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## ***Aedes aegypti* mosquitoes, vectors for dengue, found in Tennant Creek -Elimination Campaign in Progress**

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A program to eliminate the exotic mosquito capable of transmitting the dengue virus, *Aedes aegypti*, has been under way in Tennant Creek since 22 February 2004. This followed the finding of this mosquito via routine adult mosquito trapping on 17 February 2004. Further surveys by the Medical Entomology Branch (MEB) of the Centre for Disease Control (CDC), Northern Territory Department of Health and Community Services (DHCS) have indicated to date that the dengue mosquito is firmly established in Tennant Creek. Elimination of this mosquito will take a major effort by health and local authorities as well as by the general public in Tennant Creek.

The first phase of the program involved initial surveys by officers of the MEB in cooperation with the local Environmental Health (EH) officer in Tennant Creek, other CDC staff, and staff from the Health Department of Western Australia. The initial aim was to determine the presence and spread of the *Aedes aegypti* mosquitoes, and involved surveying urban and semi-rural areas throughout Tennant Creek and inspecting water-holding receptacles for mosquito larvae. The team also set mosquito traps, including ones better designed for capturing *Aedes aegypti* mosquitoes, to determine what localities were infested. Initial surveys also involved inspection of water

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receptacles in the nearby towns or localities of Ali Curung, Threeways, and Elliot. A comprehensive public relations and information program was initiated to inform and seek assistance from local residents, councils and authorities.

The second phase of the program involved a door-to-door education campaign on how to eliminate breeding sites and the distribution of insecticide surface spray cans to all Tennant Creek householders with instruction to spray all potential water holding receptacles in their yards and premises. The distribution of the spray and initial treatment of premises was carried out by the elimination team, in conjunction with the Julalikari Council, the Anyinginyi Congress and the Tennant Creek Town Council. The team also carried out a fogging operation of the town with assistance from the Alice Springs Town Council. Transport hubs including the railway, the airport, and bus facilities were also surveyed and treated.

The third phase is now well under way, and involves re-inspecting and treating every premises in Tennant Creek. Other towns further north including Renner Springs and Mataranka have also been surveyed. This program is being undertaken by the elimination team in conjunction with local pest control operators, local councils and authorities, and local businesses. Storm water drains and underground telephone facilities are also being targeted. There has been an excellent public response with only 8 refusals to enter or treat premises. There have also been generous offers of assistance from health staff, local councils, and other volunteers.

As of 28 March, 689 of a total of 1110 properties in Tennant Creek have been revisited and treated by the teams. This includes occupied residential blocks, vacant blocks, vacant houses, and industrial, business and rural blocks. The survey has found 54 different premises breeding *Aedes aegypti* mosquitoes. The range of receptacles with dengue mosquitoes includes, in decreasing numbers of positive receptacles; bird baths, dog bowls, old tyres, buckets, pot plant drip trays, ice cream containers, sheets of plastic, machinery, an unkempt spa, a vase, a compost bin, a boat, a tarpaulin and an old car body. Of the 58 premises with rainwater tanks, 53 have been successfully treated.

The extent of the infestation indicates that the *Aedes aegypti* have been in the town from at least December 2003 when the seasonal rains began. It is possible that they may have been brought in, for example from north Queensland, as eggs in a receptacle in the wet season of 2002/2003. Mosquitoes can be brought in as drought resistant eggs stuck to the sides of dry, water holding receptacles, possibly in machinery, pot plant drip trays, or spare vehicle tyres. Once re-flooded, these eggs hatch, and after the aquatic wriggler stage is completed, i.e. in 7-8 days, the adult mosquitoes emerge and fly away, thus spreading new pest and disease threat species in an area.

The DHCS is asking for public cooperation in the surveys and efforts to eliminate the mosquito. Members of the public have been urged to contact the free call hot line on 1-800-008-002 for answers to any inquiries and also to request to have their premises and receptacles inspected and treated to destroy any eggs. The public has additionally been asked to report any unsealed septic tanks or rainwater tanks. Any water collecting receptacles left out in the rain could be breeding sites for the *Aedes aegypti*. Therefore, the public is being asked to empty all water holding receptacles and then spray them with surface spray, or dispose of all water holding receptacles. The public should also avoid transporting out of Tennant Creek any receptacles that have held water, to prevent the spread of the mosquito to other towns. So far the mosquito has not been detected in any town apart from Tennant Creek.

This campaign towards elimination of *Aedes aegypti* has required extensive management and continuous teams of CDC staff and other workers/volunteers from Tennant Creek, other NT towns and WA to assist and provide expertise. The CDC MEB and EH staff have lead the program but other CDC staff, taken from other areas such as eg TB nurses, AIDS/STD RNs, Aboriginal Health Workers and educators have contributed to the initial response. Travel into Tennant Creek is expensive (eg commercial airfare for Darwin-Tennant Creek-Darwin is \$911) and travel via road is timely (approximately 10 hours one way Darwin to Tennant Creek and 5 hours one way Alice Springs to Tennant Creek). Elimination of

this mosquito in Tennant Creek should be achievable but will require a continued comprehensive program of surveying, educating and intervention in the coming months. Additionally, at this time it is unknown as to the status of *Aedes aegypti* presence in nearby areas such as Mt Isa and Camooweal in Queensland.

The NT has been free of the *Aedes* mosquito vectors of dengue since the late 1950s, despite many instances of importations from overseas in port areas of Darwin. The current infestation has been discussed in a national forum by the National Arbovirus and Malaria Advisory

Committee (NAMAC), and the Commonwealth Department of Health and Ageing is cooperating with initial assistance and considering a risk assessment of the infestation for the rest of Australia. If the mosquito can be eliminated from Tennant Creek, it will prevent the species from spreading further north to areas that are much more receptive and vulnerable to dengue outbreaks. If these areas can be kept free of mosquitoes capable of transmitting the dengue virus, the eventual large and life threatening dengue fever outbreaks, such as are occurring in Indonesia and north Queensland, will be prevented.



### Community Service Announcement

#### Keep Tennant Creek Dengue-free

#### “Your help is needed”

*Aedes aegypti* mosquitoes, which are capable of transmitting the life-threatening dengue virus, are still entrenched in Tennant Creek with wide-spread breeding sites.

#### They need to be eliminated.

- Spray your property now as directed.
- Eliminate breeding containers (tins, tyres, jars, tarps) or store them out of the rain.
- Empty and wipe bird baths and dog water bowls at least weekly.

**Act now! Keep Tennant Creek dengue-free**

**More information on Hotline 1800 008 002**

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## Exotic mosquitoes detected in tyres at East Arm Wharf, Darwin, NT, 1 December 2003

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### Detection

Approximately 30 tyres chained together to be used as buffers in off-shore drilling activities were off loaded at East Arm wharf on Saturday or Sunday 30-31 November 2003. The off-loading and storage site was approximately 1.5 km from the nearest shore. This area is open with no sheltering vegetation and is in the vicinity of 1 large cargo shed. The consignment had been declared as drilling equipment rather than that of second hand tyres. The regular compulsory methyl bromide fumigation treatment had therefore not been carried out and the cargo was left on the wharf until inspection on Monday 1 December 2003. Australian Quarantine and Inspection Service (AQIS) officer Hugo Espinoza detected mosquito larvae in the tyres, and a sample of two 4<sup>th</sup> instar, one 3<sup>rd</sup> instar and one 2<sup>nd</sup> instar was submitted to the Medical Entomology Branch (MEB) on 1 December 2003. The 4<sup>th</sup> instar larva was identified as *Aedes albopictus*. One 4<sup>th</sup> instar larva was collected live and an attempt was made to rear it to an adult, but the larva died.

A second inspection of the tyres by an MEB officer on 2 December 2003 detected further larvae and 2 pupal skins, as well as remnants of another 2-3 pupal skins. The incident was therefore treated as a risk interception, because of the possibility of adult emergence and dispersal. The risk was assessed as a moderate level risk due to the presence of the low number of pupal skins, and the probability that a maximum of only a few adults would have emerged.

### Elimination procedures

After the initial finding of mosquito larvae around 1500 hrs on 1 December 2003, the tyres were treated with knockdown insecticide spray (bioresmethrin) between 1700 hrs and 1800 hrs. A tarpaulin was used to cover the tyre pile overnight.

The tyres were ordered to be unchained on 2 December 2003 and were moved from the wharf closer to the main cargo shed. The unchaining was not completed until the afternoon, as special tools needed to be organised. The individual tyres were drained completely through the holes that were used for the chain link. During the unchaining procedure, the supervising AQIS officer, Kevin Langham, caught 3 adult mosquitoes by hand as they were attempting to bite. These were all later identified as *Ochlerotatus vigilax*, the endemic salt marsh mosquito. The tyres were fumigated with methyl bromide at 48 g/m<sup>3</sup> for 24 h starting at 1700 hrs on 2 December 2003.

A fogging operation was carried out on 2 December 2003 by MEB at East Arm wharf using a ULV LECO fogging machine and bioresmethrin. The operation was planned to begin around 1800 hrs, but heavy rain delayed the start to 1845 hrs. Fogging was carried out until 1915 hrs targeting the large cargo shed inside and outside, and all of the adjacent open areas within approximately 300 m, which held various types of cargo and vehicles.

### Increased surveillance

AQIS set 2 carbon dioxide baited Encephalitis Virus Surveillance (EVS) mosquito traps<sup>1</sup> on the East Arm wharf on 4 nights from 3 – 7 December 2003 close to where the tyres were unloaded. The results of these 8 trap nights are summarised in Table 1.

