgery and 1 had foreign bodies in his cornea requiring surgical removal. After an initial period of blurred vision both recorded normal vision on discharge but required further visits to the eye clinic for assessment of structural impairment.

Anatomical sites of the injuries are shown in Figure 2. The commonest sites were the hands and eyes. The extent of the burn injuries was recorded for 19 of 28 (68%) participants, 3 of whom had burns covering greater than 5% of the body surface area.

Table 1. Distribution of injuries by hospital and by severity

Name of hospital/clinic	Severity of injury				Total
	Severe	Moderate	Mild	Not classified	
Royal Darwin Hospital	4	7	6	0	**17**
Alice Springs Hospital	0	1	3	0	**4**
Gove District Hospital	0	2	1	0	**3**
Katherine District Hospital	0	0	1	1	**2**
Defence Services clinic	0	2	0	0	**2**
Total	**4**	**12**	**11**	**1**	**28**

Figure 1. Severity of firework related injuries by age group

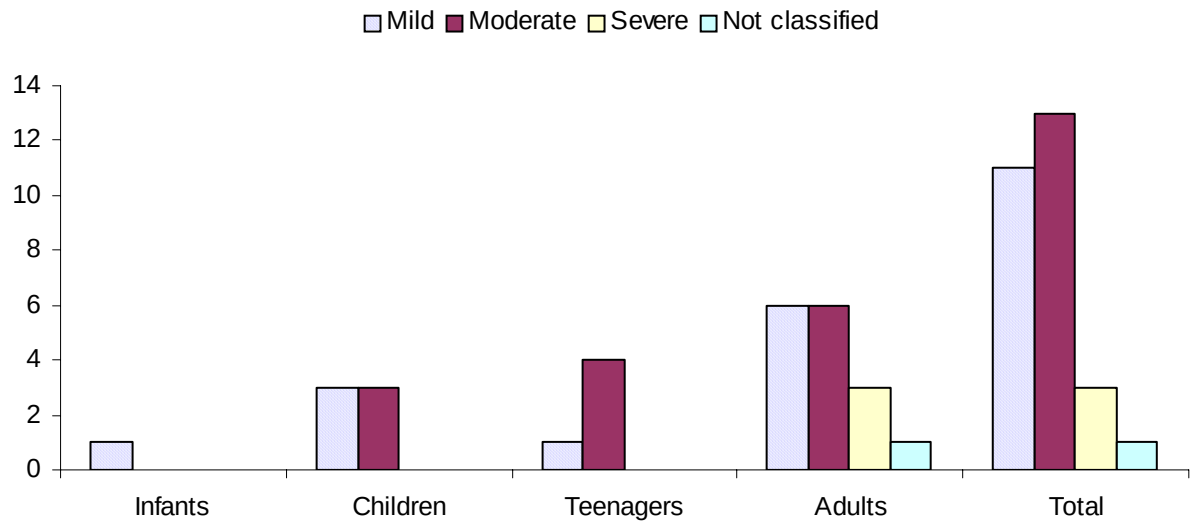
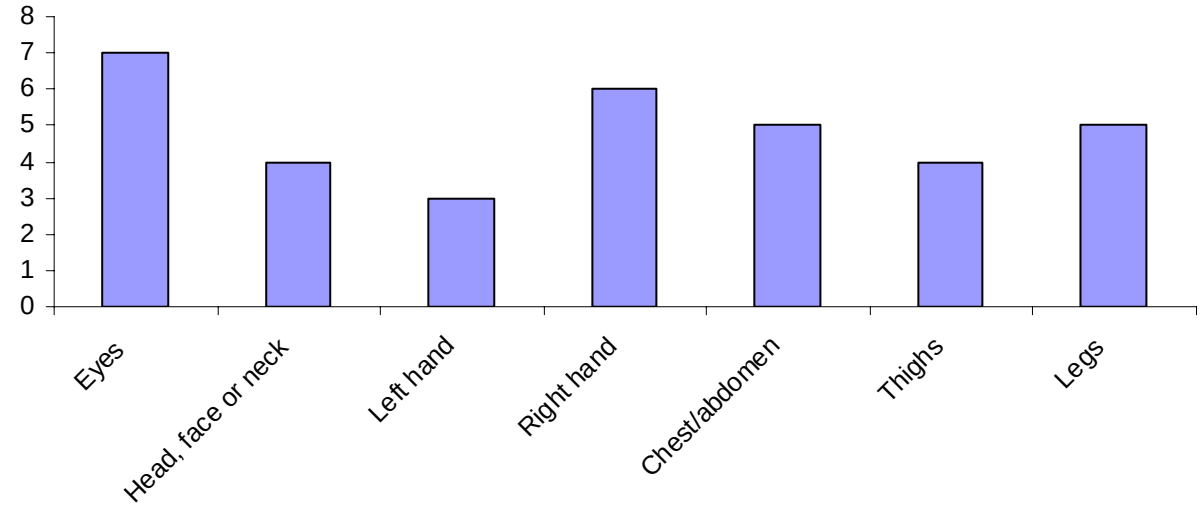


Figure 2. Anatomical sites of the firework-related injuries – 2011



A common cause of injury (16 cases) was the firework exploding while it was being lit. Of these people 16 were holding the firework at the time and 1 person had tied 3 fireworks together which exploded in his hand causing severe lacerations to his hand and fingers. Fireworks firing in an unexpected direction, in particular the rocket type fireworks, was another common cause. The majority of bystanders 9/12 (75%) were injured in this manner. In 2 cases injury occurred when someone intentionally aimed fireworks at others "in fun". In 1 case a 10 month old infant burnt his hand when he grabbed a discarded 'fountain' that was still burning.

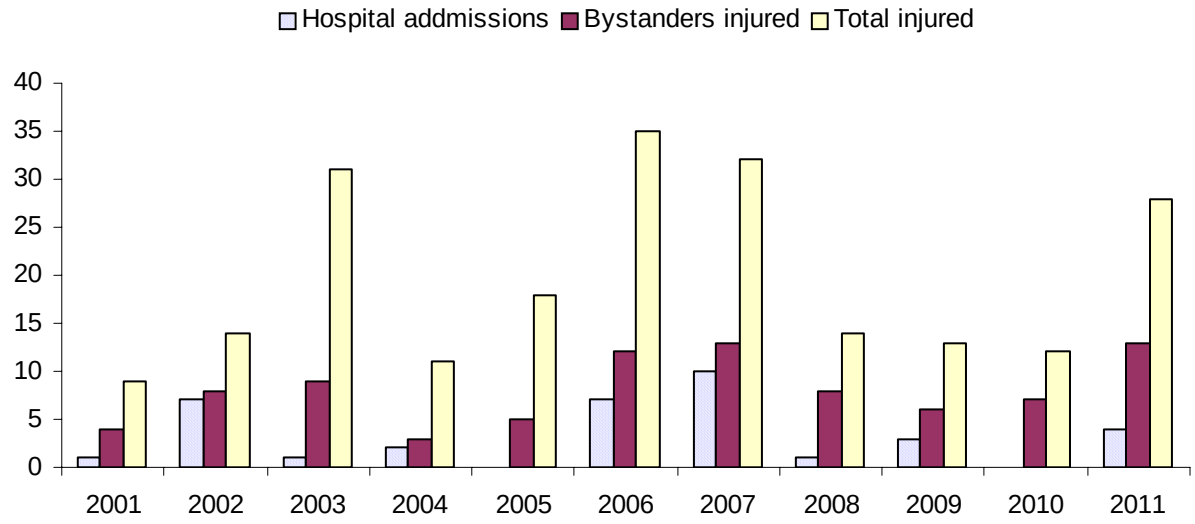
The type of firework causing injury and the severity of injury are shown in Table 2. In 2 reports the type of firework or the severity of the injury was not recoded. 'Multi-shots' appear to be the commonest type of firework causing injuries.

Table 2. Type of firework causing injury and severity of injury

Type of firework	Severity of injury			Total
	Severe	Moderate	Mild	
Multi-shot	3	4	4	11
Skyrocket	0	4	3	7
Crackers	1	0	2	3
Bumblebee spinner	0	2	0	2
Fountain	0	1	0	2*
Home made	0	1	0	1
Jumbo party popper	0	0	1	1
Unknown	0	0	1	1
Total	4	12	11	28*

* Severity was not classified in 1 record

Figure 3. Frequency of firework-related injuries in the NT – Hospital admissions, bystanders and total number injured, 2001 – 2011



The place of occurrence of injury was recorded in 26 of the 28 cases with backyards of houses being the commonest place (39%) reported. Other common places were streets (25%) and beaches (21%). No injuries were reported from Mindil Beach – the location where large numbers of people gather to watch a professional firework display and where personal fireworks are not permitted.

Trends in firework injuries, hospitalisation and injuries to bystanders from 2001 to 2011 are shown in Figure 3. The number of firework injuries has fluctuated slightly over the last decade with no clear upward or downward trend (Chi-square for trend 1.71, p= 0.09).

Information on whether the injured was a local resident or a visitor to the NT was recorded in 27 of 28 persons and no visitors were among them. Information concerning whether alcohol was consumed was recorded in 25 persons of whom 6, including 2 with severe injuries, reported consuming alcohol prior to their injury.

Discussion

Territory Day is traditionally celebrated with fireworks in the NT. Use of fireworks is not without danger to the users, onlookers and other bystanders particularly when they are used by non-professionals. This 2011 survey was carried out to maintain awareness of the injuries associated with fireworks, understand some of the associated factors and to inform safety promotion strategies.

Trends in firework-related injuries and impact of preventive measures

The number of firework injuries has fluctuated over the years with no clear upward or downward trend. Since the series of surveys began, 2006 and 2007 recorded the highest number of injuries (35 and 32 respectively). There was a decrease in the numbers in the next 3 years but a higher number (28) was recorded in 2011 doubling the number that occurred in 2010.

In 2011 in the NT the per capita rate of injuries was 12.4 per 100,000 population. The comparative reported rate of such injuries in other developed countries was 0.52 in New Zealand[4] and a range of between 4.6 and 31.4 in different States in the United States of America (USA) where the rate of injuries in states with less regulation of firework activity is higher than in those with greater regulation.[5-9] The experience in the USA suggests that injury rates in the NT could be reduced by greater regulation of fireworks use.

Changes in the Darwin City Council by-laws in 2009 resulted in a prohibition of possession and ignition of private fireworks in the Mindil Beach area with offences punishable by a $520 spot fine. This area is the most popular viewing location for the public fireworks display. No injuries have been reported from the area since 2009 indicating that usage of fireworks by trained people and restriction on individual usage carries a lesser risk of injury.

Risk groups for firework injuries

International studies consistently report overrepresentation of males in fireworks injuries, with a male: female ratio of 3 to 1 reported by the USA Centre for Disease Control.[10] In 2011, 19 out of 28 injured in the NT were males making the ratio 2 to 1.

Risk groups for firework injuries include not only the firework lighters but also the bystanders. This has been a feature in many places that allow individual use of fireworks.[5,9,10] Bystanders make up a large proportion of the total injuries in the NT; 88 of 217 (41%) since 2001. Bystanders therefore should continue to be a target group for safety promotion campaigns. In recent years safety promotion materials in the NT have recommended that fireworks be lit on a flat and stable surface as well as at a safe distance from any bystanders as a way of reducing the risk of injuries. It is however, difficult to recommend what a "safe" distance is for observing fireworks. In 2009 a child in a pram was injured as a result of a firework that was lit approximately 50 metres away.

A particular concern was whether the domestic or foreign tourists to the NT are more susceptible to injuries than NT residents who may have had access to information on firework safety for a longer period. This study assessed whether the visitors to the NT are among those injured but all injured were found to be local NT residents.

In many places, alcohol and fireworks have been shown to be a dangerous mix for firework-related injuries among adults.[11,12] Of those assessed (25/28) in this study, 24% (6/25) had been drinking alcohol before the accident happened and 2 of these had severe injuries. Under the Dangerous Goods Act it is an offence to sell fireworks to persons under 18 years of age or to intoxicated persons, and to use fireworks 'in a way likely to damage property, or injure a person or animal'. Advice against the use of fireworks when an individual has consumed alcohol should be re-emphasised in the future injury prevention campaigns.

Anatomical sites and type of injuries

Burns were documented in 68% of firework-related injuries and hands or fingers were the most affected body part (32%) in this study. In other studies, burns are also the commonest type and hands the most frequent anatomical site of firework-related injury.[7,9,10,12] At the time of this report 3 of these injuries required admission for skin grafting for burns which are usually slow and painful to heal and sometimes cause long term scarring and contractures.

One out of every 4 (25%) reported injuries involved the eyes. Such injuries have been reported in the NT in previous years too. [2,13,14] Eye injuries are commonly associated with fireworks in other countries as well resulting in devastating permanent structural and visual impairment.[7,15-18]

Type of fireworks and causes of injury

Most injuries (75%, 21/28) were caused by multi-shots, rockets and firecrackers. These findings are consistent with previous reports.[2,13] Holding a firework while lighting it, resulted in burns and other injuries to the hands and fingers in 6 people. This unfortunately is a mishandling technique that has been repeated over the years.

Fireworks legally purchased by individuals appear to have been the cause of all injuries except in 1 case where apparently a home made or home improvised firework was used. 'Multi-shots' were the type of firework that caused most injuries (39%) followed by rockets (25%) and crackers (11%). Government has the capacity to regulate the type and power of fireworks available in the NT. Multi-shots have been the commonest cause of injury over many years and consideration could be given to reducing their explosive capacity or requiring that greater safety information be made available concerning their use.

This year there were no injuries resulting from sparklers. Sparklers have in the past been among the more common type of firework causing injury especially when several are held at a time when being lit. This can result in a "super-ignition" showering the hand with very high temperature material. In 2008 specific warnings against this practice became a prominent part of the safety promotion materials distributed by CDC. Since then there have been 4 sparkler injuries in 4 years compared with 12 such injuries in the 2 years prior.

Highlights of 2011 survey in the NT

- In 2011, 28 persons were injured including 4 severely. The number injured was more than double the 2010 figure.
- Average age of the injured was 22 years.
- More than twice as many males (19) were injured than females (9).
- 43% of those affected were bystanders.
- Common body sites affected were hands (32%) and eyes (25%).
- Multi-shot (39%), rockets (25%) and crackers (11%) caused bulk of injuries.
- Most injuries (90%) occurred within the legally permitted time on Territory Day and the commonest place for accidents was the home backyard (39%).
- The injured person had been drinking alcohol in one quarter of cases.
- All injured were local residents in the NT.

Conclusions

The personal use of fireworks in the NT remains a controversial public issue. Clearly as long as the practice is permitted injuries will continue to occur as a result. Rates of injury in the NT appear higher than other jurisdiction with different regulations. After the banning of personal firework use at Mindil Beach in Darwin, the site of the largest professional fireworks display and the largest gathering of people to watch it, no injuries have been reported for 3 consecutive years. The CDC is committed to continue monitoring fireworks injuries and to promoting messages and practices around the safe use of fireworks in order to reduce the injuries they cause.

Acknowledgements

We would like to thank the staff of the emergency departments of the Royal Darwin Hospital, Alice Springs, Gove, Katherine and Tennant Creek hospitals and the Australian Defence Force Health Services clinic and the Burns Unit of the Royal Darwin Hospital for their assistance in the data collection. We also acknowledge contributions made by Justine Glover throughout the survey.