MEB set one carbon dioxide baited EVS mosquito trap on the perimeter of the East Arm port area closest to vegetation and suitable as close harbourage in relation to the port facilities for 2 nights from 3 – 5 December 2003. The results of these 2 trap nights are also summarised in Table 1.

AQIS set 1 ovitrap in the East Arm port in addition to their 4 routine ovitraps in the area.

**Table 1: Summary of adult CO<sub>2</sub> baited EVS mosquito trapping at 2 sites during 4 trap nights (AQIS) and of 1 trap set during 2 nights (MEB) (total of 10 trap nights)**

Trap location	<i>An. (Cel) hilli</i>		<i>Cx. (Cux) annuliro-stris</i>		<i>Cx. (Cux) quinque-fasciatus</i>		<i>Cx. (Cux) sitiens</i>		<i>Oc. (Fin) notoscriptus</i>		<i>Oc. (Mac) species</i>		<i>Oc. (Och) vigilax</i>		<i>Ve. (Ver) funerea</i>		Total No. of fe-males	Total No. of males
	No. of fe-males	No. of males	No. of fe-males	No. of males	No. of fe-males	No. of males	No. of fe-males	No. of males	No. of fe-males	No. of males	No. of fe-males	No. of males	No. of fe-males	No. of males	No. of fe-males	No. of males		
East Arm Port perimeter, MEB site (2 nights)	3	0	57	1	2	0	16	0	316	0	0	0	665	0	6	0	1065	1
East Arm Port, AQIS trap 1 (4 nights)	0	0	0	0	0	0	0	0	0	0	0	1	8	0	0	0	8	1
East Arm Port, AQIS trap 2 (4 nights)	2	0	0	0	0	0	1	0	1	0	0	0	8	0	0	0	12	0
<b>TOTALS</b>	<b>5</b>	<b>0</b>	<b>57</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>17</b>	<b>0</b>	<b>317</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>681</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>1085</b>	<b>2</b>

No exotic mosquito species were detected. MEB set 2 ovitraps outside East Arm port perimeter for 1 week in vegetated areas, which was additional to the 1 routine MEB ovitrap set on the premises of a neighbouring business. The results of the MEB ovitrapping is summarised in Table 2.

### Receptacle surveys

AQIS carried out a receptacle survey on the East Arm wharf inside the Darwin Port Corporation vicinity. Precautionary spray of deltamethrin was applied to all tyres and receptacles capable of holding water. No exotic mosquitoes were detected.

MEB carried out a receptacle survey on 5 premises outside the East Arm port wharf area (landward of the boom gate) on 5 December 2003. MEB also carried out precautionary spraying by hand held pressure sprayer applying deltamethrin to any receptacle holding or likely to have held water. A summary of the MEB receptacle survey is provided in Table 3.

### Discussion and conclusions

None of the increased surveillance measures detected *Aedes albopictus* or any other exotic mosquito species. It is concluded that the procedures undertaken were sufficient to eliminate any adult *Aedes albopictus* mosquitoes that may have emerged from the tyres. *Aedes albopictus* is the vector of the arboviral diseases dengue and chikungunya.

One advantage of the East Arm port facility is the long distance between the wharf berthing and holding areas and the shore. The exotic *Aedes (Steg) species* are mainly short distance fliers that are expected to seek shelter in and under the demountables, sheds and cargo, rather than flying the approximately 1.2 km from the cargo shed area to the closest mangrove vegetation.

The risk was assessed as moderate due to the recovery of only a few pupal skins and a relatively low number of larvae. The problem with this interception was the late inspection due to an incorrectly declared cargo. After the

**Table 2: Mosquito larvae collected using 2 ovitraps for 7 days (MEB)**

TRAP LOCATION	NUMBER SAMPLED	NUMBER POSITIVE	SPECIES PRESENT	NUMBER OF LARVAE
Berrimah Road - LHS, 100m before boom gate at East Arm Port in bushes.	1	1	<i>Oc. (Fin) notoscriptus</i>	134
East Arm Port - LHS 20m past boom gate in mangroves.	1	1	<i>Oc. (Fin) notoscriptus</i>	286
<b>TOTALS</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>420</b>

Table 3: Summary of receptacle survey carried out by MEB on 5 December 2003

RECEPTACLES					NUMBER POSITIVE BY SPECIES			
CATEGORY DESCRIPTION <sup>2</sup>	Total No. of potential receptacles	Total No. of receptacles sampled	Total No. of receptacles with water	Total No. of receptacles breeding	Receptacle Index: % of receptacles with water and breeding	<i>Oc. (Fin) notoscriptus</i>	<i>Cx. (Cux) annuli-rostris</i>	<i>Oc. (Och) vigilax</i>
Garden Accoutrements	1	1	1	1	100.0	0	1	0
Domestic commercial usage receptacles	56	51	28	5	17.9	5	0	0
Building fixtures and materials	25	10	10	0	0	0	0	0
Rubbish	11	11	7	0	0	0	0	0
Water storage receptacles	2	2	2	0	0	0	0	0
Recreation items	1	1	0	0	0	0	0	0
Natural habitats	101	11	2	1	50.0	0	0	1
<b>TOTALS</b>	<b>197</b>	<b>87</b>	<b>50</b>	<b>7</b>	<b>14.0</b>	<b>5</b>	<b>1</b>	<b>1</b>
<b>% OF TOTALS</b>		<b>44.2</b>	<b>25.4</b>	<b>3.6</b>		<b>71.4</b>	<b>14.3</b>	<b>14.3</b>

discovery that second hand tyres were imported and the finding of mosquito larvae, AQIS followed the procedures established for eradication.<sup>3</sup> The unchaining and complete drainage of tyres before fumigation was necessary to ensure that the fumigation procedures was adequate to treat the whole inner surface of each tyre.

This was the second exotic mosquito interception at Darwin's East Arm port since its opening in 2003. The previous importation was also *Aedes albopictus*.<sup>4</sup> With the increased cargo traffic at East Arm port, more interceptions can be expected in the future. The continued surveillance and eradication measures undertaken at East Arm port will be vital to ensure the NT remains free of dengue vectors and endemic dengue.

### Acknowledgements

We thank Private Lloyd Cooper from the Robertson Barracks Environmental Health Unit

for his participation in the MEB receptacle survey. MEB officers Jane Carter and Leah Stratford carried out the fogging operation in a timely and professional manner.

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## Prevention of opportunistic infections in immunosuppressed patients in the tropical Top End of the Northern Territory

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### Introduction

The Top End is unique, both in the infectious agents that are endemic there and in its population. This guideline has been developed with the people, geography and microbial ecology of the Top End in mind. It may also be useful for other parts of tropical Australia. It aims to supplement existing protocols and practices for defined patient groups, such as organ transplant recipients and chemotherapy patients. It also aims to draw attention to patients who are being immunosuppressed, but for whom no protocol exists regarding prevention of opportunistic infections.

This article focuses on recommendations for the prevention of disseminated strongyloidiasis (DS), tuberculosis, melioidosis and other bacterial sepsis, scabies hyper-infestation and activation of hepatitis B virus infection, which anecdotally have each presented as opportunistic complications in immunosuppressed patients in the Northern Territory over recent years. These conditions are generally more common in the Top End than elsewhere in Australia. The recommendations are justified by varying levels of evidence and represent a consensus guideline developed by local infectious diseases, renal, oncology and public health physicians.

This guideline is only intended to apply to people receiving significant immunosuppression. This is defined in Box 1.<sup>1,2,3</sup>

It does not include the following patients: inhaled corticosteroids, hydroxychloroquine, sulfasalazine, colchicine, gold, weekly

#### Box 1. Eligible patients for the opportunistic infection prevention protocol

1. Anyone receiving  $\geq 0.5$ mg/kg per day of prednisolone or the equivalent for >14 days.
2. Anyone currently receiving cyclosporin, cyclophosphamide, azathioprine, mycophenolate, tacrolimus or cancer chemotherapy.

methotrexate and oral courses of prednisone less than 14 days regardless of dose and where the frequency is less than 6 courses per year. Patients having  $\geq 6$  courses of prednisolone per year may also benefit from the protocol.

With systemically administered steroids, the risk of infection is related to the dose of steroid and the duration of therapy as demonstrated in a meta-analysis of 71 controlled trials.<sup>3</sup> The overall rate of infectious complications was 12.7% in steroid-treated patients compared to 8.0% in the control group (relative risk 1.6). The rate of infection was not increased in patients receiving less than 10 mg per day or a cumulative dose of less than 700 mg of prednisone (which is roughly equivalent to 0.5mg/kg for 20 days). Therefore a cut-off of prednisolone = 0.5mg/kg/day for > 14 days for this protocol is practical. This is supported by there having been to date no confirmed cases of disseminated strongyloidiasis in the Top End in patients on intermittent prednisolone therapy for respiratory and other conditions.

Each infection will be addressed in turn.

### *Strongyloides stercoralis*

*Strongyloides* infestation is endemic in most remote communities of the Top End of the Northern Territory, particularly in the East Arnhem region. A stool microscopy prevalence study in 1997 at Galawin`ku (Elcho Island, Arnhem Land) showed *strongyloides* larvae in the stool in 15% of 300 people.<sup>4</sup> In 1991/1992, at least 3.4% (68/2000) of all admissions to Royal Darwin Hospital (RDH) had *strongyloides* larvae detected in stool.<sup>5</sup> During this 12-month period, another 98 cases of strongyloidiasis were detected in other Top End laboratories. Reliable prevalence data for other Top End communities is not available, but the incidence of symptomatic infection and stool positivity seems significantly lower outside East Arnhem. We encourage collection and analysis of stool prevalence data from Northern Territory communities outside East Arnhem to confirm this impression.

The authors are aware of 6 cases of disseminated strongyloidiasis (including 1 death) in immunosuppressed patients from the Top End over the last 10 years, with a range of 0–2 cases per year.<sup>6</sup> There may also be undiagnosed cases occurring, as overwhelming sepsis in the absence of a microbiological diagnosis is relatively common at RDH. The reported mortality of DS is up to 87%.<sup>7</sup> Thus, detection and treatment of infestation prior to

immunosuppression could avoid potentially fatal DS. However, in immunocompetent individuals with chronic asymptomatic infestation, even the best diagnostic methods may miss the presence of *strongyloides*. Eosinophilia is usually absent in immunosuppressed people with *strongyloides* hyper-infestation, although it is often present before immunosuppression begins. In a 1993 RDH survey, peripheral eosinophilia was only present in 57% of immunocompetent patients with asymptomatic infection.<sup>5</sup>

Direct stool examination for *strongyloides* larvae has a sensitivity of approximately 30% if 1 stool is examined<sup>8</sup> and 50% for 3 stools.<sup>9</sup> One study claimed sensitivity of close to 100% if 7 stools are examined.<sup>10</sup> This is clearly impractical in our setting.

Culture of stool (as opposed to direct microscopic examination) improves sensitivity, but is labour intensive, and poses a small risk of laboratory acquired infection. Agar-plate culture of a single stool specimen was approximately 90% sensitive in 1 study.<sup>8</sup> This takes 2–3 days and may not be practical for screening large numbers of specimens.

The utility of serology varies widely depending on the exact nature of the test used.<sup>7</sup> Using an ELISA method, with crude extract of filariform larvae, improves sensitivity. Performance can be enhanced by pre-incubating the patient's serum

#### **Box 2. Management recommendations to prevent disseminated strongyloidiasis in eligible patients**

1. Encourage the wearing of shoes to prevent infection or decrease worm burden through reduced exposure to soil-borne larvae.
2. Before immunosuppression (or at initial evaluation):
  - test all eligible patients with serology, eosinophil count and stool microscopy and culture. Treat all patients from highly endemic areas (East Arnhem), regardless of the above results, with a single dose of oral ivermectin 200 mcg/kg. Pregnancy test is first required for all reproductive age women. For patients with a positive stool microscopy or culture, give a second dose of ivermectin 7 days after the first dose. Repeat stool culture 7 days after the second dose. If still positive, discuss with the Infectious Diseases Unit.
  - outside of East Arnhem, only treat those with evidence of *strongyloides* infection.
3. with ongoing immunosuppression:
  - in East Arnhem, repeat ivermectin every 3 months without investigation. Elsewhere, undertake serology, stool microscopy and culture for *strongyloides* and eosinophil count every 3 months and treat if positive.
4. Treat any immunosuppressed patient with unexplained pulmonary infiltrates, fever, abdominal pain or septic shock with ivermectin on a day 0,1 and 7,8 regimen.

with *Onchocerca* antigens to eliminate non-specific cross-reactions before testing. Under the above conditions, the assay was 88% sensitive and > 90% specific for the detection of strongyloides infection in a nonendemic setting.<sup>11</sup> Serology may remain positive for months to years after a successfully treated infection, and may cross-react with other helminth infestations, notably *Ascaris lumbricoides*. The titre does not reliably fall with successful eradication.<sup>12</sup> RDH is using an ELISA with *Strongyloides ratti* as the antigen. We do not have good data about the sensitivity and specificity of this technique in our setting, and therefore the above-quoted published rates may not apply.

In summary the sensitivity of current diagnostic methods is not sufficiently high to be able to confidently exclude chronic asymptomatic infestation in a patient who is about to begin immunosuppression.

Disseminated strongyloidiasis can occasionally occur with mild levels of immunosuppression e.g. a 65-year old man receiving 20 mg per day of prednisolone for severe chronic obstructive pulmonary disease (COPD) for 6 weeks.<sup>1</sup> However, most case reports relating to DS in patients on prednisolone, were with doses around 1 mg/kg/day.<sup>2</sup> There are also multiple case reports suggesting a strong association of disseminated strongyloidiasis with HTLV-I infection, and less so with HIV infection. However, this association has to date not been borne out in Central Australia where HTLV-I infection is endemic.

A recent review recommends empiric treatment (including those with negative serology and stool examinations) before organ transplantation in 'high-risk patients from endemic areas'.<sup>13</sup>

Ivermectin is very well tolerated. Repeated dosing has been used in the Northern Territory for crusted scabies for at least the last 5 years without any significant toxicity.<sup>14</sup> Large-scale studies with regular 6 monthly dosing have been conducted in West Africa, also without significant drug toxicity detected.<sup>15</sup>

For the treatment of simple strongyloides infestation (in immunocompetent patients), a single dose of ivermectin seems equivalent to 2 doses of ivermectin, but is superior to 3 days of

albendazole.<sup>16,17,18</sup> Disseminated strongyloidiasis, where the worm burden is massive, requires multiple doses of ivermectin, and suspected cases of DS should be discussed urgently with an infectious diseases specialist. The concern for DS applies primarily to patients with solid organ transplants, chemotherapy for malignancy, immunosuppression for SLE and other auto immune disorders, and patients with severe, steroid dependant COPD/asthma requiring multiple courses of higher dose prednisolone. The recommended management procedures to prevent disseminated strongyloidiasis are shown in Box 2.

### **Tuberculosis**

A significant proportion of the population of the Top End has latent infection with *Mycobacterium tuberculosis* (LTBI). Immunosuppressive medication greatly increases the chance of reactivation. In patients with HIV co-infection, the chance of developing active TB is approximately 10% per year (compared with 10% cent over 10–20 years for immunocompetent people).

This risk is similarly increased in patients taking immunosuppressive medications, although this risk is less well defined. Early treatment of LTBI with 9 months of isoniazid greatly decreases the chance of reactivation (by around 90%) and should be strongly considered in a person with LTBI who is to begin immunosuppression. A short course alternative is the combination of rifampicin and pyrazinamide for 2 months, however there may be an unacceptably increased risk of adverse reactions to the medication with this latter regime (see Box 3 for recommendations).

### **Scabies**

Scabies infestation is very common in many Top End communities, and poses a risk of secondary bacterial sepsis. Infected immunosuppressed patients may develop a severe form of scabies, crusted (Norwegian) scabies,<sup>14</sup> therefore it should be treated before immunosuppression. The mortality of crusted scabies in the Top End was up to 50% within 5 years of diagnosis until recent improvements in scabies treatment and prevention and treatment of secondary sepsis.<sup>19</sup> Scabies infestation can be reliably detected by clinical examination.

Box 3 shows the management recommendations to prevent tuberculosis.

**Box 3. Management recommendations to prevent tuberculosis in eligible patients**

1. Ascertain past history of tuberculosis or latent tuberculosis infection.
  - The relevant communicable diseases clinic or chest clinic should be contacted to ascertain if the patient already has a diagnosis of LTBI or partially treated TB. If there is no record of a Mantoux, one should be performed, before starting immunosuppression if possible, as immunosuppression (particularly corticosteroids) will significantly decrease response to the test. If immunosuppression must be commenced immediately, do a Mantoux on day one.
2. Baseline two-step Mantoux testing.
  - The cutoff for a positive Mantoux prior to immunosuppression is 10 mm. If immunosuppression already exists, the cutoff is 5 mm.
  - If the initial Mantoux result is negative (<10 mm or <5 mm as appropriate), a second Mantoux should be performed 1 to 3 weeks after the first in order to boost a false-negative first result to a true positive value (when a person has LTBI, but has acquired infection many years before, or has anergy to tuberculin).
  - A positive Mantoux result on the initial or second test in the absence of active TB (on CXR and at clinical review) will require treatment of LTBI with a 9-month course of isoniazid (plus pyridoxine to decrease neurotoxicity) or a 2-month course of rifampicin and pyrazinamide.
3. Ongoing screening if baseline two-step Mantoux is negative.
  - If the baseline two-step Mantoux test is negative, annual Mantoux screening for newly acquired LTBI should occur in those with continuing immunosuppression.

Management recommendations to prevent scabies are shown in Box 4.

**Box 4. Management recommendations to prevent scabies in eligible patients**

1. Treat pyoderma with a single dose of intramuscular benzathine penicillin (Bicillin), 1.2 million units (900 mg).
2. Treat scabies with 5 % topical permethrin at days 0 and 7. All household contacts should also be treated.
3. If crusted scabies is present or suspected, hospital admission for eradication of infection should be organised prior to or coincident with the initiation of immunosuppression.

**Hepatitis B virus**

Chronic hepatitis B virus (HBV) infection is endemic in Top End communities with over 40% of individuals in some communities having evidence of hepatitis B exposure. Endemicity, clinical impact and recommendations for follow up in immunocompetent patients from remote communities have been published. A guideline

for follow up and management of these non-immunosuppressed patients from remote communities is in use<sup>20</sup> and should be used for patients on steroids alone, but not for those on more potent immunosuppression (Box 5). In a study at the RDH renal unit of patients undergoing renal replacement therapy, 73 of 122 Indigenous patients (59.8%) had evidence of hepatitis B virus exposure while 10 (8.2%) were HBsAg positive (Dr Nick Gray, Registrar in Renal Medicine, Royal Darwin Hospital, 2001, unpublished).