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"Firework-ignited debate" - An analysis of opinions published by the *NT News* on the use of fireworks surrounding Territory Day

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Abstract

Objective. *To provide an analysis of the opinions and comments expressed by the general public regarding the personal use of fireworks in the NT News.*

Methods. *All published text messages, letters and online comments in the NT News from 14 June to 14 July 2011 were analysed. Trend on polarisation of public opinion towards or against the personal use of fireworks since the start of the series of published opinion analysis in 2006, was also assessed.*

Results. *The majority of messages were regarding annoyance resulting from the personal use of fireworks surrounding the Territory Day without being either for or against their ban. Equal proportions of comments were clearly in favour of, or clearly against a ban on personal use of fireworks.*

Conclusion. *Public opinion is divided with opinions favouring or against the personal use of fireworks in the NT while some are neutral. The proportion of messages either clearly in favour of a ban compared with those expressing enjoyment of fireworks or against a ban has been relatively similar overall since 2006.*

Keywords: fireworks; The NT News; media survey; Territory Day; public opinion

Introduction

July 1 is Territory Day in the Northern Territory (NT) of Australia and marks the anniversary of self-government in the NT. On this day people in the NT are allowed to purchase and set off fireworks without a permit. The NT remains the only jurisdiction in Australia that allows this practice after the Australian Capital Territory banned the personal usage of fireworks without a permit in 2009.[1] Government-funded public fireworks displays are also held at several places throughout the NT.

For many years the issue of whether the personal use of fireworks in the NT is desirable has been a subject of considerable public discussion. The general publics views on this subject may be obtained by examining the opinions expressed in letters and text messages sections of newspapers.[2,3] The *NT News*, a newspaper owned by News Limited, is the only daily newspaper in the NT. It has an average daily readership of 48,000 on weekdays and 59, 000 on Saturdays.[4] The paper has a section for letters to the editor and text messages as well as an online forum where people may leave comments in direct response to articles available for public viewing on the internet. The use of fireworks has been the subject of extensive comment in these forums in the weeks leading up to and after Territory Day.

The Centre for Disease Control (CDC) has previously conducted 3 analyses of the letters to the editor and text message discussions of the fireworks issue in the *NT News*.[5, 6, 7] This survey is the fourth in the series.

Methods

All letters, text messages and online comments published in the *NT News* between 14 June and 14 July 2011 that referred to fireworks were examined.

All 3 communications types were classified initially as either generally "negative" or not in favour of fireworks use, generally "positive" or in favour of fireworks use, and "other", where the nature of the opinion could not clearly be classified as either for or against fireworks. The negative messages were then further classified into 3 groups: 1) clearly in favour of a ban, 2) clearly in favour of further restriction or 3) expressing an annoyance with some aspect of fireworks use but without explicitly calling for a ban or further restriction. The positive messages were also classified into 3 groups; 1) generally enjoy personal use of fireworks, 2) in favour of reduced restriction, or 3) clearly against a ban.

There was considerable overlap at sub classification level regarding the reason for being either positive or negative. There were also many instances when the author's intent was not directly stated by was able to be inferred. For example we considered as calling

for ban a message that said 'let professionals do fireworks'. To reduce the observer bias in the analysis all messages were initially classified by one author (PE) and subsequently independently reviewed by another (JG). Discordant observations were then discussed further to reach consensus in each such occasion.

Results

During the time frame a total of 141 messages appeared in the 3 sources with the majority 85 being online communications. Published in print were 41 text messages and 12 letters to the editor (Figure 1). The largest proportion (68/138 (49.3%) of messages were broadly classified as negative towards personal fireworks use while 51/138 (37%) were classified as positive. The remaining 19/138 (13.7%) were not able to be so classified.

Themes

As in previous years there were a number of recurring themes in the comments with considerable overlap in the reasons why people contacted the newspaper. Many people expressed multiple reasons for their opinion(s). For the purpose of the analysis we identified the primary reason or opinion.

Within the positive messages, general enjoyment and the unique nature of the NT were the most common themes. The most common themes within the negative comments were related to the irresponsible use of fireworks and use outside of the licensed time period.

Figure 2 shows the reasons behind the opinions of those generally in favour of personal use of fireworks.

Figure 1. Distribution of published comments by classification

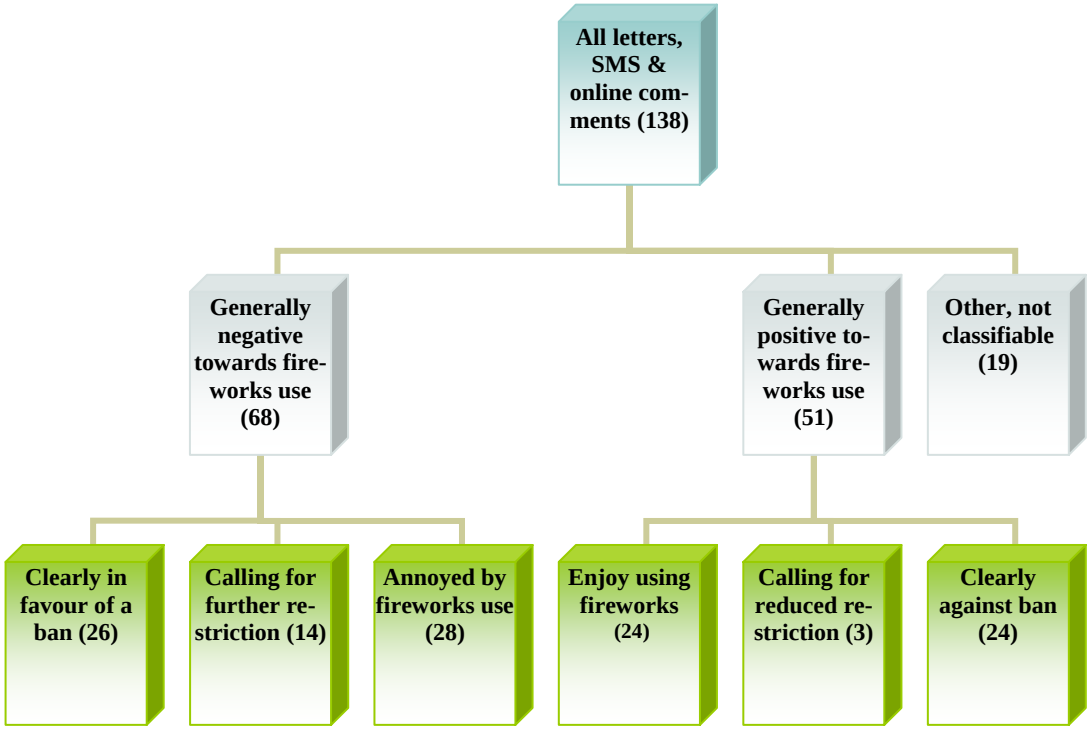
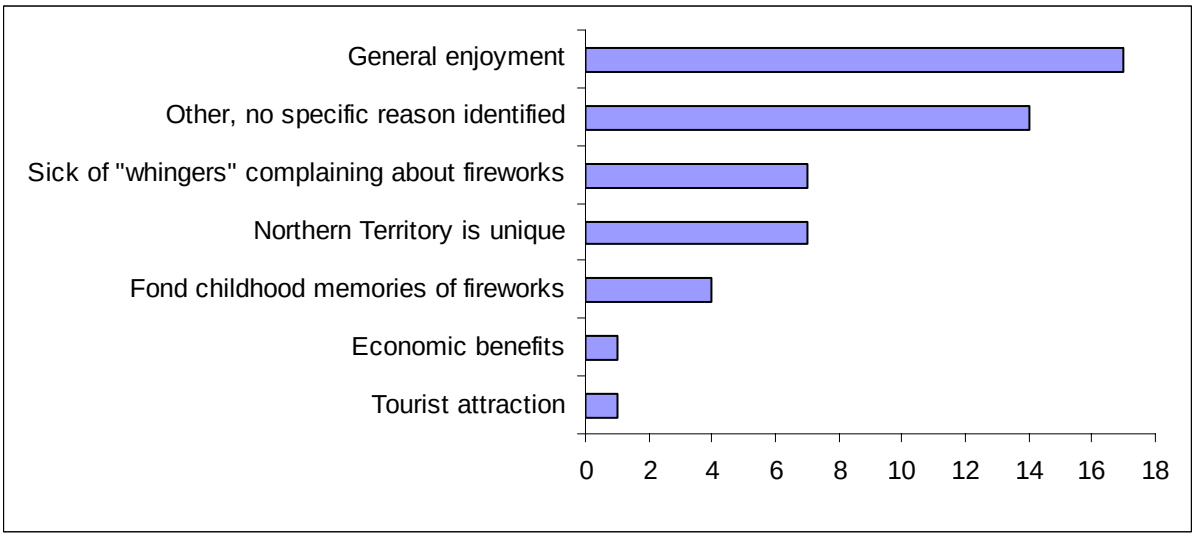


Figure 2. Reasons behind positive messages on fireworks



Some examples of this year's messages in favour of personal use of fireworks are reproduced below:

"Thank you NT we loved our first Cracker night; I had such a ball. Please don't ever abolish it and become as overregulated as the rest of the country; we love Darwin it's so refreshing to live in a place that still knows how to have a good time!"

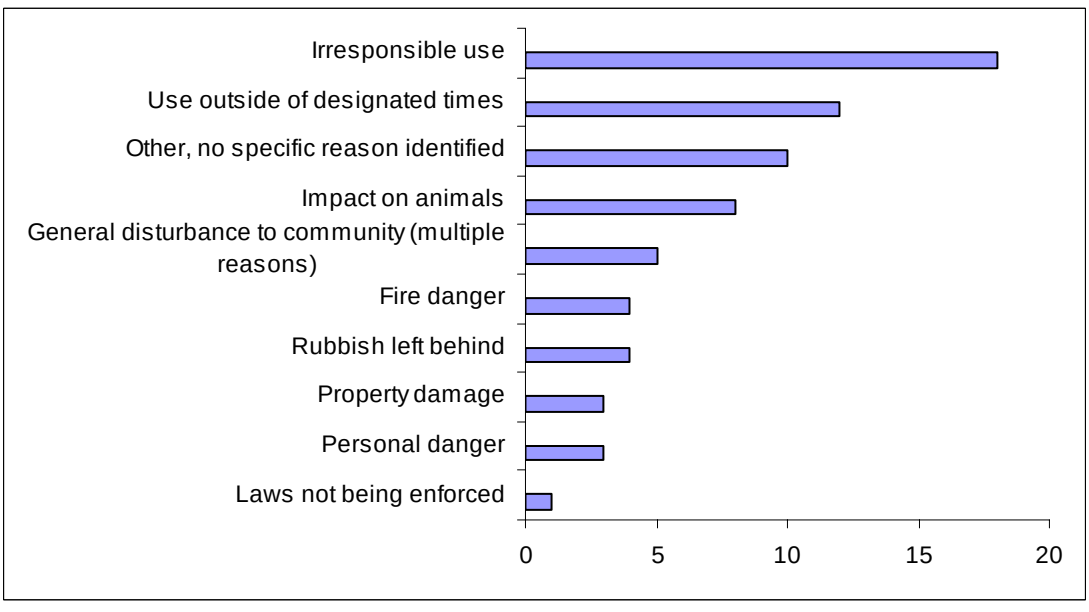
"Love cracker night. It's only once a year, folks, and it's an amazing amount of fun. I have such great memories of my parents and their friends letting them off down south when I was little, and I'm sure kids here grow up to cherish those memories. All the kids I was with last night had eye goggles, and ran around excitedly writing their name with sparklers, adults setting off the fireworks. There's just such an air of excitement and revelry. Cracker night – last defence against the nanny state!"

"The annual post cracker night onslaught has begun. And I say to everyone of you who moans and complains and calls for the government to ban it. Do us all a favour and leave the NT, or just stop whinging. We have far more urgent and serious social problems here, in case you haven't noticed. For the amount of fireworks sold on NT day, very few people and property are hurt or damaged. And often those who are were not handling the fireworks properly. Lets have some fun left in life."

"Wonderful night, I have celebrated 1st July for the past 25 years with family and friends. It is wonderful to see my grandchildren enjoying and using fireworks in a safe and supervised manner. You will always get idiots that go outside the boundaries, even with crocodiles, but they wont cull crocodiles, so leave our fireworks alone."

Figure 3 shows recurring reasons among those expressing a negative opinion on the personal use of fireworks.

Figure 3. Reasons behind negative messages on fireworks



Some examples of messages not in favour of personal use of fireworks in 2011 are reproduced below:

"Whilst Territorian day is great with organised crackers, it's a shame that there are still a lot of morons setting them off to annoy and upset others. Damaging property, and aiming at moving traffic when will you stop living in the past and take safety seriously. I'm sure that we will now get the usual idiots who bought extras, setting off their crackers throughout the year. Once again the few ruin it for the majority. Better to ban the sale than to risk the potential for serious injuries."

"Territory Day is a good idea and why not celebrate with Fireworks BUT not individually. I think a special event at Mindil Beach is nice and everyone can enjoy a nice safe evening. Letting people buy fireworks and let them off is irresponsible and each year is proven to be a costly exercise for our Police and emergency services and not to mention a sleepless night for most people."

"Get with the real world! Darwin special people do not have the intelligence to be left alone with matches let alone fireworks. Fireworks should be banned. The idiots setting them off on top of the next door multi-story car park at 2.00 pm should be rounded up slung in jail with the key thrown away."

"Too many people are irresponsible and cause problems with firecrackers. They need to be licensed, there should be designated locations for fireworks with security present. I don't know of any other State that would be allowed to do such a thing. Both my dogs were clinging to me and upset. They were very loud and everywhere. I was trying to watch TV and had it up to full volume".

There were also many messages with strong language clearly showing the polarization, strong feelings and intensity of the debate. We have not reproduced them in this article.

Discussion

The aim of this study was to provide an analysis of the comments of the general public published in the *NT News* regarding the personal use of fireworks on Territory Day.

This year there were a total of 138 comments in the survey period which is fewer than the 155 in 2010, but higher than 113 in 2006 and 109 in 2007. Online comments seem to be replacing comments in print over the years. In 2011 the largest proportion (62%) of comments were online, similar to that seen in 2010.

Table 1 shows the trends in the public opinions expressed through media since 2006. Over the years the proportion of people expressing negative opinions about fireworks use has been substantially greater than those who a positively disposed towards them. However, this has changed over time with the proportion of those opinions in favour steadily increasing while those against have steadily declined. The "for and against split" has gone from 19% / 72% in 2006 to 37% / 49% in 2011.

Table 1. Trends in fireworks opinions 2006 – 2011 (Total number (%))

		2006	2007	2010	2011
Negative	**Total**	73/102 (72)	62/109 (57)	85/155 (55)	68/138 (49)
	Outright ban	22/102 (22)	20/109 (18)	40/155 (26)	27/138 (20)
Positive	**Total**	19/102 (19)	28/109 (26)	52/155 (34)	51/138 (37)
	Clearly against ban	NA	NA	29/155 (19)	24/138 (17)
Other		10/102 (10)	19/109 (17)	18/155 (12)	19/138 (14)

Limitations of the study

There are number of limitations in interpreting the data in our study. Letters and text messages are published at the editor's discretion leading to possible publication bias. It is not known how many messages on this subject were received and not published by the newspaper. Online comments are less subject to publication bias as they are only occasionally removed by online moderators if their content is deemed offensive or abusive to others.

Unsolicited comments such as texts and letters to the editor are subject to self-selection bias. This may arise from the motivation of individuals to contribute to the debate as people who feel more passionately about the use of fireworks will be the most likely to submit their comments for publication. It is also possible that some people may have commented more than once either online or in text messages as names are not verified during the publication process. Another form of selection bias may arise due to variable access to or use of the internet or electronic communication that exists. The process of writing and sending a letter to the editor is prohibitive to some people, but the ease of submission of text messages and online comments may reduce that obstacle, particularly in younger age groups.

Last year, the *NT News* conducted an online poll of readers with the question "Should the use of fireworks be restricted to public displays only on Territory Day". Its results showed 442 of 741 (57%) responders were in favour of further restriction. However, this type of a survey also could have suffered the same type of bias as the survey of unsolicited messages. The best way to properly judge public opinion would be to conduct a community survey with a formal sampling process.

Conclusions

Public debate via the *NT News* on the personal use of fireworks continued in 2011 with a wide variety of opinions expressed. Our analysis showed that the public opinion expressed through media on this subject continues to be divided. This year, as in previous years, those expressing a negative opinion towards the personal use of fireworks have been in the clear majority. However, over the past several years the gap between positive and negative opinions has narrowed substantially.