Rapidly progressive chronic active hepatitis may occur in chronically HBV-infected people who become immunosuppressed.<sup>21</sup> HBsAg positive patients undergoing renal transplantation almost invariably develop significant liver dysfunction with deaths from fulminant hepatic failure documented.<sup>22</sup> Antiviral therapy is of proven benefit in the renal transplantation setting, and it is now standard practice that antiviral therapy for patients who are HBsAg positive be used preemptively irrespective of other markers of hepatitis B viraemia or liver enzyme levels.<sup>23,24</sup> Reactivation of hepatitis B in patients undergoing chemotherapy or potent immunosuppressive therapy has a mortality of

37 to 60%.<sup>25</sup> Pre-emptive antiviral use is also now standard practice in liver transplant recipients, since studies in recent years have provided evidence of its efficacy and safety.<sup>26,27</sup>

For the prevention of reactivation of hepatitis B recommendations in this protocol, potent immunosuppression refers to chemotherapy for malignancy, organ transplantation, or potent therapy for autoimmune disease. This would include cyclophosphamide, azathioprine, cyclosporin, mycophenolate and leflunomide but **not** corticosteroids alone. Assessment will usually include a liver biopsy and initiation of lamivudine and possibly regular hepatitis B immunoglobulin. The other and most newly available antiviral treatment is adefovir dipivoxyl. At this stage, adefovir remains reserved for use in those developing the YMDD (lamivudine resistant) mutation of the reverse transcriptase gene, which occurs commonly e.g. up to 27% of liver transplant recipients on lamivudine at 52 weeks.<sup>26</sup> The use of antiviral medications for hepatitis B is generally restricted to approved liver clinics.

**Box 5. Management recommendations to prevent reactivation of hepatitis B in eligible patients**

1. Any HBsAg positive patient in whom chemotherapy for cancer or potent immunosuppression is planned should be referred to the liver clinic for assessment, preferably prior to therapy.
2. Non-immune patients should be vaccinated against hepatitis B prior to planned immunosuppression.

**Bacterial sepsis/melioidosis**

Melioidosis is more common, more severe and more likely to cause death in people who are relatively immunosuppressed.<sup>28</sup> These data mainly apply to those with diabetes, heavy alcohol intake or chronic renal impairment, all of whom have subtle immune defects including poor neutrophil function. There have been cases of both acute melioidosis and relapsed melioidosis in people on therapeutic immunosuppression,<sup>29</sup> and thus it is probable that all significant therapeutic immunosuppression increases the probability of melioidosis occurring, and of it being more severe if it does occur.

*Nocardia* infection is uncommon, but well described in immunosuppressed people. Pulmonary and cerebral infections are likely to occur if an immunosuppressed person is infected, and are difficult to treat and have a high mortality.

Skin and systemic sepsis with *Staphylococcus aureus*, Group A streptococcus and *Streptococcus pneumoniae* (among others) are very common in the Top End. Opportunistic infections have been a significant cause of morbidity and mortality in renal transplant patients, with a reported odds ratio for all infectious complications of 30 compared with non-transplant patients.<sup>30</sup> The majority of these infections are with 1 of the 3 bacteria mentioned above. Bacterial sepsis with *S. aureus* and *Escherichia coli* were the commonest causes of death in Top End patients with SLE from 1984–90.<sup>6</sup> In these patients, staphylococcal and *E. coli* sepsis were particularly common in the setting of disease exacerbation and a significant increase in steroid dosage with or without other immunosuppressive agents.

A review reported, ‘The use of low-dose trimethoprim-sulfamethoxazole in organ transplantation markedly reduces the risk of developing *Listeria* infection, *Pneumocystis carinii* pneumonia (PCP), toxoplasmosis, nocardiosis, and urinary tract infections’.<sup>13</sup> In our setting, we recommend continuing the prophylactic trimethoprim-sulfamethoxazole as long as potent immunosuppression continues.

Prophylactic antibiotics are usually not needed with steroids alone. The exception to this rule is patients on particularly high doses (100 mg per day or more of prednisolone or equivalent). In the study on SLE in the Top End quoted previously, when steroid dose was intensified, the incidence of serious opportunistic infections increased significantly, so trimethoprim-sulfamethoxazole prophylaxis may be justified in this subgroup. This is for PCP prophylaxis, and also will decrease bacterial infections (including those from *Nocardia*, staphylococci, streptococci and gram negatives, including *Burkholderia pseudomallei*). The recommended dose is trimethoprim-sulfamethoxazole 1 double strength tablet daily (160 mg/800 mg).

Varicella zoster virus (VZV) vaccination prior to heavy immunosuppression<sup>13</sup> should be given

prior to organ transplantation if the patient is not already immune, as recommended by the Infectious Diseases Society of America.<sup>13</sup> As it is a live vaccine, it should NOT be given to those who are already immunosuppressed.

Management recommendations to prevent melioidosis and bacterial sepsis are shown in Box 6.

**Box 6. Management recommendations to prevent melioidosis and bacterial sepsis in eligible patients**

1. Pneumococcal vaccination (23-valent pneumococcal polysaccharide) should be given, and other adult vaccinations made up to date, **before** planned immunosuppression (VZV, MMR, ADT, polio). Pneumococcal vaccination should be repeated every 5 years with ongoing immunosuppression.
2. Prophylactic trimethoprim/sulfamethoxazole one double strength tablet (160 mg/800 mg) daily should be given to all patients receiving potent immunosuppression (as defined in Box 5 above) plus those on 100 mg per day or more of prednisolone or equivalent.
3. In the wet season, patients should be encouraged to wear gardening gloves and footwear when coming into contact with mud or soil.
4. Melioidosis serology should be performed on all patients in the Top End prior to immunosuppression. If positive (an indirect haemagglutination titre of  $\geq 1:40$ ), swabs for melioidosis culture should be taken from throat, rectum and any wounds. Urine and sputum (if any) should also be collected for melioidosis culture. If cultures are positive, full treatment is required (refer to Infectious Diseases Unit).

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Centre for Disease Control has updated the

**‘Guidelines for the Control of Diphtheria in the Northern Territory’, March 2004.**

Copies are available from CDC, Research/Project Officer on 89228089 or at <http://www.nt.gov.au/health/cdc/protocols.shtml>

## ***Neisseria gonorrhoeae* Sentinel Site Surveillance – data analysis July 2001 to June 2002**

**Deidre Ballinger, AIDS/STD Program, CDC**

### **Summary**

In 2001, 4 sentinel surveillance sites were established to monitor the incidence of *Neisseria gonorrhoeae* isolates that were penicillin resistant and the proportions of cases that were diagnosed by culture and non-culture measures. From July 2001 to June 2002, 3149 gonorrhoea tests were performed at these sites with 232 cases (7%) testing positive for gonorrhoea. All 5 isolates that were penicillinase producing *N. gonorrhoeae* (PPNG) were associated with a travel history and likely to have been imported. No cases of penicillin resistant gonorrhoea were diagnosed in Aboriginal people but 11% of the non-Aboriginal sample isolates were penicillin resistant. There was no resistance detected at sentinel sites 1, 2 or 3, however, 9% of isolates from site 4 were resistant to penicillin. Overall 68% of the gonorrhoea cases including all 5 PPNG cases were treated according to recommended treatment guidelines.

These data support the continued use of penicillin as first line treatment for gonorrhoea in the NT except where there is a history of sexual contact with partners from interstate or overseas. High quality data were obtained from 3 of the 4 clinical sites involved in the surveillance and this report recommends maintaining sentinel surveillance at those sites.

### **Introduction**

*Neisseria gonorrhoeae* is a sexually transmitted infection that is endemic in the Northern Territory (NT). Gonococci have the ability to develop antibiotic resistance which may be mediated in 2 different ways. The production of beta-lactamase results in an organism resistant to all concentrations of penicillin (penicillinase-producing *N. gonorrhoeae* – PPNG). Alternatively, chromosomally-controlled mechanisms result in higher concentrations of penicillin being needed to kill the organism (CMRNG).<sup>1</sup> The effect of this may result in organisms which are fully sensitive, less sensitive, relatively resistant, or resistant to penicillin.

The major microbiology laboratories in the NT perform initial testing locally on cultures to detect PPNG. Isolates are then referred for assessment of CMRNG via laboratories of the Australian Gonococcal Surveillance Programme (AGSP). The AGSP monitors the trend of antibiotic resistant *N. gonorrhoeae* (ARNG) nationally and provides data on susceptibility trends. Regional standard treatment regimens are best derived from consideration of local patterns of susceptibility rather than from aggregated national data.<sup>2</sup>

The World Health Organisation (WHO) recommends that an antibiotic should no longer be used routinely to treat gonorrhoea once the proportion of gonococcal isolates in a defined population resistant to it reaches 5%.<sup>3,4,5</sup> Since the current treatment for uncomplicated gonorrhoea in the NT is amoxicillin and probenidicid, the primary concern is gonococcal resistance to the penicillin group of antibiotics.

In recent years, clinical experience and data from the AGSP suggests that penicillin resistant gonorrhoea in the NT is strongly linked with interstate or overseas sexual exposure. Locally acquired gonorrhoea infection, however, can be treated with penicillin (3 grams of amoxicillin and 1 gram of probenidicid). Surveillance of ARNG and in particular, PPNG is necessary to ensure this recommended treatment remains appropriate and to detect any shift in epidemiological patterns of transmission of resistant gonorrhoea to and within the local population.

The introduction of non-culture-based diagnostics in the NT in 1995 led to a reduction in the number of isolates available for antibiotic sensitivity testing and therefore, less information by which to accurately assess levels of resistance.<sup>6</sup> It became necessary therefore to ensure that a sufficient proportion of gonococcal infections were being diagnosed by culture in order to maintain adequate surveillance of antibiotic susceptibility patterns. Sentinel surveillance sites were established as a pilot

project in the NT in July 2001 to better inform the AIDS/STD Program about

- the epidemiology of antibiotic resistant *N. gonorrhoeae* among known and suspected populations at risk of acquiring the infection in the NT and
- the proportion of gonorrhoea diagnosed by non-culture diagnostic in a sample population.

This report deals with the proportion of PPNG identified in sentinel sites and other aspects of the sentinel surveillance system in the NT. Further information on CMRNG and resistance to other antibiotics is reported by the AGSP and is not discussed here.

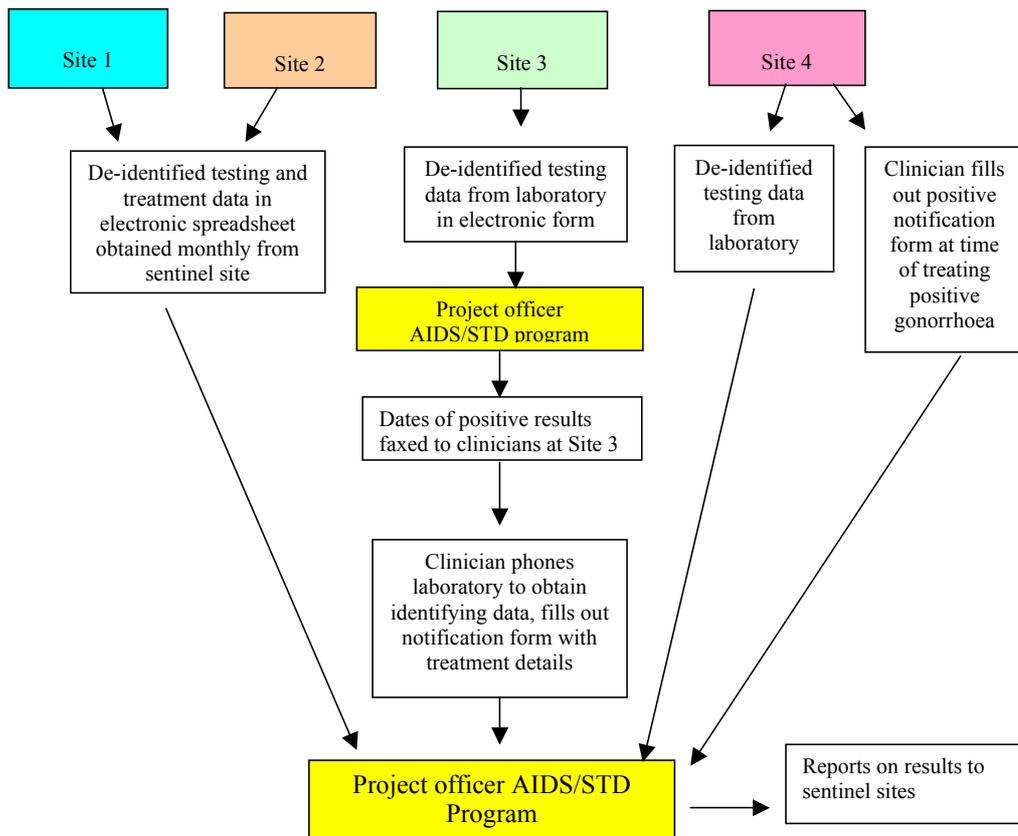
**Methods**

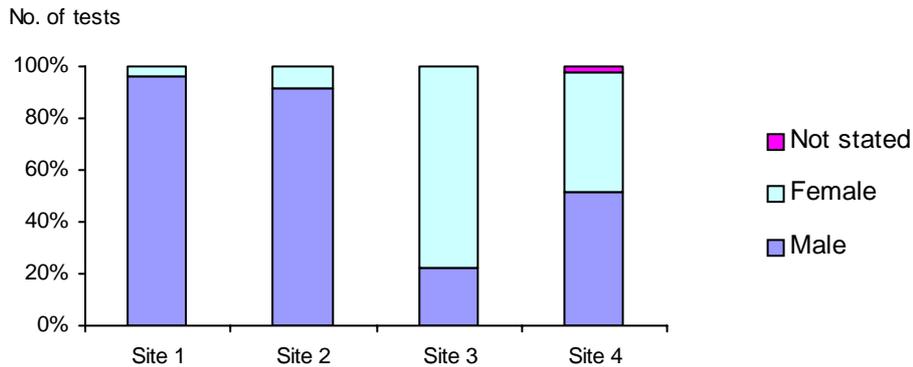
**Data Collection Process**

The 4 sentinel surveillance sites are located in 3 health districts of the NT, representing parts of the Top End and Central Australia. They were chosen to best represent the population groups who were likely to present with resistant gonorrhoea and those most at risk of acquiring gonorrhoea. All 4 sites are situated in urban settings and 3 of the 4 sites offer gonorrhoea testing and treatment services to people moving to and from remote areas. Specific site locations are not identified in accordance with ethics committee approval.

De-identified testing data are obtained electronically in Excel spreadsheet format from

**Figure 1. Flow chart of data acquisition for sentinel site surveillance**



**Figure 2. Individuals tested by sentinel site and gender**

either the laboratory servicing the testing site, or the sentinel site itself as shown in the flow chart (Figure 1). A positive case of gonorrhoea was defined as either a positive culture or a positive Polymerase Chain Reaction (PCR) test which is confirmed by a different PCR test. Demographic, clinical and treatment details on cases are collected from the clinicians at the sentinel sites. Only gonococcal isolates identified as PPNG by local laboratories were classified as penicillin resistant for this report.

The sentinel surveillance system is administered by a Project Officer based in the AIDS/STD Program. This process is supported by clinicians at the sentinel sites and laboratory and information management staff who supply testing and treatment data.

The data collection process presented in Figure 1 was developed in consultation with each sentinel site and laboratory at the beginning of the project.

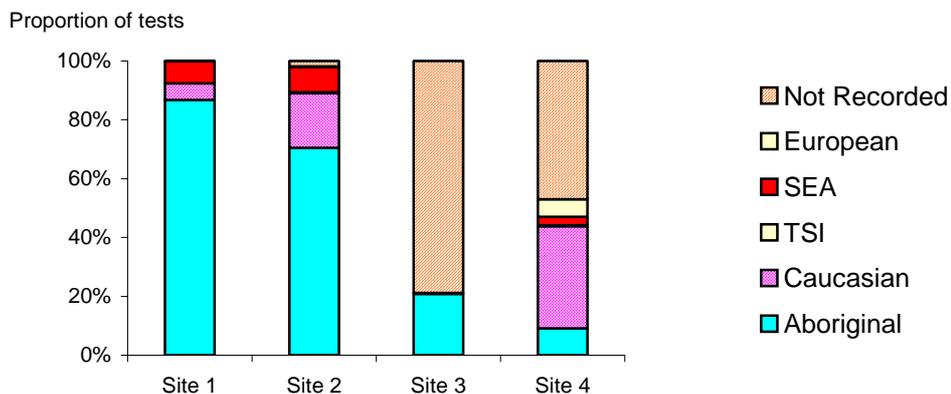
## Results

### Numbers tested

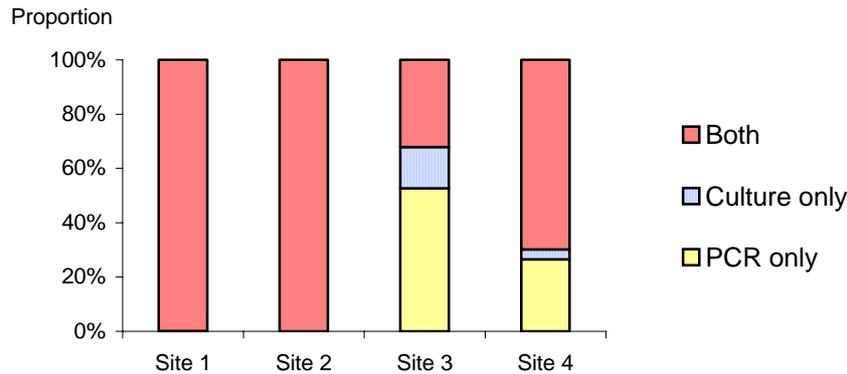
In the first 12 months of the project there were 3149 clinic attendees from the 4 sentinel sites tested for *N. gonorrhoeae*. There were 620, 954, 412 and 1163 tests from sites 1, 2, 3 and 4 respectively with 2165 (69%) being male, 955 (30%) female and 29 (1%) with no recorded gender. The median age was 29 years with a range of 6 to 77 years.

At sentinel sites 1 and 2 the great majority of those tested were male while 78% of specimens from site 3 were from women. Both genders were represented more equally at site 4 (Figure 2).

Ethnicity was recorded for 2259 (71%) of individuals tested and of those 62% were Aboriginal. Site 3 had the highest proportion (79%) of tests where indigenous status was not reported (Figure 3).