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Towards GET 2020: Trachoma in the Northern Territory 2010

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Abstract

Australia is a signatory to the GET 2020 (Global Elimination of Trachoma by 2020) program. Trachoma remains endemic in the remote parts of the Northern Territory (NT). The NT Trachoma programs annually screens school-aged children as part of the Healthy School Aged Kids program. Skilled screeners assess for clean faces and active trachoma and give treatment where indicated. They assist the primary health providers with contact tracing families as part of the SAFE strategy.

In 2010, according to the database, approximately 41% of children in the target age group were screened with a prevalence of 14% active trachoma found. Only 40% of children found with active trachoma are reported to have received treatment. Of those identified as contacts 81% were treated, but only 19% were treated within 2 weeks as per guideline recommendations. The overall prevalence of trachoma in the population screened has remained fairly static over the last 5 years indicating that a change in direction in trachoma management is required.

The data analysis showed that there are likely gaps between what is represented in the database and what happened on the ground in 2010. A 'live' database that linked with existing electronic health databases in communities would be a considerable improvement, more accurately representing individual case treatment and contact tracing.

Basing trachoma control on school screening is difficult, as school enrolment and attendance numbers are fluid and there is high mobility in remote communities and true population numbers are not known. However improvements in trachoma control can be undertaken by working on the social determinants of health (overcrowding and insufficient hygiene access) as well as mass treatment (there is evidence from overseas that is successful in lowering the disease burden) to achieve elimination by 2020.

Key words: trachoma; elimination; school screening; Northern Territory

Introduction

Trachoma, caused by *Chlamydia trachomatis,* is the leading infectious cause of blindness worldwide. It is an ocular infection that remains to this day a disease which proliferates in overcrowded, unhygienic environments. The diagnosis of trachoma is clinical, and using the World Health Organization (WHO) (2006)[1] grading system for diagnosis is classified as trachomatous follicular inflammation (TF), trachomatous intense inflammation (TI) and trachomatous scarring (TS). Australia uses the same clinical grading tool for diagnosis. Repeated infections cause inflammation and scarring of the tarsal conjunctiva. Left untreated there is inverting of the eyelids (trichiasis), corneal scarring and blindness. Trachoma has a strong association with dry dusty conditions (such as arid desert environments) and flies as a vector for *C. trachomatis* are another contributing factor.

Internationally there is a global elimination strategy GET 2020 (Global Elimination of Trachoma by 2020)[2] that aims to eradicate this leading cause of preventable blindness, which has huge personal, societal and economic costs particularly in developing countries. Australia is a signatory to this declaration.

In the Northern Territory (NT) trachoma has been a scourge on eye health in remote communities for at least 50 years. In the 1950's Dame Ida Mann[3] conducted surveys of the remote communities in the Kimberley and the NT and found trachoma. She reported anecdotal evidence of 97% prevalence in some remote communities in the NT. Trachoma continues today to be endemic in many central Australian communities.

The association of poverty and unhygienic conditions with trachoma is well recognised. WHO, in working to eliminate trachoma has adopted the 4 arms of trachoma programs as the S.A.F.E. control strategy: 1) Surgery (for trichiasis); 2) Antibiotics; 3) Face washing and 4) Environmental health improvement.[1] The chief aims of the NT Trachoma Program are to annually screen children at school in at-risk remote communities and to treat for trachoma

(including all household contacts), promote face washing, in addition to other core activities. The NT Program collects data on all 4 areas and uses this information to assess improvements.

Aim

This audit measured and compared the 2010 results from school based screening against the 2008 NT Guidelines[4] and the Communicable Disease Network of Australia (CDNA) 2006 guidelines[5] and refers to previously published data on trachoma prevalence in the NT.[6] There are a set of approved indicators to measure program performance and review the prevalence and endemicity of trachoma. The audit reviewed screening, prevalence and treatment, including contact tracing.

Method

The Healthy School Aged Kids (HSAK) program conducts annual screening of children at schools throughout the remote and rural communities of the NT. Trachoma screening is a part of this process and members of the Trachoma Team participate in the program. Screening is conducted at the school with the consent of the community and school, parents and caregivers. Treatment for trachoma is usually provided on the spot at school or at the local clinic. All results and treatment are entered into the child's medical notes. The data is then collated and de-identified for the purpose of the trachoma database, with information collected on age, clean face status, grading of trachoma and treatment given. Any follow up is documented in the clinic notes and is performed by the clinic with the assistance of the Trachoma Team staff. The de-identified personal information is then collated by community and region. The Trachoma Program is dependent on seeing children who attended school at that designated period. All screeners have been specifically trained in order to diagnose trachoma.

Ethics approval for this audit of the 2010 trachoma screening database was obtained from the Menzies School of Health Research Ethics Committee.

The NT Department of Health maintains a minimum dataset on trachoma, as stipulated in the Guidelines.[4] All data were entered by dedicated trachoma staff in the NT. The 2010 trachoma Microsoft Access database was reviewed and entered into Microsoft Excel. This is currently under review and in 2011 a new 'live' database is under construction.

Information on 2010 population was also sourced from the HSAK programs, in regard to background population numbers of children residing in each community. The background numbers of children are dependent on school enrolment, which does not necessarily reflect all the children living in that community and therefore may not be accurate.

Results

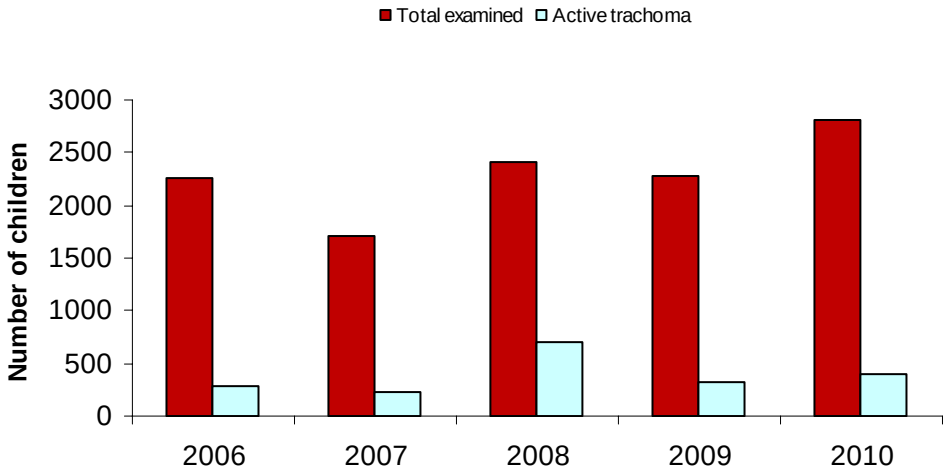
In 2010, 65 communities in at-risk areas were screened achieving coverage of 76% of communities in the NT (Table 1).

The number of children residing in the target area screened remains more difficult to define. As it has been some time since the last census and many of the populations are highly mobile, exact numbers of children residing in each community is not known. In consultation with the HSAK population numbers (which are based

Table 1. Trachoma screening coverage 2006 – 2010[6]

	Total Number 'at-risk' communities	2006 N	2007 N	2008 N	2009 N	2010 N (% communities screened)
Alice Springs Remote	30	25	19	18	23	27 (90)
Barkly	8	6	6	2	3	5 (62)
Katherine	20	11	11	7	7	10 (50)
Darwin Rural	16	15	12	11	14	16 (100)
East Arnhem	12	12	12	4	6	7 (58)
Total	86	69	60	42	53	65 (76)

Figure 1. Active trachoma in examined children aged 1–9 years in the NT 2006-2010



on school and clinic enrolments) populations remain an estimate. In 2010, 4478 children aged 1–15 years were screened. From a baseline population estimate from the HSAK program this represents 40.7% of children in at risk areas being screened.

The overall number of children examined increased with the prevalence of trachoma remaining static at 14% overall in the NT, further visually illustrated in Figure 1.

Overall in 2010, 3 regions had communities with a prevalence of ≥20% prevalence for trachoma, namely Katherine, Barkly and Alice Springs. Table 2 demonstrates that 21 communities in Alice Springs remote region reported a prevalence ≥20% and overall (Table 3) 32% of children aged 1-9 years living in that region had active trachoma.

Prevalence per age group in the NT

As can be seen from Figure 2, the highest burden of disease is in the southern regions of the NT. However the number screened is likely to be inaccurate, as young children do not attend school and are difficult to screen and older children are often sent away to high school or no longer attend school. The prevalence of trachoma in the children screened in the 1 – 9 year age group in Barkly, Katherine and Alice Springs Remote is above 20%. The total numbers are small, but Figure 2 demonstrates the high burden of disease particularly in the Alice Springs remote region. Children residing in the town camps in Alice Springs were not screened.

Clean faces are assessed as part of the screening process and Figure 3 shows that the majority of children have clean faces on assessment.

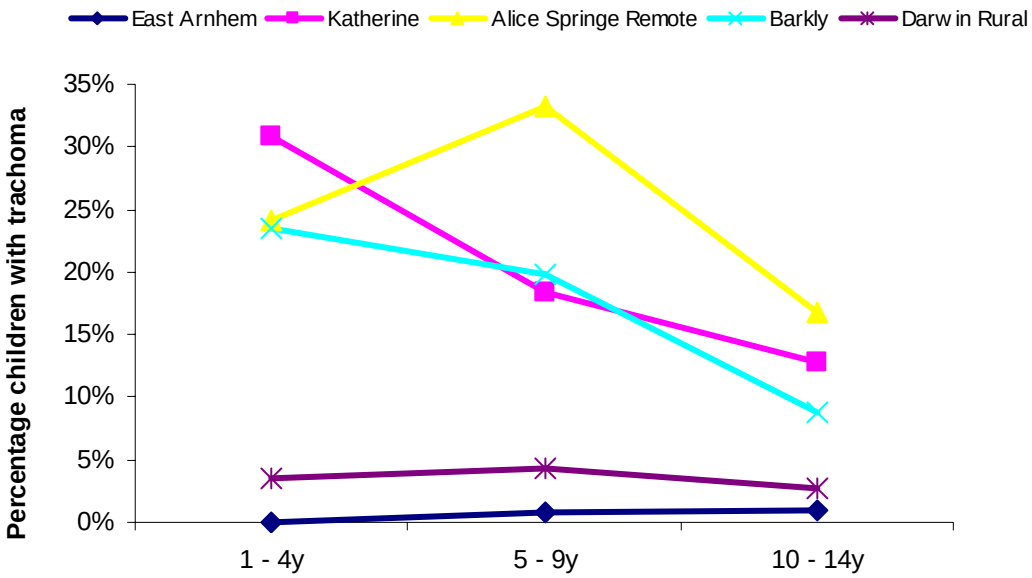
Table 2. Number of communities with percentage prevalence of trachoma in 2010

	Total Number of communities	<5% prevalence	5-<10% prevalence	10-<20% prevalence	≥20% prevalence
Alice Springs remote	**27**	1	2	3	21
Barkly	**5**	1	2	0	2
Katherine	**10**	3	2	1	4
Darwin rural	**16**	10	5	1	0
East Arnhem	**7**	7	0	0	0
Totals	**65**	**22**	**11**	**5**	**27**

Table 3. Prevalence of trachoma in children by region aged 1–9 years by region in the NT 2006-2010

	2006 N (%)	2007 N (%)	2008 N (%)	2009 N (%)	2010 N (%)
Alice Springs remote	530 (18)	231 (20)	459 (34)	586 (33)	722 (32)
Barkly	105 (21)	68 (26)	87 (67)	64 (44)	163 (20)
Katherine	218 (30)	562 (19)	732 (39)	506 (13)	419 (20)
Darwin rural	522 (16)	377 (7)	907 (20)	877 (2)	1086 (4)
East Arnhem	879 (3)	465 (5)	232 (4)	250 (1)	422 (1)
NT	**2254 (13)**	**1703 (13)**	**2417 (29)**	**2283 (14)**	**2812 (14)**

Figure 2. Prevalence of active trachoma by age and region in the NT 2010



Trachoma treatment

Once diagnosed with active trachoma (TF or TI), according to the NT Guidelines[4] a single dose treatment of azithromycin is given with the aim being for 100% treatment coverage. According to the trachoma database statistics, only 40 % of children identified with trachoma received treatment. There were regional variations in the level of treatment (see Figure 4).

Contact tracing

In 9 communities only the identified trachoma cases were treated and the contacts were not treated, Figure 5 shows that across all age groups where contacts were treated, only 19% of identified contacts were treated within the recommended 2 week period.

There was considerable regional variation in timeliness to treatment with the mean time varying from 8 days to 56 days.

Trichiasis screening

Overall screening for trichiasis in the adult population according to the database was not done outside of Alice Springs Remote region. In this region, only 18 communities conducted screening and in total only a small number (221) adults were screened. No trichiasis was found, however 7 people were referred for an ophthalmological consultation where 2 adults were each found to have had surgery for trichiasis in the past year.

Discussion

The results from the 2010 screening are very similar to the 2009 data[6]. More children were screened in 2010 with the overall prevalence of trachoma remaining at 14% (Table 3). This

Figure 3. Trachoma prevalence in 1 – 9 year old screened children in the NT 2010

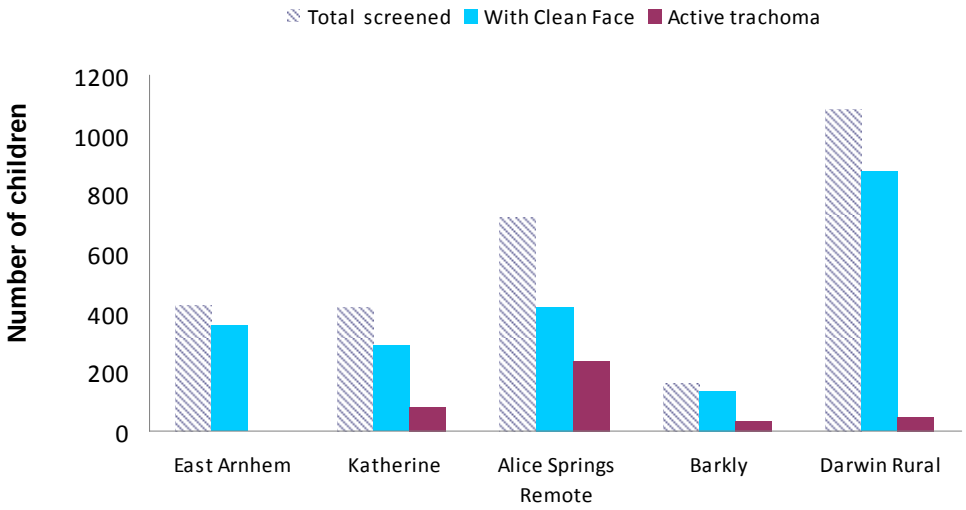
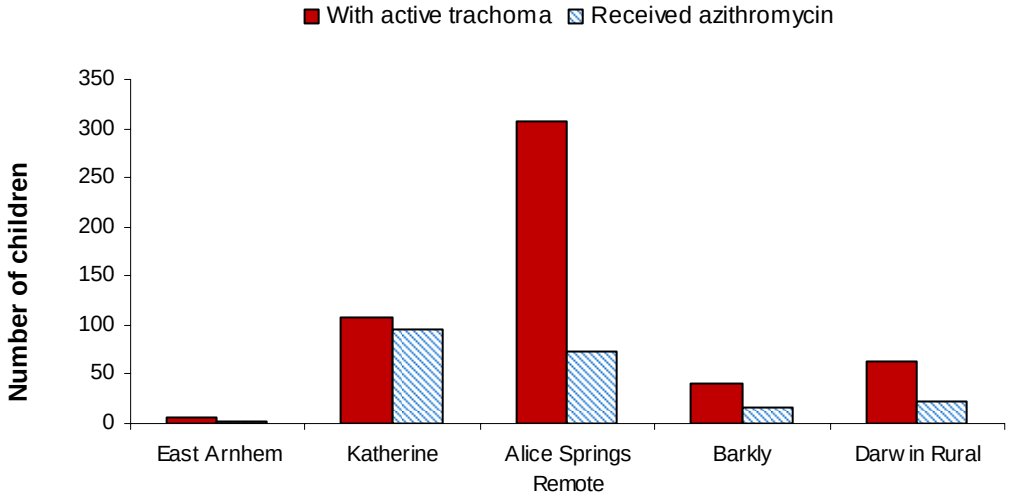


Figure 4. Number of children aged 1 – 15 years with active trachoma who received treatment NT 2010



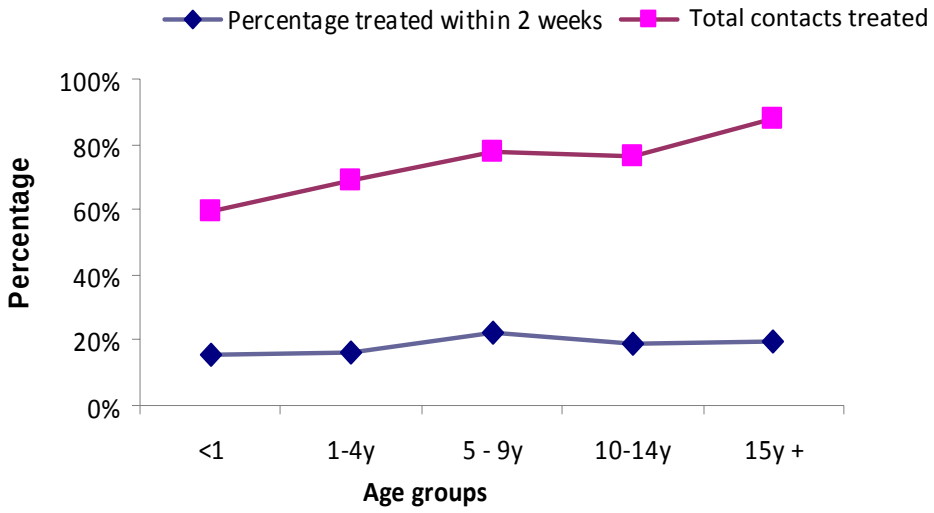
overall increase in number of children screened compared to the previous years perhaps reflects increased funding and resources in the Trachoma Program. The NT Guidelines[4] stipulate that a minimum of 80% of children in the target group should be screened and with 40% screened, this target was not achieved. The data from previous years is not complete as the federal intervention which screened children in 2007 – 2008 was not included in the national reporting.