**Figure 3. Individuals tested by sentinel site and ethnicity**

**Figure 4. Type of test requested by sentinel site**



**Tests requested**

Both PCR and culture were requested on almost all samples (99.9%) from sites 1 and 2. At site 3 PCR only was requested on 53% of specimens, culture only on 15% and both PCR and culture were requested on 32% of specimens. At site 4 culture and PCR was performed on all specimens. However, due to a temporary data extraction error, data concerning the results for both PCR and culture were only available for 70% of specimens.

proportion (15%) of positive tests (Table 1) and detected 40% of all gonorrhoea cases diagnosed across all 4 sites.

**Symptoms**

Of the male cases, 55% had no symptoms (Figure 5). Either discharge and/or dysuria were the most frequently reported symptoms and these occurred in 30% of cases. In 12% of cases, symptom assessment was not recorded.

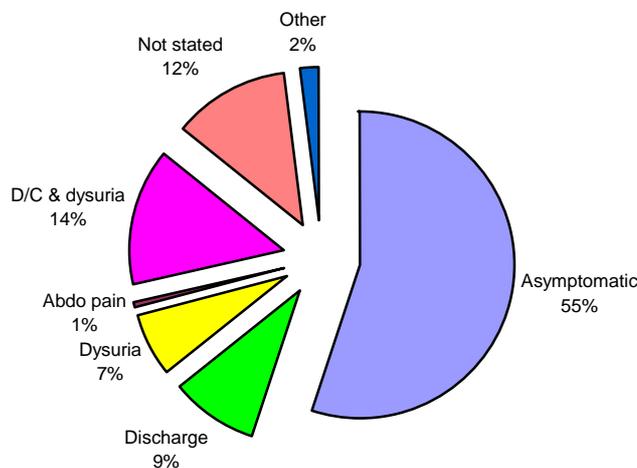
**Cases of infection**

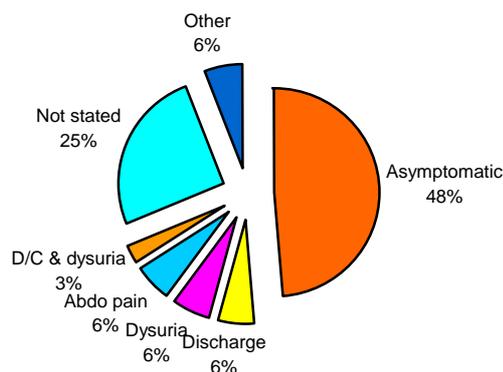
According to the case definition (i.e. confirmed PCR and/or culture) there were 232 (7%) positive gonorrhoea tests in this 12 month period from all sites (results in Table 1). Males accounted for 195 cases, with 35 cases in females. In the remaining 2 cases no gender was identified. Sentinel site 1 had the highest

**Table 1. Tests and cases (by confirmed PCR and/or culture) by site**

Sentinel Site	Cases	Tests	% Positive
1	94	620	15.2%
2	43	954	4.5%
3	40	412	9.7%
4	55	1163	4.7%
<b>Total</b>	<b>232</b>	<b>3149</b>	

**Figure 5. Symptomatic profile of male cases**



**Figure 6. Symptomatic profile of female cases**

Amongst female cases, 17 (48%) were asymptomatic. Symptom assessment was not recorded for 25% while abdominal pain, discharge, dysuria and other were each reported equally at 6%. The remaining 3% presented with discharge and dysuria (Figure 6).

### ***Ethnicity***

Seventy three percent of cases were identified as Aboriginal, 11% as Caucasian and 10% had no ethnicity recorded. There were very few cases identified in South East Asian and Torres Strait Islander groups.

### ***Exposure***

Heterosexual activity was the most commonly reported mode of exposure (61%) with 3% of cases recorded as having same sex preference. No information on exposure was recorded in 35% of cases.

### ***Diagnostic technique***

Of the 232 cases, 200 had both PCR and culture requested on specimens, 29 were sent for PCR testing alone and 3 had only culture ordered. Of the 200 where both PCR and culture were requested, 24% were PCR positive and culture

negative, 73% were positive by both tests and 3% were culture positive and PCR negative (Table 2).

### ***Treatment***

The antibiotic treatment recommended for uncomplicated genital gonorrhoea acquired in the NT, i.e. amoxicillin and probenidic, was administered in 38% of cases and the empiric treatment for gonorrhoea and chlamydia (amoxicillin, probenidic and azithromycin) was given in 30%. There was no record of treatment in 11% of cases, while 10% were recorded as receiving no treatment and 11% were not treated according to recommended protocols.

### ***PPNG***

Over the 12 months, 5 cases of PPNG were identified. All cases were in males with an associated travel history (1 to the Philippines, 3 to Indonesia and 1 not specified). Heterosexual contact was recorded as the risk exposure for all cases. Two of the cases were recorded as Caucasians, 2 as South East Asians and in 1 ethnicity was not recorded. All cases were diagnosed at sentinel site 4 and were treated appropriately with ceftriaxone +/- azithromycin.

Using a denominator of culture isolates only (as PPNG is unable to be determined from PCR tests), 11% (95% CI 2% to 22%) of isolates among the non-Aboriginal sample were resistant to penicillin. There was no resistance detected in any of the cultures recovered from Aboriginal patients. All PPNG cases were detected at site 4 and they accounted for 9% (95% CI 3% to 19%) of the cases diagnosed at this site. No data are available on CMRNG from the sentinel sites.

**Table 2. Positive results where both PCR and culture were requested**

N=200	PCR positive	PCR negative
<b>Culture Positive</b>	146(73%)	7(3%)
<b>Culture negative</b>	47(24%)	0

## Discussion

### *Data acquisition*

#### *Sentinel Sites 1 and 2*

Figure 1 illustrates the flow of data within the sentinel surveillance system and provides a context for discussion of the strengths and weaknesses of the system. All the testing and treatment details from sites 1 and 2 were forwarded to the AIDS/STD Program in electronic format from a single source. This resulted in high quality and timely data from these sites.

#### *Sentinel Site 3*

Only 47% of specimens from site 3 had culture performed. The supply of testing data from the laboratory servicing site 3 was effective, however access to demographic and treatment information from cases diagnosed at this site was very limited. This was likely to be influenced by the complicated flow of steps to obtain the enhanced data from the clinicians (as illustrated in Figure 1).

A high rate of staff turnover and competing clinical priorities at sentinel site 3 were thought to contribute to the low proportion of culture tests and the incomplete data transfer on cases to the Project Officer. In an attempt to address this, bimonthly summary reports were circulated to the clinicians responsible for requesting gonorrhoea tests at that site. This included a brief introduction to the surveillance project, a summary of testing and treatment data for the previous 2 months for that site and reminders about recording ethnicity, ordering both PCR and culture and completing positive notification forms at the time of diagnosing and treating a positive gonorrhoea case. Site visits were also conducted by the Project Officer and despite staff and management agreement to participate, these interventions were unsuccessful in improving data quality or information flow.

#### *Sentinel Site 4*

Testing data at sentinel site 4 were acquired separately from the treatment data. However the congruence between them was high due to the commitment of clinicians to supply

demographic and treatment details on positive cases of gonorrhoea at the time of treatment. Ethnicity was the only variable to be regularly omitted from the pathology request forms from this site.

### *Findings*

Current PCR tests do not detect penicillin resistance. The organism must be cultured to determine its resistance profile. More than half (n=217) of the specimens from site 3 did not have culture requested. While there were no cases of PPNG reported from this site, with such a low proportion of culture being performed it is not possible to draw any conclusions from this data.

Anecdotally, many clinicians believe a specimen will be routinely sent for culture by laboratory staff if the PCR is positive. This illustrates the need for ongoing monitoring of clinician requesting patterns in testing for gonorrhoea. Persistence in raising awareness among health care providers about the need to specifically request culture for gonorrhoea testing is important if we are to monitor antibiotic resistance in the NT population.

There was a short period when the laboratory servicing sentinel site 4 was unable to perform confirmatory PCR testing. During this period, positive PCR screening tests in the absence of a positive culture were included in Table 1 as cases if the clinicians had treated and contact traced the individuals. These cases do not impact on the proportion reported as penicillin resistant obviously as culture was not available.

A significant finding was that the majority of males who tested positive for gonorrhoea had no symptoms.\* This is in contrast to the generally held assumption that men with gonorrhoea are likely to experience and report symptoms. However, the finding is consistent with a growing body of evidence which suggests that a substantial proportion of males with gonorrhoea do not present with symptoms.<sup>7,8,9</sup>

Of concern is the relatively low rate of appropriate treatment administered. Only 69% of cases had documentation of receiving

\* Sentinel site 4 contributed a very small proportion of the asymptomatic cases and therefore the overall figure of 55% of cases being asymptomatic is little affected by the short period when confirmatory PCR testing was not available.

appropriate treatment. This poor result is not due to a lack of documentation as 21% of cases had a definite recording of either no treatment or inappropriate treatment being given. This finding demonstrates the utility of the sentinel system to identify deficiencies in clinical care systems and to highlight areas of educational need.

## Conclusions

The data from the sentinel system are consistent with the recent understanding of the epidemiology of gonococcal infection in several ways. The majority of infection occurred among Aboriginal people, there was no antibiotic resistance observed in samples from Aboriginal people, and all cases of antibiotic resistance occurred in people with a history of sexual exposure either interstate or overseas. A caveat on these observations arises from the smaller proportion of specimens from females in the overall sample. The system could be modified to ensure that it is more closely representative of the demographic profile of the population in terms of gender, age and location. A more comprehensive understanding of overall gonococcal antibiotic resistance will require data from pathology companies, the Notifiable Diseases System and the AGSP.