It is clear that the screening data represents only the proportion of children in the NT who attend school. As screening is currently an annual event, many 'missed opportunities' to screen children remain. The prevalence documented is only for children who attended school on that particular day.

Once a community has attained a prevalence of >10% of trachoma then the NT Guidelines[4], recommend a community based treatment approach modified only if there is obvious clustering. Once 20% is reached, then a whole of community approach with possible repeated treatment in 6 months is recommended.

Figure 3 shows that while the majority of children did have clean faces on assessment they did not attain the 100%, as required in the Guidelines.[4] This is no doubt a result of school activities encouraging

Figure 5. Treatment rates of contacts and timeliness across age groups in the NT 2010*



*There were 4 communities that re-treated over the time period. The second treatment was excluded.

clean faces and blowing noses to start school. In addition the graph shows that Alice Springs has the greatest burden of disease, perhaps reflecting the dusty environment.

The NT and CDNA Guidelines[4,5] recommend treatment of all household contacts as a minimum to reduce the disease burden and minimise the risks of ongoing infection however 9 communities treated only the identified trachoma cases and did not treat the contacts. The CDNA Guidelines[5] state that treatment of contacts should occur within 2 weeks; however as can be seen in Figure 5, across all age groups, only 19% of identified contacts were treated in a timely fashion. There was considerable regional variation in timeliness to treatment (varying from 8 days to 56 days) which extends well beyond the NT and CDNA Guidelines[4,5] (Table 4).

Trichiasis screening and surgery is another mainstay of the trachoma program. Early detection of trichiasis is required for the best results from surgery. Limited trichiasis screening reduces this preventive potential.

In 2009 it was estimated that only 20.4% of children in at risk areas were screened and in the current trachoma 2010 data only 40% of the target population were screened. It is difficult to make generalisations based on such low coverage, however this has been a limitation in all previous annual reports, and this bias is acknowledged. Screening small numbers of children annually with a large selection bias, namely the ones that come to school does not truly represent the trachoma prevalence in the community.

Diagnostic dilemmas

Trachoma diagnosis is a clinical diagnosis, based on the WHO grading system and has its

Table 4. Timeliness to treatment for trachoma contacts

	Number of communities	Communities with trachoma	Mean time to treatment (days), CI 95%
Alice Springs Remote	**27**	17	42 days, CI(20, 64)
Barkly	**5**	2	8 days (1, 15)
Katherine	**10**	4	6.25 days, CI (1, 12)
Darwin Rural	**16**	6	56 days, CI (9, 103)
East Arnhem	**7**	2	No treatment

limitations.[1] Screeners must be trained in order to make the correct diagnosis. This further limits the screening and monitoring ability in the NT. There are no doubt cases missed, as infection can be subclinical and young infants and toddlers can be difficult to examine. Alternatively people who have been treated or whose condition has resolved and are no longer infectious may still have follicles present and be counted at the time of examination. Recent research performed in the NT reviewed the use of the WHO clinical diagnostic tool, versus polymerase chain reaction (PCR) versus a point of care test (field based rapid diagnostic test).[8] Michel et al[9] had already demonstrated that a field test may be of use in Tanzania but it was further tested in the NT[8] where it was shown that the point of care testing and PCR antigen tests were poor predictors of disease.[8] The authors[8-9] concluded that there was little benefit in a low prevalence setting using this as an alternative tool for screening. These tests were not assessed as useful in the NT and as yet there is not a sufficiently sensitive or specific laboratory tool for trachoma screening.

Treatment concerns

Overall according to the database only 40% of children diagnosed were treated for trachoma. There may be a number of reasons why this number is so low. Children may well have been treated later in the screening process but not documented on the screening sheet, as screening is based at schools not clinics and the onus for follow up is on the clinic. This would therefore represent a flaw in the current data collection system and may not reflect reality.

The NT Trachoma Program 2010 results have demonstrated the endemicity of trachoma. The fact that it remains consistent with previous years demonstrates that trachoma remains a public health problem and the current approach needs modification. Where populations are so mobile, it is surprising that a town like Alice Springs, a hub for central Australian communities, is not included in trachoma programming. As the prevalence in the remote communities is higher than 20% a mass treatment program for the region would appear indicated. This is recommended by the WHO.

The NT Guidelines[4] mention in hyperendemic (>20% prevalence) communities the need to retreat after 6 months, but do not specify which part of the community. As yet this is not being followed by the NT community health centre and trachoma health staff. While the prevalence data may be questioned as a low number are screened, the fact remains that the traditional reactive approach (screen then treat) is clearly not working.

The Guidelines[4,5] state that all household contacts should be treated with a single dose of azithromycin. Ideally treatment of contacts should occur on the same day, as reinfection could occur rapidly as the treated case goes home. The CDNA Guidelines[5] state that this should preferably be done within 2 weeks, as reinfection of the treated case is highly likely. Overall 81% of contacts were treated with only 19% treated in a timely manner which is not achieving the target set. In the Alice Springs remote region it took on average of 6 weeks to treat families. Mathematical modelling of trachoma by Gambhir et al[10] demonstrates that the mean duration of infection after multiple prior infections is 2.8 months. If there is poor identification of contacts initially and infection persists for long periods, those treated may well get reinfected before all their identified contacts are treated. To reduce the disease burden in the community it would appear that a broader approach is needed.

Contact tracing in remote communities can be difficult due to a number of reasons including logistical issues (available staff and transport), residence identification and cultural language barriers. Engagement with the community health leaders is critical to ensure this is as complete as possible. Many children would no doubt have several houses they call home as extended family members provide care.

Currently trichiasis screening is included as part of the Trachoma Program. With such low numbers of trichiasis actually included in the dataset, perhaps energies could be used elsewhere to better serve the population. The need or desire to document the burden of trichiasis however is acknowledged and clearly to treat trichiasis it must first be found. This highlights the resources required for all aspects of trachoma control.

Ways forward

Current changes to the database including real-time web-based live updating is certainly a move in the right direction in trachoma documentation. It is important however that electronic linkages with primary health care systems that document follow up (treatment and surgery) be enabled to ensure the data is more accurately and efficiently collected. Without such linkages, the data cannot be interpreted adequately to inform health providers and policy developers as to what is needed for trachoma control and eventual elimination.

There is much discussion in the literature regarding who to treat and how often. Mathew et al[11] advocates a biannual treatment to reduce prevalence. This has been achieved by Melese[12], in hyperendemic regions in Ethiopia where 90.8% of the population were treated biannually achieving a drop in disease prevalence from 31.6% to 0.9 % over a 24 month period. To achieve GET 2020 for the NT a mass regional treatment program for Alice Springs, Barkly and Katherine seems indicated. Ewald et al[13] advocate for a region-wide approach to trachoma control in Central Australia. There seems little point in screening as the problem is clear. The logistical resources and political will needed to do this is significant. It would also have to include the Indigenous populations in the Alice Springs town camps as well the communities that live close to the border in South Australia and Western Australia that use Alice Springs as their regional focus. It appears that without a harmonised, multi-jurisdictional approach trachoma is going to remain endemic.

A pragmatic approach would be one where there is suspension of annual school screening for trachoma and everyone in the community and region (age regardless) would be treated with azithromycin 6 monthly for 2-3 years and then screening could be recommenced. There would have to be discussion regarding risks of azithromycin resistance. A 'Trachoma Treatment Day', with the aim to treat 95% of the population, would vastly reduce the disease burden. At the same time work on vector control, particularly for bush flies which are known carriers of the trachoma causing organism as discussed by Hu et al,[14] should include flyscreens on all housing, better waste management and vector spraying to further reduce the disease burden.

The development of molecular field based tools in the future will assist in the diagnostic issues of trachoma, particularly for infants, who can be reservoirs for infection. The CDNA Guidelines[5] do support the use of nucleic acid and DNA testing as part of quality control programs, but not for population level screening. Validated point-of-care testing for trachoma would vastly change trachoma control in Australia and would be a very welcome testing addition.

It remains to be seen whether specific trichiasis screening should be part of the current trachoma program or should be incorporated into the older persons health check. The current specific trichiasis dataset is very incomplete. Incorporation into an adult annual health checks may better capture this information. Older people should always be included in mass treatment programs.

Conclusions

To achieve lasting trachoma control the government and wider society need to address the social determinants of health (education, overcrowding, poor public housing and poverty) which fuel ongoing community transmission. This takes time and there are studies to support that direct reduction of disease burden is required while other more complex programs continue to develop and evolve.

To achieve GET 2020 (which is only 9 years away) and eliminate trachoma, Australia will have to demonstrate a significant commitment of time and resources. Australia, being the last developed country with a trachoma burden, does have adequate health resources to be able to eliminate trachoma. To achieve GET 2020 a multi-jurisdictional approach focussing on treatment, will be the way to eliminate trachoma. Simply screening without the commitment and resources to treat is fruitless. Elimination of a preventable cause of blindness in Australia in the 21st century is possible with the full commitment of government and civil society.

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Editorial: Update on NT trachoma program

In February 2009, the Australian Government announced new funding to "eliminate blinding trachoma within a finite time frame." The Northern Territory (NT) has entered into a Funding Agreement with the Australian Government via the Office for Aboriginal and Torres Strait Islander Health (OATSIH) for $3.4M to 31 December 2011. This funding is being used to implement the NT Trachoma Strategy which was developed in partnership with the Aboriginal Medical Services Alliance Northern Territory (AMSANT) and $1.25 million of this funding has been directed to the Aboriginal Community Controlled Sector.

Trachoma Control measures across the NT have been expanded significantly during 2010 and 2011. The Trachoma Strategy NT has committed funding to the following organisations to support trachoma control measures:

- Central Australian Aboriginal Congress
- Anyinginyi Congress Aboriginal Corporation
- Katherine West Health Board
- Sunrise Area Health Service
- Wurli Wurlinjang Health Service
- Centre for Disease Control Dept of Health NT.

Currently there are 9 (2 casual) positions working directly on trachoma control measures across the NT. These include public health nurses, health promotion officers, trachoma education and training co-ordinators and trachoma data managers. A further 4 positions are under negotiation and are expected to on board by the end of 2011. There are also several trachoma positions funded through grant provision to other organisations and associated health care providers contribute to trachoma control.

In most communities trachoma screening is conducted as part of Healthy School Aged Kids Screening program which is conducted annually. trachoma treatment programs are conducted with support from Trachoma Strategy funding. In communities were trachoma prevalence is over 20%, community wide treatment with antibiotics is being planned on a 6 monthly basis whereas previously this could only be offered annually.

Health Promotion measures have been enhanced due to new clean face resources. In August 2010, Hon Warren Snowden, launched the Trachoma Story Health Promotion Kits which were developed by Katherine West Health Board and the Indigenous Eye Health Unit in collaboration with the Department of Health Trachoma Program. These kits promote "Clean Face Strong Eyes" health promotion message. These kits have been rolled out to all remote Community Health Centres, Schools and Child Care Centres.

The Strategy is supported by the Trachoma Strategy Advisory Group and the Trachoma Strategy Working Group and reports to the Northern Territory Aboriginal Health Forum.

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Elimination of infectious syphilis in the Northern Territory Are we ready for it yet?

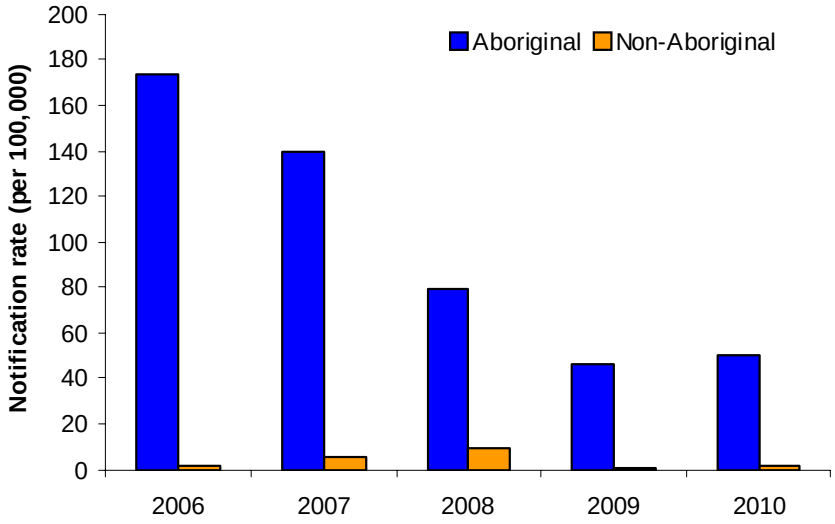
Jiunn-Yih Su, Nathan Ryder and Jamie Broadfoot, CDC, Darwin

Abstract

In the Northern Territory (NT), infectious syphilis is predominantly a disease diagnosed in the Indigenous population. The notification rate of infectious syphilis for the NT Indigenous population has declined by 70.8% between 2006-2010, from 173.4 to 50.7 per 100,000. In 2010, there was on average less than 10 cases diagnosed per district. It is believed that the notification rate has reached an adequately low level that it is appropriate to consider working towards the elimination of this infectious disease. This paper describes both the changing epidemiology of syphilis and the theoretical and practical requirements for an elimination program. An action plan is proposed for the NT to consider in order to achieve the elimination of infectious syphilis in the NT.

Key words: Infectious syphilis; Indigenous; disease elimination

Figure 1. Notification rates of infectious syphilis by ethnicity, NT, 2006-2010



Introduction

Syphilis was an extremely common infection in Australia from the 18th century until only a few decades past, but in recent years numbers of new infections have decreased significantly.[1] In fact, syphilis has been virtually eliminated from the general population of Australia. Only 2 Australian populations continue to be affected by syphilis in the 21st century, namely, those residing in remote Indigenous communities and urban homosexual men.[1-2] The National Gay Men's Syphilis Action Plan was initiated in November 2009 to address the epidemic among homosexual men. However, there are currently no co-ordinated national or regional plans to address syphilis among Indigenous people despite specific mention in the *Third National Aboriginal and Torres Strait Islander Blood Borne Viruses and Sexually Transmissible Infections Strategy 2010-2013.*[3]

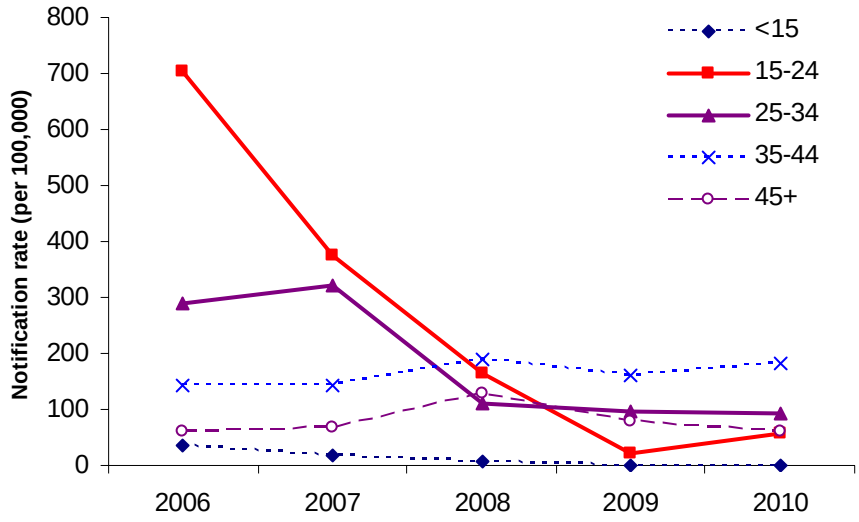
During the period 2006 – 2010 there was a 70.8% reduction in the syphilis notification rate from 173.4 to 50.7 per 100,000 (Figure 1) among Northern Territory (NT) Indigenous residents. Indigenous people contributed the overwhelming majority (91.5%) of infectious syphilis cases in the NT. The majority of the rate reduction in the Indigenous population occurred in the 2 most at-risk age groups, namely, the 15-24 and 25-34 year age groups (Figure 2). This decreasing trend has also been noted nationally between 2005 and 2009 as reported in a recent study, prompting the authors to suggest the elimination of infectious syphilis among Indigenous Australians is feasible.[4] This paper will discuss the plausibility of eliminating infectious syphilis in the NT and outline what steps would be required to achieve this.

Elimination of infectious syphilis in the NT: Is it plausible and worthwhile?

Untreated syphilis causes serious multi-organ disease in around one third of those infected. Women transmit syphilis to their children in-utero causing high rates of foetal loss or the severely destructive consequences of congenital syphilis infection. While these factors alone make the elimination of syphilis worthwhile, the social implications for a population affected by a stigmatizing sexually transmitted infection that is virtually unknown in the general population, should not be underestimated.[5]

A basic understanding of some clinical features is needed when considering elimination. Syphilis is highly infectious in the early stages but relatively non-infectious after 1 year and virtually never sexually transmitted after 2 years. As the signs and symptoms of early syphilis are generally mild, painless and self-limited in men and totally unapparent to women, patients often do not seek medical attention during the infectious period and therefore treatment does little to prevent spread.

Figure 2. Age-specific notification rates of infectious syphilis for the Indigenous population, NT, 2006-2010



What is elimination and what is required?

The elimination of infection has been defined as a 'reduction to zero of the incidence of infection caused by a specific agent in a defined geographical area as a result of deliberate efforts; continued measures to prevent re-establishment of transmission are required'.[6] In order to achieve elimination, efforts are required to reduce the number of new diagnoses to zero. To do this a defined area must be chosen and ongoing measures to detect imported cases are needed to prevent reintroduction.

To achieve the elimination of infectious syphilis in the NT the following 3 criteria must be met:

1. An effective intervention needs to be available to interrupt the transmission of the infectious agent:
   - Highly effective single dose treatment for early infectious syphilis is universally available and cost effective in the form of benzathine penicillin.
2. Practical diagnostic tools with sufficient sensitivity and specificity need to be available to detect levels of infection that can lead to transmission:
   - The mainstay of syphilis diagnosis in the NT is serology. Syphilis serological tests are well established and allow accurate diagnosis of new cases during the early infectious stages. Diagnosis of re-infection is more difficult, with clinical expertise and previous testing and treatment information required. The NT Syphilis Register provides clinicians with access to information and expertise to improve management and surveillance of syphilis. As most transmission occurs within the first year after infection, annual serological screening is unlikely to prevent transmission. Nucleic acid or PCR-based direct detection of the syphilis spirochete from the clinical manifestations of early syphilis provides another means of both diagnosing and accurately staging early cases. Current practices rely on recognition of lesions therefore limiting the number of cases detected. The use of PCR as a screening test for females has been proposed as a potential means of overcoming this limitation.[7] As syphilis becomes increasingly rare, screening at a sufficient frequency to detect infectious cases will become less and less efficient.
3. Humans are essential for the life-cycle of the agent, which has no other vertebrate reservoir and does not amplify in the environment.
   - There is no known non-human reservoir of syphilis.

Public health and human resources considerations

The elimination of infectious syphilis is technically plausible. The public health benefits of eliminating syphilis are clear. Congenital

syphilis is a priority of the World Health Organization and the control of syphilis in the population is now recognised as critical in achieving this goal. We believe the current epidemiology of infectious syphilis in the NT indicates that elimination could be achieved with limited additional resources. The current incidence of infectious syphilis cases has decreased to a low and manageable level. Two examples can be used to illustrate this point. Firstly, in 2010 there were 10 or less new notifications of infectious syphilis per district in the NT and an internal review found a high proportion of notified cases might not be true cases. The effect of this difficulty in accurately defining infectious cases is clearly shown by the failure of rates to decline in people over 34, who now account for the majority of all notified cases (Figure 2). The second example concerns a recent outbreak in Tennant Creek which occurred in early 2011. A multidisciplinary outbreak management team was formed by the existing staff of the Centre for Disease Control and due to efforts to enhance syndromic management, actively locate and treat sexual partners and improve screening rates, the outbreak was contained.

An action plan for the elimination of infectious syphilis in the NT

We believe that with such low incidence the current infrastructure and personnel in the NT are adequate to conduct ongoing surveillance and achieve effective control of infectious syphilis.

The following points are necessary to achieve the elimination of infectious syphilis in the NT.

- Effective and efficient surveillance: rapid identification and reporting of suspected infectious syphilis cases by clinicians and other providers; establishing a 'probable' category to capture cases that are likely to be infectious but do not meet the surveillance case definition.
- Prioritising the treatment and contact tracing for infectious syphilis cases.
- Ongoing and regular education and training for clinicians to improve case-detection and case-management through syndromic management and screening of those at high risk.
- Provision of outreach services to identify suspected cases among marginalized populations that rarely access services at established health care facilities.
- Ensuring the inclusion of syphilis testing in antenatal screening tests.
- Maintaining the services provided by the Syphilis Register and expanding the operators' role in detecting and responding to infectious cases.
- Establishing a Northern Australia regional collaboration with northern Western Australia and Queensland in controlling infectious syphilis.
- Developing an outbreak response plan to establish readiness for outbreak containment.

Conclusions

The elimination of a sexually transmitted infection is not easy, although the donovanosis elimination success shows that at least with some STIs it is achievable. Syphilis elimination will be more difficult, due to a higher transmission rate over a shorter and less symptomatic period. However, the annual number of notifications of infectious syphilis is currently less than half that of donovanosis when the eradication project commenced, decreasing the resources required. Now is the time to turn the focus of our response to syphilis from treatment to elimination.

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Change to Northern Territory (NT) Childhood Immunisation Schedule to introduce 13 valent pneumococcal vaccine 1 October 2011

Background

The *Northern Territory (NT) Childhood Vaccination Schedule* will change on 1 October 2011 to reflect the introduction of a new 13-valent conjugate Prevenar13® (13vPCV).

Prevenar13® will replace Synflorix®, the 10-valent conjugate pneumococcal vaccine that has been administered throughout the NT since October 2009.

Prevenar13® (13VPCV) includes the 10 serotypes contained in Synflorix® and provides additional protection against 3 other serotypes – 3, 6A and 19A.

The NT has notified about 2 cases of invasive pneumococcal disease caused by type 3, 6A or 19A per year in under 2 years olds in the past 3 years.

Prevenar13® has been administered as part of the *National Immunisation Program* (NIP) at 2, 4 and 6 months of age throughout the rest of Australia since July 2011.

Who will receive Prevenar13®?

From October 1 2011, Prevenar13® will be offered routinely to all children in the NT at 2, 4 and 6 months of age. Due to high rates of disease in this group, all Indigenous children will also receive an additional dose of Prevenar13® at 18 months of age.

In the transition to Prevenar 13® all children who have only received doses of Synflorix® (10vPCV) or Prevenar7® (7vPCV) at 2, 4 and 6 months of age will be offered a single dose of Prevenar13® at 18 months of age.

Any child who is under 5 years of age and has an underlying medical condition that may predispose them to invasive pneumococcal disease (IPD) should receive an additional dose of Prevenar 13® at 12 months of age.

A new immunisation schedule effective from 1 October 2011 will be available at http://health.nt.gov.au/Centre_for_Disease_Control/Immunisation/index.aspx.

Hard copies are available from regional Centre for Disease Control units and will be mailed out to all vaccine providers.

Vaccine information

Prevenar13® is issued as a single pre-filled syringe for intramuscular use in children less than 2 years of age. It should be protected from light and stored at between 2-8°C.

The side effect profile of Prevenar13® is similar to Synflorix®. Injection site erythema, pain and tenderness, fever, poor appetite and restlessness are common.

There may be a small increased risk of fever/ febrile convulsions with the co-administration of trivalent influenza and pneumococcal conjugate vaccines in children 12-35 months of age. The Australian Technical Advisory Group on Immunisation (ATAGI) advise that these vaccines may be given together and that providers discuss this risk with parents prior to administration of 13vPCV. If there are strong parental concerns, these vaccines can be administered separately using an interval of at least 3 days between each.

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Northern Territory Government

Effective from 1 October 2011

Childhood Vaccination Schedule

healthy Territory
A Territory Government initiative

	Hepatitis B	Rotavirus	Diphtheria Tetanus Pertussis Hepatitis B Poliomyelitis Haemophilus influenzae type b	Conjugate Pneumococcal (13vPCV)	Haemophilus Influenzae type b	Measles Mumps Rubella	Meningococcal C	Hepatitis A	Polysaccharide Pneumococcal	Varicella	Diphtheria Tetanus Pertussis Poliomyelitis	Human Papillomavirus	Adult Diphtheria Tetanus Pertussis
	Engerix B™ 0.5ml IMI	Rotarix® 1.5ml ORAL	Infanrix®Hexa 0.5ml IMI	Prevenar 13® 0.5ml IMI	Hiberix® 0.5ml IMI	Priorix™ 0.5ml IMI	NeisvacC® 0.5ml IMI	VAQTA® 0.5ml IMI	Pneumovax23® 0.5ml IMI	Varilrix® 0.5ml SC	Infanrix®IPV 0.5ml IMI	Gardasil® 0.5ml IMI	Boostrix® 0.5ml IMI
Birth ●	✓												
2 months*		⊸● ✓	✓	✓									
4 months		⊸● ✓	✓	✓									
6 months			✓	✓									
12 months					✓	✓	✓	■					
18 months				▲				■		✓			
4 years*						✓					✓		
12 years												♀♀♀	
13 years										◆			✓
15 years									■				

Vaccine notes:

✓	=	All children.
●	=	BCG for all Indigenous newborns, newborns who will live in Indigenous communities, newborns of overseas born parents from high tuberculosis (TB) countries who will be going back for extended visits and newborns of families who have been treated for leprosy. Hepatitis B Immunoglobulin for all newborns of Hepatitis B surface antigen positive mothers.
*	=	All vaccines due at 2 months can be given from 6 weeks of age. All vaccines due at 4 years can be given from 3 years and 6 months of age.
⊸●	=	ORAL VACCINE: first dose must be given by 14 weeks and 6 days of age; second dose must be given by 24 weeks and 6 days of age.
▲	=	ALL Indigenous children AND Any non-Indigenous children who have previously received Synflorix (10vPCV) or Prevenar (7vPCV) and Synflorix (10vPCV) but NOT Prevenar13 (13vPCV).
■	=	Indigenous children only.
◆	=	If no history of previous disease or vaccination.
♀♀♀	=	Females only. Requires 3 doses given at 0, 2 and 6 month intervals.

www.healthynt.nt.gov.au

Information:

For more information contact your nearest Centre for Disease Control:

Darwin	8922 8044
Katherine	8973 9049
Barkly	8962 4259
Alice Springs	8951 6907
East Arnhem	8987 0357

Immunisation catch-up schedule for newly arrived refugees in the NT

Padmasiri Eswara Aratchige[1], Chris Nagy[1], Vanessa Johnston[1] and Catharine Kent[2]
[1]CDC, Darwin and [2]Darwin Refugee Health Service

Abstract

The Northern Territory (NT) Centre for Disease Control (CDC) is developing a NT refugee immunisation protocol to provide a coordinated approach to the assessment and delivery of immunisations for newly arrived refugees to the NT. The protocol aims to provide clarity around the roles and responsibilities of the NT Centre for Disease Control, the Darwin Refugee Health Service and, where utilised, to Community Care Centres or other General Practices (GP) providing refugee immunisation. Additionally it aims to outline a clear schedule for catch up immunisation for this target group, document and maintain record keeping while providing immunisation data on a regular basis (monthly) to the NT Immunisation Register at the NT Department of Health (DoH).

Key words: immunisation; catch-up, protocol; refugees

Background, aims and features

Vaccination while protecting individuals also protects others in the community by increasing the general level of immunity and minimising the spread of infection.[1] Newly arriving refugees comprise an important group of the population in this context. They often have no vaccination records or give an incomplete history of vaccination. Parental or self-recall of immunisations received in the absence of written records may be inaccurate.[2] The presence of a BCG scar is however evidence of BCG vaccination against tuberculosis (TB). Vaccination schedules of the refugees' countries of origin may also not match the Australian immunisation schedule and such scenarios may necessitate offering vaccines that differ from those vaccines that are currently funded by the Australian Government under the National Immunisation Program (NIP). The *Australian Immunisation Handbook*[1] provides clinical guidelines for health professionals on the safest and most effective use of vaccines. The Northern Territory (NT) and other jurisdictions have adapted the national guidelines and immunisation schedules.[3-6] Some jurisdictions have also implemented specific immunisation activities to cover newly arriving refugees and humanitarian entrants.[4-6] A comprehensive analysis and recommendations for a catch-up schedule of immunisation for newly arriving refugees has been developed by the Australasian Society for Infectious Diseases.[2]

Taking the above into account, the (proposed) NT refugee immunisation protocol aims to provide a coordinated approach to the assessment and delivery of immunisations for newly arrived refugees to the NT. The protocol aims to provide clarity around the roles and responsibilities of the NT Centre for Disease Control (CDC), the Darwin Refugee Health Service and where utilised to Community Care Centres or other General Practices (GP) providing refugee immunisation. Additionally it aims to outline a clear schedule for catch up immunisation for this target group, document and maintain record keeping while providing immunisation data on a regular basis (monthly) to the NT Immunisation Register at the NT Department of Health (DoH).

Roles and responsibilities

NT Immunisation Unit – Centre for Disease Control

The NT Department of Health via the Centre for Disease Control (CDC)

- Provides telephone advice on immunisation recommendations including due and overdue vaccines.
- Provides advice on vaccine procurement and vaccine storage.
- Assists in vaccine training via the About Giving Vaccines (AGV) course.
- Records vaccine information on the Northern Territory Immunisation Register (NTIR) and facilitate transfer of data to ACIR(Australian Childhood Immunisation Register) and

National Human Papillomavirus Register (HPV) if required.

- Provides data analysis (with notice).
- Assists in the investigation of adverse events following immunisation.