The WHO recommends that an antibiotic no longer be used when 5% of culture isolates are resistant to it. Nine percent of isolates were PPNG at sentinel site 4. None occurred at any of the other sites and all cases of PPNG were associated with sexual activity outside the NT. However, sentinel site 4 was chosen as one highly likely to represent the population most likely to present with resistant strains of gonorrhoea. In the NT, urgent notification to the local CDC of antibiotic resistant gonorrhoea is required by the Notifiable Diseases Act. CDC

### Box 1

Urethritis / Cervicitis	
<b>Acquired in the NT</b>	<b>Acquired outside the NT or contact of known resistant gonorrhoea</b>
Azithromycin 1g PLUS Amoxicillin 3g and Probenecid 1g	Azithromycin 1g PLUS Ceftriaxone 250mg IM or Ciprofloxacin 500mg

### Box 2

Gonorrhoea (uncomplicated lower genital tract)	
<b>Acquired in the NT</b>	<b>Acquired outside the NT or contact of known resistant gonorrhoea</b>
Amoxicillin 3g (unless culture shows resistance to Penicillin)	Ceftriaxone 250mg IM or Ciprofloxacin 500mg

staff then immediately contact the diagnosing clinician to ensure appropriate treatment has been administered, offer help with contact tracing if required and obtain details on likelihood of local acquisition.

For these reasons it seems reasonable to maintain the current recommendations for the treatment of gonorrhoea in the NT (See Box 1 and 2). However all practitioners must be alert to the possibility of antibiotic resistance and need to ask clients about possible sexual exposure outside the NT. When such exposure is ascertained treatment with either ceftriaxone or ciprofloxacin should be offered. In addition, practitioners should attempt to perform culture whenever possible.

## Recommendations

1. That current recommendations for the treatment of gonococcal infection in the NT remain unchanged.
2. The sentinel site project continue to collect testing and treatment data on *N. gonorrhoeae* from sentinel sites 1, 2 and 4 according to ethics approval.
3. That sentinel surveillance cease at site 3. The amount of culture performed remained too low, in spite of considerable effort to increase it. In addition, data were largely incomplete and therefore the site did not make a useful contribution to the overall system.
4. Consideration be given to establishing another sentinel site which might provide a sample with a greater proportion of female clients.
5. Data from pathology companies, the NT Notifiable Diseases System and the AGSP be routinely collected and analysed in conjunction with data from the sentinel surveillance system.

## Acknowledgements

The important and helpful role of clinical staff at participating sentinel sites, pathology staff and information management staff involved in the provision of testing and treatment data is sincerely acknowledged.

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## Editorial

*Steven Skov, AIDS/STD Program, CDC*

The sentinel surveillance site system should be a part of a broader system of surveillance and analysis of gonococcal antibiotic sensitivity. Its principle role is to provide sites where culture for gonorrhoea will always be performed in a high proportion of cases, hopefully 100% of the time. As has been done, the selection of the sites should provide some samples which are broadly representative of the general population and others which are more likely to detect antibiotic resistant infection.

Analysis of the sentinel site data should be combined with other data available from pathology companies, the NT Notifiable Disease Database and the Australian Gonococcal Surveillance Program (AGSP). It will be important to compare the demographic profile, in terms of age, gender and location, of persons tested and cases of infection between the sentinel sites and the general population. The data from the various pathology laboratories on the proportion of all tests which included a culture

and proportion of diagnoses made by culture should also be monitored. This will allow identification of areas where more should be done to perform culture or to improve the yield of culture. Data on both types of antibiotic resistance (PPNG and CMRNG) is available from the AGSP. This provides information on a large sample of gonococcal cultures from all over the NT and permits an understanding of changing patterns of resistance in different regions. By providing a more comprehensive understanding of the situation, data from these other sources will allow an understanding of how to modify the sentinel system if necessary.

The *Neisseria gonorrhoeae* Sentinel Site Surveillance System is an important step towards monitoring antibiotic resistance in the NT. It now needs to be combined with regular data collection and analysis from other sources to produce a comprehensive system. The challenge remains for the AIDS/STD program to put this in place.

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## **New Child Health Team!**

### *Barbara Paterson, Child Health Program*

The Child Health team is an NT-wide network of town-based and community-based staff. The multidisciplinary team is being formed with new government funding for specialist child health positions and some existing staff such as Strong Women Coordinators, Health Promotion Officers, Central Australian Growth Assessment and Action (GAA) Coordinator and Top End Child Health Nurse.

Coordinators in Central Australia and the Top End will provide leadership and guidance to staff and ensure a coordinated and consistent approach to evidence-based services and interventions to improve child health outcomes, under the guidance of the Program Director, Child, Youth and Family Health, Health Development and Oral Health Services.

Town-based staff are located in Darwin, Nhulunbuy, Tennant Creek and Alice Springs. In the Katherine area an Aboriginal Health Worker (AHW) has been employed in Borroloola, as other communities are serviced by Katherine West and Sunrise Health Boards, who receive their funding directly.

The team will provide program support, training and practical assistance to remote area health centres and communities.

Priorities for the first 12-24 months will be staff orientation and training, full implementation of the GAA Program, with an emphasis on "Action" for those children who are not thriving, roll-out of the Healthy School-Age Kids Program Department of Health and Community Services/Department of Education, Employment and Training and further development of 'early years' strategies. The latter will take a community development approach based on local needs and include maternal health, early nurturing and care and child health monitoring for early detection and intervention for problems such as ear disease and hearing loss.

New team members so far:  
Mundullullu Koops, Aboriginal Child Health Worker - Borroloola (community based)

Tess Narkle, Aboriginal Child Health Worker - Darwin team

Megan Wingrave, Nutritionist - Darwin team

Cath Moody, A/Top End Coordinator - Darwin based

Colleen Edwards, Child Health Nurse - Tennant Creek

Melanie Van Haaren, A/Central Australian Coordinator - Alice Springs based

Mollie, Child Health Nurse – Alice Springs

Patricia Hansen, Child Health Nurse – Nhulunbuy

Tina McKinnon, P/T Child Health Nurse, Darwin team

Six of the 8 half time (4FTE) community based Child Community Workers started in Feb. (TiTree, Docker River, Yeulamu, Hermansberg, Ali Curang and Tennant Creek).

One Child Health Nurse position in Alice Springs remains unfilled following recent interviews. Recruitment of 5 Aboriginal Child Health Workers in Groote Eylandt, Milingimbi/Ramingining, Port Keats, Oenpelli and Maningrida is progressing. Of the 25 new Child Health positions, 18.5 will be employed by DHCS and funding for 6.5 positions has been transferred to the existing Health Boards. Health Department and Health Board staff will work closely together.

The new Child Health team will continue to work closely with Community Paediatrician and CDC throughout the NT, particularly in areas such as vaccination, school-age screening, trachoma and rheumatic heart disease.

For further information contact:

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## Food Bill 2003

*Tracy Ward, Environmental Health Officer, CDC*

The development of nationally uniform Food Acts is a major public health initiative and regulatory reform project for Australia and New Zealand.

The existing Northern Territory *Food Act 1986* was based on a Model Food Act adopted by Australian State and Territory Health Ministers in 1980. The intended uniform adoption had not been fully achieved and led to substantial differences in State and Territory legislation. In 1996, the former Australia New Zealand Food Standards Council (ANZFSC)<sup>1</sup>, agreed that a review of the 1980 Model Food Act should be a priority of the then Australia New Zealand Food Authority (ANZFA)<sup>2</sup> and the States and Territories.

The 1996 review examined each provision of the Model Food Act, existing State and Territory Food Acts (or food provisions of Health Acts) and the New Zealand Food Act to assess whether existing provisions were necessary.

In 1997, the Commonwealth Food Regulation Review (the Blair Review) examined existing food regulations in Australia. The Blair Review was a whole of government, "paddock to plate" review of food regulation and regulatory systems. The key objectives of the Review were to protect public health while:

- reducing the regulatory burden on the food sector and examining those regulations that restricted competition; and
- improving the clarity, certainty and efficiency of food regulation.

The findings of the Blair review were released in 1998. The review found the current regulatory framework in Australia to be complex and fragmented. The report suggested a need for governments to implement an integrated and coordinated national food regulatory system through improved partnership arrangements and the adoption of nationally consistent guiding principles.

In 1999, State and Territory Governments endorsed the final report of the Food Regulation Review.

These reviews were wide ranging and included input from governments, industry groups and individuals across Australia and culminated in the signing of an Intergovernmental Agreement (IGA) on Food Regulation by all the States and Territories and the Commonwealth Government on 3 November 2000. The outcomes of the IGA include:

- a. establishing a new Ministerial Council, with expanded membership, (Australia New Zealand Food Regulation Ministerial Council) to replace ANZFSC; and
- b. the adoption of a Model Food Act, which formed Annex A and Annex B of the IGA.

Each State and Territory agreed to adopt Annex A of the Model Food Act. It deals with definitions, offences and defences relating to food safety and the adoption of the Food Standards Code.<sup>3</sup>

Adoption of each provision in Annex B of the Model Food Act is discretionary. Annex B includes issues such as food business registration, food safety programs and auditing arrangements and improvement notices and prohibition orders.

The Food Bill 2003 contains the entire Annex A provisions as required by the IGA and a number of provisions drawn from Annex B of the Model Food Act.