Refugee Health Service (RHS)

The role of the refugee immunisation provider at the Darwin RHS is to coordinate refugee immunisation services to:

- Promote vaccination to the target group.
- Use an interpreter during consultations as appropriate.
- Coordinate their own clinic vaccine ordering and delivery.
- Review the current immunisation status of new arrivals and develop a catch-up schedule according to the recommendations of the current *Australian Immunisation Handbook* and the tables included in this guideline.
- Administer all vaccines in a safe manner and in accordance with the recommendations of the current immunisation handbook.
- Maintain vaccines in accordance with the National Storage Guidelines Strive for 5.
- Provide documentation to the patient by way of a handheld record of the vaccines given and advice on when the immunisations are next due.
- Document that vaccines are given according to clinic protocols, enter relevant data in the refugee immunisation database maintained at the clinic and transfer all data to the NTIR for recording on the DoH database.
- Make appointments for individuals and family groups for follow up vaccination.
- Report any adverse event either to CDC and/ or the Therapeutic Goods Administration (TGA) and refer those requiring treatment to GP or Emergency Department (ED).

Immunisation catch-up schedule

The recommended catch-up immunisation schedules for newly arrived refugees in the NT facilities are summarised in Tables 1-4 (Please go to web link * at end of document). They were developed by adapting schedules suggested by the Australasian Society for Infectious Diseases[2] the *Australian Immunisation Handbook*,[1] NT immunisation schedules[3] and with expert input from the NT Immunisation Unit at the CDC. They are also structured in line with those produced in other states.[4-6] Each table is further articulated with supporting tables for ease of interpretation at the provider level if required to help in deciding on required vaccination based on the client's age at the time of the first visit.

Summary key points

- Always use the current *Australian Immunisation Handbook* for current recommendations and advice.
- Use every available opportunity to vaccinate children and adults.[1]
- For new arrivals, complete a 'primary course of immunisation' that matches the immunisation schedule of the NT. For information on NT immunisation please visit http://www.health.nt.gov.au/Centre_for_Disease_Control/Immunisation/index.aspx. A catch-up schedule will need to be created in many cases and guidance for spacing of booster doses can be obtained from the current *Australian Immunisation Handbook* pages 28-30 or by contacting CDC for advice.
- Where feasible always follow age-appropriate immunisation according to the standard NT vaccination schedule. See annex 3 (Please go to * web link at end of document). For instance if a child is born to a refugee family after arriving in Australia, hepatitis B vaccine can be given at birth and the rest of the vaccinations can be given according to the standard schedule without having to create a catch-up schedule.
- The immunisation catch-up schedules in Table 1-4 are for newly arrived refugees who have no documented vaccinations or provide a patchy history of vaccination (Please go to * web link at end of document for tables 1-4). They are arranged according to the age of the individual as a practical way of creating a catch-up schedule.
- A very important requirement for assessment of vaccination status is written documentation of vaccination. Verbal history may be unreliable.

- Please refer the *Australian Immunisation Handbook* for contraindications to immunisation and for dosing instructions. Adverse reactions are very rare with additional doses in individuals already immune for hepatitis B, varicella, polio and mumps/measles/rubella (MMR) vaccines. Diphtheria and tetanus containing vaccines may be associated with an increase in local and systemic reactions; if such reactions occur, review prior to giving further doses.
- Extra vaccine protection may be required in children with medical conditions such as those with anatomic or functional asplenia, HIV infection, chronic illnesses and haemoglobinopathies. Consult the *Australian Immunisation Handbook* or CDC in the NT for guidance on the vaccines required in such conditions.
- HPV vaccine is given to girls as part of a NT school based program at age 12 (Year 7). The RHS should not routinely administer this vaccine.
- Criteria for use of NT government funded vaccines that are FREE for refugees and humanitarian entrants are given in Annex 1 (Please go to web link * at end of document).

A worksheet for catch-up appointments (Annex 2) can be used to record and/or remind the provider as well as the recipient on the proposed schedule and the next dose/s to be given (Please go to web link * at end of document).

Additional information for vaccine providers

Tables are presented below by age groups for quick decision making on creating a catch-up immunisation schedule based on the age of the individual when first presented at the immunisation clinic.

The 1st visit refers to the day the first vaccinations are given.

Combination vaccines such as INFANRIX® Hexa can be used for the primary course of catch-up immunisation in children less than 8 years of age.

If the recommended intervals between doses are exceeded there is no need to recommence the schedule or give additional doses because the immune response is not impaired by such delay.

Some vaccines require extra doses in addition to the National Immunisation Program schedule or vaccine doses given earlier than required depending on the medical risk factor for an individual. Please see the current edition of the *Australian Immunisation Handbook*, 'Groups with special vaccination requirements' for further information.

*Web link http://www.health.nt.gov.au/Centre_for_Disease_Control/Immunisation/NT_Immunisation_Schedules/index.aspx (note this link will be available from late October 2011).

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A review of enteric disease in 2010 from the OzFoodNet perspective

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Abstract

In 2010 notifications for salmonellosis cases were higher than expected and higher than in previous years; however notifications for campylobacteriosis and shigellosis were lower than expected and lower than in previous years. During 2010, there were a number of foodborne outbreaks investigated that occurred in a variety of settings. There were also a large number of non-foodborne outbreaks and cluster investigations conducted this year.

Key words: Salmonellosis; Shigellosis; Campylobacteriosis; Outbreak; Cluster; Northern Territory

Introduction

In 2010 there were 843 notifications of foodborne or potentially foodborne disease in the Northern Territory (NT). This is 4% less than the 5 year mean (880) but 1% more than the previous year (832). Salmonellosis notifications account for 70% of the foodborne disease notifications in the NT, followed by campylobacteriosis notifications (21%) and shigellosis notifications (9%). All notification counts in this article are generated using the notification received date from the NT Notifiable Diseases System (NTNDS)*. There were 7 foodborne or suspected foodborne outbreaks, 14 non-foodborne outbreaks and 5 clusters investigated in 2010.

Salmonellosis

In 2010 there were 587 notifications of salmonellosis in the NT. This represents a 26% increase in comparison to the 5 year mean (466 cases) and a 14% increase compared to the previous years number of notifications (516). The overall rate of salmonellosis cases was 256 per 100,000. The median age of salmonellosis cases was 2 years (range 0 – 85 years; mean 16.7 years).

The highest rate of disease was seen in the 0-4 year age group, with a rate of 1732 cases per 100,000 (n=325 cases). The rate of salmonellosis in the Indigenous and non-Indigenous populations was similar, with (269 vs 222 cases per 100,000; rate ratio 1.2). In the 0-4 year age group, the rate of disease is similar with 1712 cases per 100,000 in the non-Indigenous population and 1577 cases per 100,000 in the Indigenous population.

The serovar with the highest number of notifications was *Salmonella* Virchow (n=66) followed by *Salmonella* Ball (n=63), *Salmonella* Saintpaul (n=63) and *Salmonella* Typhimurium (n=55) In the past, *S.* Ball and *S.* Saintpaul were the most commonly reported serovars in the NT, with these 2 serovars thought to have established an ecological niche in the NT.

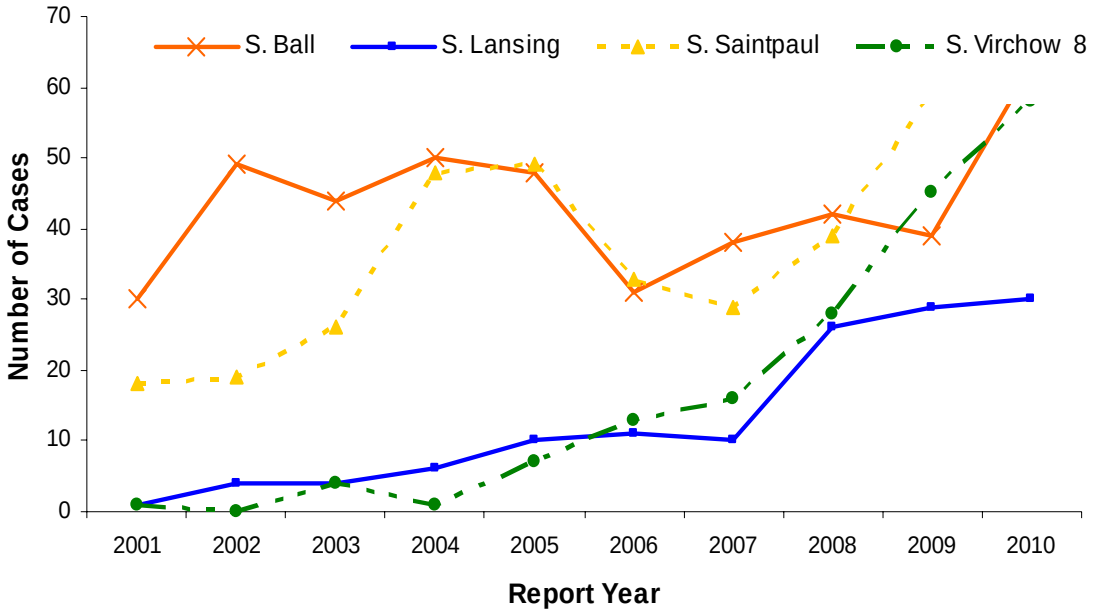
The prevalence of *S.* Virchow has been increasing over the last few years (Figure 1). The number of reported cases this year was over 2.5 times expected based on the 5 year mean (FYM) (66 cases vs 26 FYM) and 22% more than the previous year (54). Of the *S.* Virchow isolates reported this year, the majority were *S* Virchow phage type 8 (88%, 58 of 66 isolates) with the remainder being sporadic cases of various other phage types, or no typing data available (n=1). There were 2 clusters and 1 outbreak of *S.* Virchow 8 cases investigated this year.

The number of cases of 'environmental' *Salmonella* serovars was also higher than expected in 2010. Reported case numbers for *S.* Saintpaul were 51% higher than expected (63 compared to the FYM of 42). Case numbers of *S.* Ball were 59% greater than expected (63 compared to the FYM of 40) and case numbers of *S.* Lansing were 74% greater than expected (30 compared to the FYM of 17).

There were a variety of different phage types of *Salmonella* Typhimurium reported in 2010 in the NT. These included *S.* Typhimurium 108 (15 cases) and *S.* Typhimurium 135A (10 cases). There was 1 small cluster of *S.* Typhimurium 135A cases (n=7) investigated.

* The figures quoted in this article may differ from those documented elsewhere for 2010 due to differences in data extraction and the dates used for reporting, where typically date of diagnosis has been used elsewhere.

Figure 1. Case notifications of selected *Salmonella* serovars in the Northern Territory, 1992-2010



Campylobacteriosis

In 2010 there were 173 notifications of campylobacteriosis in the NT. This is 48% less than last year (214) and the expected 256 cases (FYM). The overall rate of campylobacteriosis was 75 cases per 100,000. The median age of campylobacteriosis cases was 22 years (range 0 –89 years; mean 25 years). Speciation of *Campylobacter* isolates is not routinely done by NT laboratories and the majority of isolates (97%) were reported as *Campylobacter* species (not further specified).

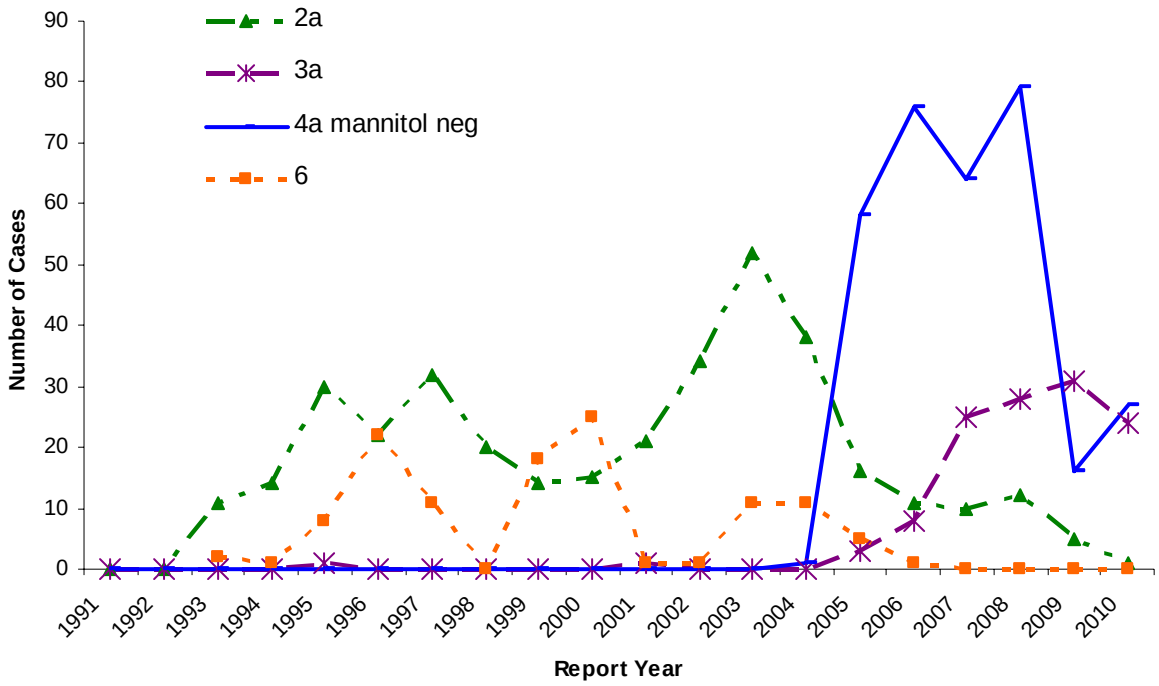
There was little difference in the rate of disease in the Indigenous and non-Indigenous populations (68 vs 61 cases per 100,000; rate ratio 1.1). The highest rate of disease was seen in the 0-4 year age group with 256 cases per 100,000. There was a significant difference between the Indigenous and non-Indigenous rates in this age group. In this age group, the rate of disease in Indigenous children was 425 cases per 100,000 compared to 105 cases per 100,000 in non-Indigenous children (rate ratio=4, p=0.044).

Shigellosis

In 2010 there were 80 notifications of shigellosis reported in the NT. This number of cases is 48% less than the 5 year mean (153 cases) and 16% less then the number of notifications received in 2009 (95). The overall rate of shigellosis was 35 cases per 100,000 population. The median age of cases was 8.5 years (range 0-71; mean 20.4 years). Shigellosis is more commonly reported in the Indigenous population. The rate of disease in the Indigenous population was 94 cases per 100,000 compared to 9 cases per 100,000 in the non-Indigenous population, with a rate ratio of 10. This difference is more pronounced in the 0-4 year age group, with the rate ratio being 14 (400 vs 29 cases per 100,000).

The most commonly reported species of *Shigella* was *Shigella flexneri* (57 cases) followed by *Shigella sonnei* (21 cases). The most commonly reported biotype was *S. flexneri* 4a mannitol negative (27 cases) followed by *S. flexneri* 3a (24 cases). *S. flexneri* 4a mannitol negative has been emerging as the most commonly reported biotype in recent years. The most commonly reported biotype of *S. sonnei* was *S sonnei* biotype a (17 cases). When a selection of the more commonly notified biotypes is examined it is possible to see that biotypes such as *S. flexneri* 6 and *S. flexneri* 2a are declining in number, while S. *flexneri* 4a mannitol negative and *S. flexneri* 3a have emerged in increasing numbers over the last several years.

Figure 2. A selection of *Shigella flexneri* biotypes in the Northern Territory, 1991-2010



Outbreak and cluster investigations

In 2010 there were 7 foodborne or suspected foodborne outbreaks investigated. Norovirus was implicated as the etiological agent in 2 outbreaks, *Salmonella* Virchow PT8 was implicated in 1 outbreak, and the agent was unknown in the remaining 5 outbreaks. The settings exposed for the outbreaks were varied and included restaurants (2), schools (1), workplace functions (1) and institutional settings (1). Some outbreaks occurred where cases were exposed in multiple possible settings (2).

An outbreak amongst attendees of 2 conferences held at a hotel was investigated in June 2010. Cases were identified from 2 different groups of attendees that shared a common menu on 1 particular day. Food was prepared at the hotel. A cohort study was performed but did not identify a vehicle of infection. One case was tested and returned a positive result for Norovirus. It is thought that widespread contamination of food(s) or the environment at the functions could have occurred from a food handler, staff member or attendee of the function.

An outbreak in a school holiday care program was investigated in July 2010. The holiday care program was for school aged children. The food for the children was prepared in the school kitchen and served in the centre where the program was being run. The epidemiology was suggestive of a point source foodborne outbreak. The etiological agent was unknown but suspected to be viral. No clinical specimens or food samples were collected.

An outbreak connected to a rally drive held across the Top End of the NT was investigated in August. Of the 105 participants, 62 reported illness characterised predominantly by diarrhoea only. Food was purchased or consumed in a variety of different settings. The etiological agent was unknown; of the 5 clinical samples submitted – no common pathogen was identified. *S.* Lansing was isolated from 1 case specimen, rotavirus was reported from another case specimen. The isolation of *Hafnia alvei* from 2 samples was of interest.[1] Food samples were negative. No formal epidemiological study was undertaken.

An outbreak of *S.* Virchow PT8 was investigated in a family of 6 persons travelling in the NT

in August. The family had been travelling via caravan and prepared their food on the road and at camp sites, but were also eating at restaurants and a private residence. All 6 family members became ill at the same time; *S*. Virchow PT8 was detected in all 4 of the stool samples submitted. The vehicle was not identified.

In September 2010 an outbreak of mild gastroenteritis at an alternative place of detention was investigated. Symptoms were suggestive of a foodborne toxin such as *C. perfringens* or *B. cereus*. It was suspected that rice or a curry/stew dish were possible vehicles for the outbreak due to some issues in food preparation and storage identified during the inspection of the kitchen. Rice was being cooked in large batches to be used through the day, and stews and curries were also cooked in large batches and reheated. Recommendations to the kitchen staff were made regarding rice preparation and reheating of meals. No further cases were reported.

In November, an outbreak of gastroenteritis at a wedding function was investigated. The epidemiology was suggestive of a point source outbreak (suspected foodborne) with some person to person transmission. The etiological agent was suspected to be viral. On inspection of the premises where the food for the reception was prepared, Environmental Health officers found a number of issues that required rectification, amongst them a lack of dedicated hand washing facilities in the kitchen. Food was prepared in the kitchens and transported to a picnic type setting for the reception. Cases were ill during the wedding ceremony and after the reception, but there were reports of illness in the days leading up to the wedding amongst staff and guests. Many of the guests consumed food from the kitchen in the day's preceding the wedding.

An outbreak was investigated in November when 12 work colleagues became ill with a gastro-like illness following a work luncheon. The foods supplied for the luncheon had come from staffs' own private homes and from some commercial premises. A cohort study was performed but did not clearly identify the vehicle for the outbreak. The index case for the outbreak was ill prior to the function. The epidemiology was suggestive of a viral foodborne outbreak. Norovirus was detected from 2 of 3 specimens submitted.

There were 14 non-foodborne outbreaks investigated in the NT during 2010. These outbreaks occurred in childcare centres (5), aged care facilities (2), schools (2), camps (3), a private residence (1) and the general community (1). Norovirus was implicated in 3 of the outbreaks. The etiological agent for the remaining 11 outbreaks was unknown. Details of one of these outbreaks have been discussed recently.[2]

There were 5 cluster investigation performed during 2010. All of these cluster investigations involved different serovars of *Salmonella.* Investigations were conducted into clusters of *S*. Virchow PT8 (2) *S.* Typhimurium PT135A (1), *S*. Mgulani (1), and *S*. Saintpaul (1). No definitive links could be established in most of the cluster investigations. Of note, within the cluster of *S*. Typhimurium 135A cases there were 3 of 5 cases who were interviewed consumed food from a kebab shop over one weekend. Food samples from the kebab shop were negative. The vehicle of infection was not identified.

For more information on OzFoodNet go to http://www.ozfoodnet.gov.au/

Acknowledgments

Thank you to Jenine Gunn for undertaking the OzFoodNet Epidemiologist position for part of 2010 and to the staff at the NT CDC public health units.

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Imported malaria case investigation and precautionary vector control: Leanyer, Darwin, March/April 2011

Peter Whelan and Huy Nguyen, CDC, Darwin

Abstract

An imported case of Plasmodium vivax malaria diagnosed in a Darwin patient returning from overseas had mosquito infective gametocytes present. An entomological investigation revealed 2 and 3 Anopheles farauti sl and 56 and 81 adult Anopheles bancroftii at 2 natural wooded harbourage sites within 1 km of the patient urban residence, which prompted a precautionary Ultra Low Volume fog of nearby harbourage areas to kill any possibly infected adult Anopheles mosquitoes. Follow up indicated no reported environmental effects and no subsequent malaria transmission. These standard investigation and control procedures have been successful in preventing any cases of introduced or local transmission of malaria in the Northern Territory since they were instituted in 1974.

Key words: malaria; Ultra Low Volume (ULV) fogging; bioresmethrin; vector control; Northern Territory; Anopheles farauti

Introduction

The Northern Territory (NT) is currently considered free of endemic malaria.[1] The NT has effective protocols in place in the event of imported malaria cases,[2,3] with no recorded incidence of introduced transmission (malaria cases arising directly from an imported case by local transmission), since the last endemic case in Australia in 1962 at Roper River, NT. This is in contrast to north Queensland where there have been a number of local outbreaks of introduced malaria.[4] However, the NT is both receptive and vulnerable to malaria transmission, due to the presence of a number of competent potential *Anopheles* vector mosquitoes, and a history of imported cases each year reported in patients that have either travelled to or are newly settled immigrants from overseas malarious areas.

An imported case of *Plasmodium vivax* malaria was recently diagnosed in a patient returning from overseas whose blood tests showed that mosquito infective gametocytes were present. The Medical Entomology (ME) unit of the Centre for Disease Control (CDC), NT Department of Health (DoH) was notified of the case and after entomological investigation, recommended a precautionary Ultra Low Volume (ULV) insecticide application for adult *Anopheles* mosquitoes.

Case details

On 30/03/11, ME was notified of an NT resident who had recently returned from India (11/03/11) and presented with an infective case of imported *P. vivax* malaria. The onset date was estimated to be 20/03/11. The patient had been infective for at least 3 days at home before hospital admission and subsequent medical treatment on 26/03/11. The patient's residence was located near the Leanyer swamp on the fringe of the suburb of Leanyer in Darwin. Due to the close proximity of the residence to active *Anopheles* breeding and harbourage areas, the seasonal favourable period for *Anopheles* vectors, and the number of days that the patient was in an infective stage, the assumption was made that the patient could possibly have been bitten by local *Anopheles* vector mosquitoes, and therefore the case required an entomological investigation.

Vector longevity and risk periods

A previous scientific study of vector longevity and the risk of malaria transmission in the NT suggested that "the period of greatest risk for malaria transmission in Darwin was from April to August".[5] This was largely due to the increasing presence of older females that are of a potentially infective age towards the early to mid-dry season (May, June and July).[5] The period in which female *Anopheles* mosquitoes become infective, after biting an infected person with the infective gametocytes, and hence able to pass on the malaria parasite to humans, is 8-16 days for *P. vivax.* Therefore a mosquito biting the malaria patient would need to be at least 8 days old before being able to transmit the parasites to another person.

The probability that an individual *Anopheles* mosquito survives for this long increases during the early to mid dry, particularly with the recent case, which coincided with a record and extended wet season and continued overcast conditions which favour adult survival. The probability of transmission occurring is also a

function of the number of *Anopheles* present at the patients residence or exposure point, and the potential exposure of the patient to mosquito bites. Assuming the patient's residence or outdoor habits has allowed mosquito exposure, the accepted protocol in the NT is that if there is at least 2 potential vector *Anopheles* at the patient's residence or 10 *Anopheles* at the nearest *Anopheles* breeding or harbouring area within 1 km of the patient's residence, this represents a potential for an *Anopheles* mosquito to possibly have bitten the patient and survive to infect another person.

When this occurs, ME usually conducts precautionary insecticide fogging operations aimed at killing or reducing adult *Anopheles* in the area in order to reduce the probability of potentially infective vectors surviving to bite other people. Generally urban residential blocks are not fogged, rather the fogging targets bushland with mosquito harbouring and breeding sites between the urban area of the patient's residence and the nearest appreciable *Anopheles* breeding areas. The rationale behind this practice is that a blood fed *Anopheles* will generally need to travel back to breeding areas every 2 to 3 days to lay eggs during the 8 days period she needs to survive to become infective. The probability she will be in the breeding and harbouring areas over a 2 to 3 day period is relatively high. This practice also avoids the prospect of complaints in relation to fogging in urban areas.

Medical Entomology recommendation for ULV precautionary fogging

On 31/03/11, ME evaluated the abundance of potential *Anopheles* malaria vectors in 2 Encephalitis Vector Surveillance (EVS) trap collections set along the fringe of Leanyer Swamp in the general vicinity of the patient's residence. Based on the DoH protocol around a proven malaria case, there were sufficient vector *Anopheles* mosquitoes in the vicinity on 22/03/11 (Figure) to warrant a precautionary fogging to kill any possibly infected mosquitoes.

The DoH protocol for Malaria Case Investigation outlines that approval is needed from the Chief Health Officer (CHO) to undertake fogging near residential areas. The last time the DoH undertook fogging was for a malaria case in 2004/05 in the bush area near the Malak suburb.[6]

Action taken

ME received CHO approval to undertake fogging, with the route modified on site to take into account wind direction. There was no fogging of urban streets or urban properties, and the fog was unlikely to have drifted to any urban residences. Fogging only occurred on access tracks around the sewage pond area, the fringe of Leanyer swamp, and adjoining rural properties where residents had given permission.

ME door knocked 6 rural properties in the area to be fogged, and requested permission to carry out fogging operations on those properties nearest to the mosquito harbourage areas. The residents contacted were told of the case of malaria and that fogging was required to prevent any potentially infected mosquitoes from passing on the parasite. Of these properties, all gave approval for ME to enter their property. Residents were asked to cover fish ponds and to close windows and louvres if they kept indoor aquariums. Inquiries also revealed hives of bees on 1 property, so the fog route was adjusted to prevent any spray drift near the hives. Only 4 rural properties were actually fogged due to vehicle accessibility problems.

The fogging operation was carried out from 18:05 – 19:35 pm on 01/04/11. A trailer mounted fogger dispensed an ULV application of bioresmethrin (a pyrethroid insecticide). The bioresmethrin is of very low mammalian toxicity, and is recommended by the World Health Organization for fogging for public health purposes.[7]

Follow-up

The resident with the bee hives contacted ME to inform that the bees were not affected and thanked ME staff for being flexible with the precautionary fogging operation. There have been no cases of introduced malaria in the area following the operation. These standard investigation and control procedures have been successful in preventing any cases of introduced or local transmission of malaria in the NT since they were instituted in 1974.

Acknowledgements

We wish to thank those Leanyer residents who gave permission for their properties to be fogged, to Jane Carter of ME for assistance with the fogging operation, and Raelene Whitters of ME for assistance with the Figure.

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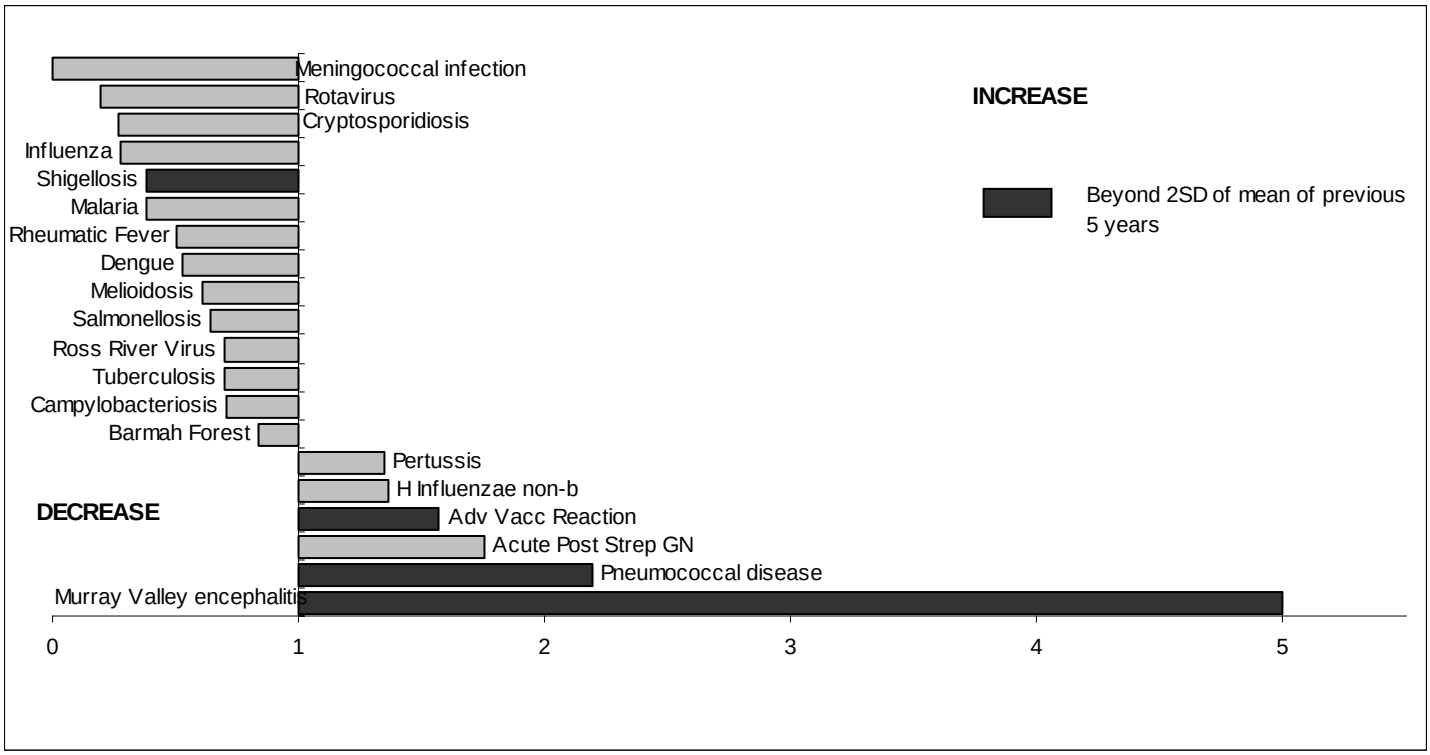
Figure. Leanyer: Imported malaria case location, vector mosquito abundance and actual fog routes

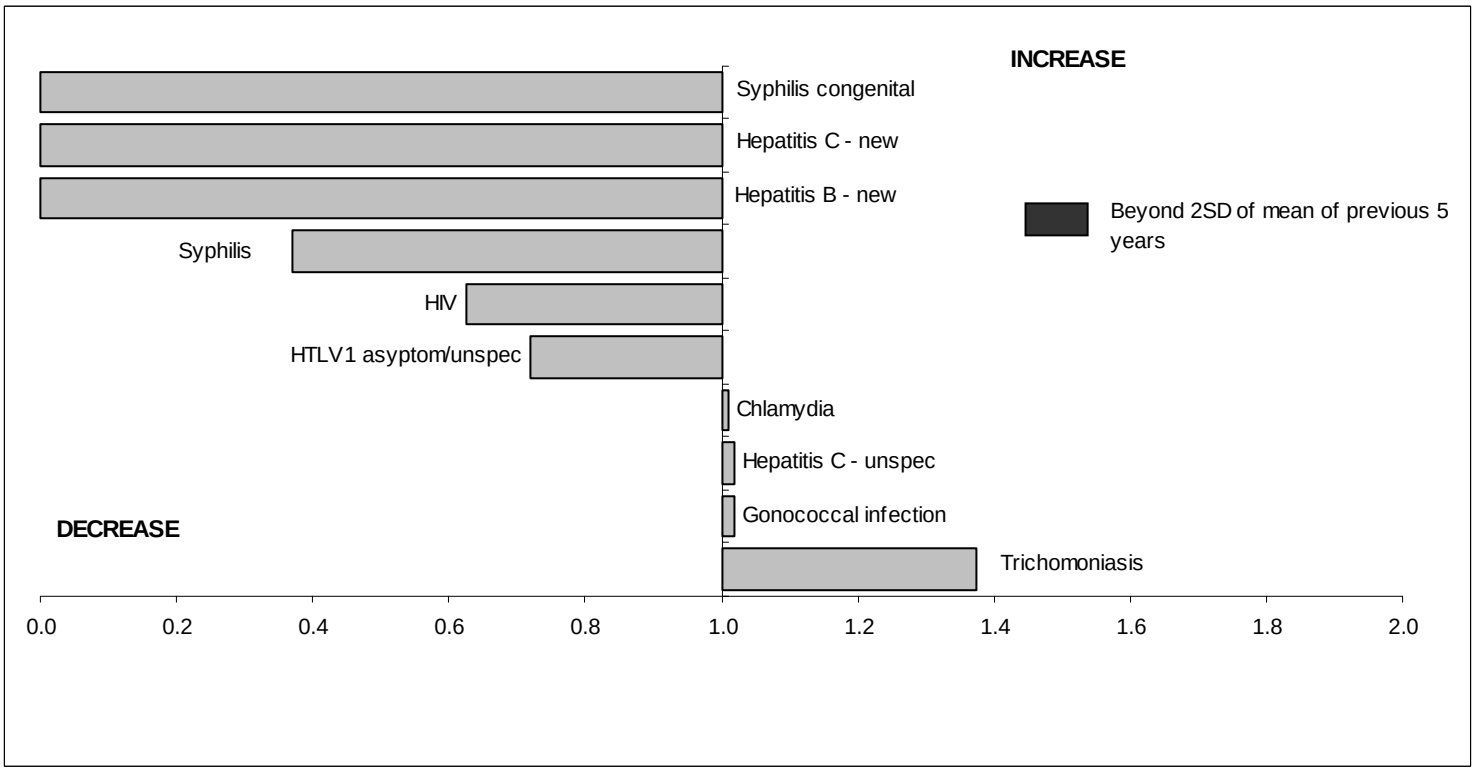
NT notifications of diseases by onset and districts 1 April — 30 June 2011 & 2010

	Alice Springs		Barkly		Darwin		East Arnhem		Katherine		NT	
	2011	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**
Acute post-streptococcal glomerulonephritis	2	0	0	0	8	1	1	1	2	0	13	2
Adverse vaccine reaction	5	4	1	0	14	11	0	0	2	1	22	16
Barmah Forest virus infection	3	0	0	1	18	15	2	4	1	0	24	20
Campylobacteriosis	7	14	1	1	33	29	0	0	8	6	49	50
Chickenpox	1	0	4	0	10	12	0	3	6	2	21	17
Chlamydia	236	177	13	10	294	316	55	48	63	77	661	628
Chlamydial conjunctivitis	0	3	0	2	1	6	0	0	0	0	1	11
Cryptosporidiosis	4	16	0	2	2	10	1	3	1	6	8	37
Dengue virus infection	1	0	0	0	3	12	0	1	0	3	4	16
Diptheria	0	0	0	0	1	0	0	0	0	0	1	0
Food/water borne disease	2	5	0	0	0	0	0	0	0	0	2	5
Gastroenteritis - related cases	0	0	0	0	0	4	0	0	0	1	0	5
Gonococcal infection	288	310	24	18	89	85	40	25	81	57	522	495
Group A streptococcal infection (invasive)	3	*	2	*	4	*	0	*	0	*	9	*
Hepatitis B - chronic	23	16	1	1	13	11	4	13	1	6	42	47
Hepatitis B - new	0	0	0	0	0	1	0	1	0	0	0	2
Hepatitis B - unspecified	25	10	3	2	24	23	0	0	1	6	53	41
Hepatitis C - unspecified	10	5	0	2	39	41	1	1	5	6	55	55
***Haemophilus influenzae* b**	1	0	0	0	0	0	0	0	0	0	1	0
***Haemophilus influenzae* non-b**	2	4	0	0	0	0	1	0	0	0	3	4
HIV	0	0	0	0	2	0	0	0	0	0	2	0
HTLV1 asymptomatic/unspecified	13	20	0	0	3	0	0	0	0	0	16	20
Influenza	3	2	0	0	11	4	16	40	5	0	35	46
Kunjin virus infection	0	0	1	0	0	1	0	0	0	0	1	1
Malaria	0	0	0	0	3	3	0	0	0	0	3	3
Measles	0	0	0	0	2	0	0	0	0	0	2	0
Melioidosis	2	0	0	0	4	20	0	3	0	1	6	24
Mumps	0	0	0	0	0	0	0	0	0	1	0	1
Murray Valley encephalitis	0	0	0	0	2	0	0	0	0	0	2	0
Pertussis	7	54	0	1	74	20	1	0	3	3	85	78
Pneumococcal disease (invasive)	21	8	1	2	12	6	1	0	1	1	36	17
Q Fever	1	0	0	0	0	0	0	0	0	0	1	0
Rheumatic fever	0	1	0	0	2	5	2	1	3	5	7	12
Ross River virus infection	9	11	1	0	26	45	1	3	8	7	45	66
Rotavirus infection	14	99	1	16	6	72	10	10	3	34	34	231
Salmonellosis	21	31	1	2	44	118	9	11	14	15	89	177
Shigellosis	4	10	2	5	4	7	1	3	1	3	12	28
STEC/VTEC	0	0	0	0	1	0	0	0	0	0	1	0
Syphilis	8	20	4	2	9	15	0	3	5	3	26	43
Trichomoniasis	274	157	19	29	205	144	97	77	127	124	722	531
Tuberculosis	2	0	0	0	3	8	1	0	1	1	7	9
Typhoid	1	0	0	0	0	1	0	0	0	0	1	1
Varicella unspecified	0	0	0	0	0	1	0	2	0	0	0	3
Vibrio food poisoning	0	0	0	0	4	0	0	0	0	0	4	0
Vibrio invasive	0	*	0	*	1	*	0	*	0	*	0	*
Zoster	14	11	2	1	25	24	6	2	3	1	50	39
Total	**1,004**	**988**	**79**	**97**	**991**	**1,071**	**250**	**255**	**345**	**370**	**2669**	**2781**

Ratio of the number of notifications (2nd Quarter 2011 cases to the mean Q2 2006-10): selected diseases



Ratio of the number of notifications (2nd Quarter 2011 cases to the mean Q2 2006-10): sexually transmitted diseases



Comments on notifications P50

Adverse events following vaccination

In the past 6–12 months, a heightened awareness by the public and health providers of possible adverse events following immunisation has occurred as a result of national reports of an increase in the number of febrile convulsions in children following the administration of a certain brand of influenza vaccine and an increase in number of severe local reactions following 2nd and subsequent doses of Pneumovax23®.

The Therapeutic Goods Association (TGA) has requested that all adverse events, regardless of their severity, be reported to them from all jurisdictions As a result the Centre for Disease Control has sent more minor adverse events (erythema, limb swelling and pain at the injection site) than usual to the TGA and recorded them on the NTNDS.

Invasive pneumococcal disease

There were 36 cases of invasive pneumococcal disease notified in the Northern Territory in the 2nd quarter of 2011, more than twice the number reported for the same period last year. In addition to the ongoing serotype 1 outbreak (contributing to over 50% of all Alice Springs cases) a sharp increase in blood culture positive pneumonia cases in June, both in Aboriginal and non-Aboriginal people in the Darwin region were notified. Several different serotypes were identified as causing non serotype 1 disease.

Shigella

Shigellosis cases this quarter are less than the previous year (12 cases vs 28). The reasons for this are not clear, but there has been a decline in the number of shigellosis notifications over the last 2 years. Other enteric disease notifications this quarter are also fewer than the previous year, with 89 salmonellosis notifications compared to 177 in the same quarter last year, and 8 cryptosporidiosis cases compared to 37 cases last year.

Murray Valley encephalitis (MVE)

There were 2 cases of MVE notified in the second quarter. Of these cases 1 was acquired in Western Australia but there was a likely third case in an overseas tourist who acquired the disease in the NT but became unwell and died from the disease on return home. The increase in cases reflected the increased rainfall during the last wet season in the Top End, Katherine and Barkly regions. This facilitated amplification of the virus in the water bird populations and promoted their dispersion to inland areas. Nationally cases were also increased with the first cases in South Australia since the 1970s.

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NT Malaria notifications April-June 2011

Frances Daily, CDC, Darwin

There were 3 notifications of malaria received for the second quarter of 2011. The following table provides details about where the infection was thought to be acquired, the infecting agent and whether chemoprophylaxis was used.

No. cases	Origin of infection	Reason for exposure	Agent	Chemoprophylaxis
1	Bali	Holiday	*P. falciparum*	No
1	Liberia	Resident	*P. falciparum*	No
1	West Papua	Holiday	*P. vivax*	No

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Immunisation coverage for children aged 12-<15 months at 30 June 2011

Region	Number in District	%DTP	%Polio	%HIB	%Hep B	% Fully vaccinated
Darwin	254	87.8%	87.4%	87.0%	87.4%	87.0%
Winnellie PO Bag	107	97.2%	97.2%	97.2%	97.2%	97.2%
Palmerston/Rural	219	95.0%	95.0%	95.0%	95.0%	95.0%
Katherine	102	94.1%	94.1%	94.1%	94.1%	94.1%
Barkly	27	88.9%	88.9%	88.9%	88.9%	88.9%
Alice Springs	144	90.3%	90.3%	90.3%	90.3%	90.3%
Alice Springs PO Bag	69	89.9%	89.9%	89.9%	89.9%	89.9%
East Arnhem	54	94.4%	94.4%	94.4%	94.4%	94.4%
NT total	976	92.0%	91.9%	91.8%	91.9%	91.8%
NT Indigenous	420	91.0%	91.0%	91.0%	91.0%	91.0%
NT Non-Indigenous	556	92.8%	92.6%	92.4%	92.6%	92.4%
Australia Indigenous	3,638	84.2%	84.1%	84.1%	84.0%	84.0%
Australia Non Indigenous	71,584	91.2%	91.1%	91.0%	90.8%	90.6%
Australian Total	75,222	90.8%	90.7%	90.6%	90.5%	90.3%

Immunisation coverage for children aged 24-<27 months at 30 June 2011

The immunisation coverage for the 24 to <27 months cohort is not presented with this report.

Immunisation coverage for children aged 60-<63 months at 30 June 2011

Region	Number in District	%DTP	%Polio	%MMR	% Fully vaccinated
Darwin	214	82.7%	82.7%	83.2%	82.2%
Winnellie PO Bag	85	96.5%	96.5%	95.3%	95.3%
Palmerston/Rural	228	88.2%	88.2%	88.2%	88.2%
Katherine	101	93.1%	93.1%	91.1%	91.1%
Barkly	23	91.3%	91.3%	95.7%	91.3%
Alice Springs	137	86.9%	86.9%	86.9%	85.4%
Alice Springs PO Bag	60	93.3%	93.3%	93.3%	93.3%
East Arnhem	54	94.4%	94.4%	96.3%	94.4%
NT total	902	88.8%	88.8%	88.8%	88.1%
NT Indigenous	389	89.7%	89.7%	89.5%	88.7%
NT Non-Indigenous	513	88.1%	88.1%	88.3%	87.7%
Australia Indigenous	3,305	87.3%	87.2%	87.2%	86.5%
Australia Non Indigenous	69,262	90.2%	90.2%	90.1%	89.7%
Australian Total	72,567	90.1%	90.0%	89.9%	89.6%

Immunisation coverage 30 June 2011

Compiled by Charles Strebor, CDC, Darwin

Immunisation coverage rates for NT children by regions based on Medicare address postcode as estimated by the Australian Childhood Immunisation Register are shown on page 52.

Background information to interpret coverage

Winnellie PO Bag is postcode 0822, which includes most Darwin Rural District communities, some East Arnhem District communities and some people who live in the Darwin "rural area" who collect mail from the Virginia store or Bees Creek. Alice Springs PO Bag is postcode 0872, which includes Alice Springs District, Nganampa and Ngaanyatjarra communities.

The cohort of children assessed at 12 to <15 months of age on 30 June 2011 were born between 1 January 2010 and 31 March 2010 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 doses of PRP-OMP Hib or 3 doses of another Hib vaccine, and 2 doses of hepatitis B vaccine (not including the birth dose) (latest doses due at 6 months of age). 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 June 2011 were born between 1 January 2009 and 31 March 2009 inclusive. To be considered fully vaccinated, these children must have received 3 valid doses of vaccines containing diphtheria, tetanus, pertussis, and poliomyelitis antigens, either 3 doses of PRP-OMP Hib or 4 doses of another Hib vaccine, and 2 doses of hepatitis B vaccine (not including the birth dose) and 1 dose of measles, mumps, rubella vaccine (latest doses due at 12 months of age). 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 June 2011 were born between 1 January 2006 and 31 March 2006 inclusive. To be considered fully vaccinated, these children must have received 4 valid doses of vaccines containing diphtheria, tetanus, pertussis antigens, 4 doses of poliomyelitis vaccine and 2 valid doses of measles, mumps, rubella vaccine (latest doses due at 4 years of age). All vaccinations must have been administered by 60 months (5 years) of age.

Interpretation

The immunisation coverage for the 24 to <27 months cohort is not presented with this report. As reported in March and June issues of The *Bulletin*, a request for recalculation of the data has been made to the Department of Health and Ageing and the Australian Childhood Immunisation Register because of a reported decline in the number of children considered fully vaccinated in relation to Hib. The re-calculations have been undertaken but they are not as yet finalised.

Immunisation coverage in NT children was above the national average for the 12 to <15 month cohort and below the national average for the 60 to <63 month cohort.

Immunisation coverage in Indigenous children in the NT was higher across the 12 to <15 months and 60 to <63 months cohorts as compared to coverage for Indigenous children at the national level. In the 12 to <15 months cohort, Indigenous NT children had coverage slightly above non-Indigenous children and slightly above non-Indigenous children in the 60 to <63 months cohort.

We will provide you with an update regarding the 24 to <27 months cohort in a future issue of the *Bulletin* once the final data from the requested re-calculations is available.

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Disease Control staff updates July—September 2011

Darwin

Frances Daily, Medical Officer, joined CDC TB Unit in August from Cambodia where she has worked for many years in public health.

Ros Webby returned from maternity leave to resume her position as Head of Immunisation. Thanks to **Chris Nagy** for acting in the position for 6 months. She now returns to her prior position of Senior Immunisation Officer.

On 16 August **Kishan Kariippanon**, Youth Health Policy Officer SHBBV unit, was formally congratulated by Tom Pauling AO QC, Administrator of the Northern Territory for "a truly intriguing and inspiring article" titled *A Social Media Blueprint for Engaging Young People from Culturally and Linguistically Diverse Backgrounds* published in the *Australian Mosaic,* issue 28, June 2011; the magazine of the *Federation of Ethnic Communities' Councils of Australia*.

Deborah Frost commenced as Manager Clinic 34 Darwin in July. She previously worked as a Nursing Officer for the Australian Defence Force for 3 years, a job which incorporated provision of pre hospital and primary healthcare. Prior to that, she worked for 9 years in the field of Genito Urinary medicine (GUM) & Sexual Health, in UK, Europe, the Middle East and Africa.

Lisa Panton, Public Health Nurse has moved from Alice Springs CDC to the Darwin Rheumatic Heart Disease Control Program.

Natalie Skultety joined the NT Immunisation Register as a Data Entry Officer in July. Prior to coming to CDC Natalie worked as a Medical Receptionist with Cavenagh Medical Centre for 3 ½ years.

Alice Springs

Mark Russell, Public Health Nurse has joined the Rheumatic Heart Disease team. He previously worked in sexual health and health development in Alice Springs.

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