Provisions relating to food safety programs and auditing of these programs have not been included in the Food Bill 2003. There are unresolved issues concerning the cost impact of food safety programs on small business. The Commonwealth Department of Health and Ageing is involved in a body of research that is addressing these concerns. At the time of drafting the Food Bill, the results of this research were not available.

This Bill was introduced to the Legislative Assembly on the 27 November 2003. The legislation was passed by the Legislative Assembly on the 19 February 2004 and will commence on 1 July 2004.

1. ANZFSC consisted of all State and Territory Health Ministers, the New Zealand Minister for Health and chaired by the Commonwealth Parliamentary Secretary to the Minister for Health and Aged Care. It has since been replaced by the Australia New Zealand Food Regulation Ministerial Council (ANZFRMC).

2. From 1 July 2002, the Australia New Zealand Food Authority (ANZFA) became known as Food Standards Australia New Zealand.

3. The Food Standards Code contains standards relating to food composition, food labelling and advertising and food safety. It is automatically adopted into the Food Law of every State and Territory.

## **An outbreak of norovirus associated with cooked oysters in Darwin**

*Rosalind Webby, MAE scholar, CDC Darwin; Leah Campbell, environmental health officer, Darwin; Karen Dempsey, OzFoodNet enteric disease epidemiologist, CDC Darwin*

### **Introduction**

On Monday 24 November 2003, the Centre for Disease Control (CDC), Darwin was notified of several cases of gastroenteritis associated with eating at a restaurant in Darwin between 20 and 22 November 2003. An investigation was commenced to determine the cause and magnitude of the disease outbreak, and to prevent further illness at the restaurant and in the wider community.

### **Methods**

#### ***Epidemiological Investigation***

On 26 November 2003, we commenced a cohort study of booked patrons who had dined at the restaurant between 31 October and 3 December 2003. Approximately 756 diners were listed on the booking sheets between these dates, with the busiest days being Fridays and Saturdays.

Initial hypothesis generating interviews using a standard gastrointestinal questionnaire<sup>1</sup> revealed that of those diners becoming ill 10 (90%) had eaten prawns and 11 (100%) had eaten oysters at the restaurant.

A specific questionnaire was designed and administered over the phone to the remaining cohort. Questions asked included demographic details, history of gastrointestinal illness, attendance at health care facilities, foods eaten at the restaurant and contact details for other people who had dined at the restaurant. A question was also asked about the number of oysters and prawns consumed.

A primary case was defined as a person who ate at the restaurant between 31 October and 3 December and developed either nausea, vomiting, diarrhoea or abdominal pain and 1 other systemic symptom such as headache, fever, anorexia, lethargy or joint pain within 12 to 72 hours after eating at the restaurant. A secondary case was defined as gastrointestinal illness in a household contact of a primary case.

#### ***Environmental /food investigation***

On 26 November 2003, an environmental health officer and an enteric diseases epidemiologist inspected the restaurant to observe food handling practices, hygiene and cleaning procedures. On a subsequent visit, the oyster preparation and cooking procedure was demonstrated by the entrée chef. All food handlers were interviewed about recent illness and submitted a stool sample for testing.

It was reported that the restaurant had recently changed the type of oysters cooked at the restaurant from half shell oysters to frozen oyster meat. The seafood supplier was contacted and samples of oysters and prawns used at the restaurant were collected for further testing. The oysters collected were from the same batch number used at the restaurant since 31 October 2003. A photograph of the oyster label was taken to assist in identification and collection of further information about the product.

#### ***Laboratory investigations***

Ten stool samples were collected from 8 primary cases and 2 secondary cases. All food handlers also submitted a stool specimen. These stools were examined for ova and parasites and cultured for bacterial pathogens in Darwin and referred to Perth for rotavirus, adenovirus and norovirus testing by polymerase chain reaction (PCR).

Ten kilograms of oyster meat were obtained from the seafood supplier and sent to the Institute of Medical and Veterinary Science (IMVS), Adelaide and Flinders University for testing. Faecal specimens were also sent to both laboratories for comparative testing and sequencing.

#### ***Statistical analysis***

Data was entered into MS Excel and analysed using Intercooled Stata 7.0.<sup>2</sup> Relative risks (RR) and 95% confidence intervals were calculated to measure the strength of association between

exposure to food and illness. The Pearson chi-square statistic was used to calculate p-values unless there was a value less than 5 in a cell, in which case Fischer's exact test was used. Stratified analysis (Mantel-Haenszel method) was used to adjust for confounding between various exposures and illness.

## Results

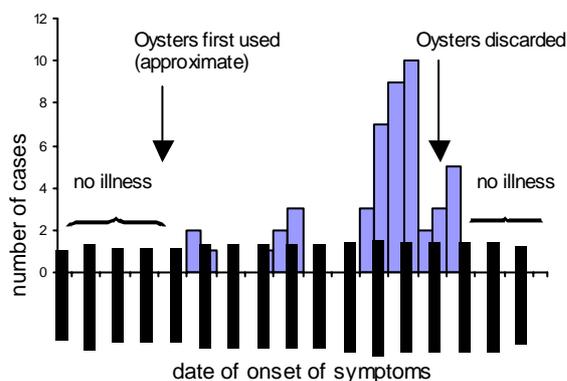
### *Epidemiological Investigation*

To determine the cause and duration of the outbreak 192 booked diners were interviewed by phone. This represented approximately 25% (192/756) of the booked diners between 31 October and 3 December 2003.

The cause of the outbreak was determined by analysing data on diners who ate at the restaurant between 7 and 25 November. This period was used as the first cases of gastroenteritis occurred on 7 November and no further cases of illness associated with oyster consumption occurred after 25 November 2003.

Forty-eight people fulfilled the case definition for a gastrointestinal illness within 12 to 72 hours after eating at the restaurant. Of these, 45 had eaten oysters (attack rate = 71%)(Table 2). The mean as well as the median age of cases was 42 years and the gender distribution was equal. The incubation period was 12 to 69 hours with a mean of 34 hours (Figure 1).

**Figure 1. Number of cases of norovirus by onset of first symptom between 7 and 25 November 2003 associated with eating at the Darwin restaurant.**



The main symptoms are listed in Table 1. The duration of symptoms ranged from 11 to 264 hours, with a mean of 59 hrs and median of 54 hours. Visits to general practitioners were required for 9 cases but no cases were hospitalised. Secondary cases occurred in 2 children whose parent had eaten at the restaurant.

**Table 1. Clinical features of people with gastroenteritis associated with eating at the Darwin restaurant between 7 and 25 November 2003.**

Symptom	number of cases (Percentage) (%)
Lethargy	44 (92%)
Nausea	42 (88%)
Anorexia	38 (79%)
Diarrhoea	38 (79%)
Abdominal pain	34 (71%)
Fever	33 (69%)
Vomiting	25 (52%)
Headache	24 (50%)
Joint pains	23 (48%)
Sore throat	13 (27%)

### *Food specific attack rates and relative risks of foods eaten*

Selected attack rates for foods eaten at the restaurant are shown in Table 2. The relative risk of illness associated with oyster consumption was 16.67 (95% confidence interval (CI) 5.45, 50.98;  $p < 0.01$ ). Other foods with a significant relative risk for illness after consumption were prawns and Pad Thai. After taking account of associated oyster consumption, Pad Thai and prawns were not associated with illness. No other foods eaten were implicated as causes of illness.

The exact duration of the outbreak was difficult to accurately determine because the start date was unclear. The approximate start date was between 1 and 7 November 2003. The end date was more certain as the oysters were disposed of on 25 November and no further cases of gastroenteritis occurred in people who consumed oysters after this date.

**Table 2. Food specific attack rates and associated risk of illness among diners to the restaurant between 7 and 25 November 2003, Darwin**

Food	Persons who ate item			Persons who did not eat item			Relative Risk 95% Confidence Interval	P value
	Ill	Not Ill	Attack rate(%)	Ill	Not ill	Attack rate(%)		
Oysters	45	18	71%	3	67	4%	16.67 (5.45, 50.98)	<0.01*
Prawns	35	29	55%	13	56	19%	2.90 (1.69, 4.97)	<0.01*
Pad Thai	7	1	88%	41	84	33%	2.67 (1.86, 3.83)	<0.01*
Bok choy	4	1	80%	44	84	34%	2.33 (1.41, 3.83)	0.06
Pandan Chicken	20	18	53%	28	67	29%	1.79 (1.16, 2.75)	0.02
Special prawns	14	12	54%	34	73	32%	1.69 (1.08, 2.66)	0.06
Chilli prawns	11	9	55%	37	76	33%	1.68 (1.04, 2.70)	0.10
Beef curry	10	9	53%	38	76	32%	1.58 (0.96, 2.60)	0.17

\*significance level 0.01

This is borne out by the attack rate being lowest (0%) in people who consumed oysters on the first and last weekends, and highest on the weekend of the 21 to 22 November 9 (Table 3).

**Table 3: Attack rates in people who ate oysters at the Darwin restaurant on Fridays and Saturdays between 31 October 2003 and 29 November 2003**

Fridays and Saturdays by week	Attack rate (Oyster eaters)
Friday – Saturday (31 <sup>st</sup> Oct – 1 <sup>st</sup> Nov)	0%
Friday – Saturday (7 <sup>th</sup> – 8 <sup>th</sup> Nov)	27%
Friday – Saturday (14 <sup>th</sup> – 15 <sup>th</sup> Nov)	60%
Friday – Saturday (21 <sup>st</sup> – 22 <sup>nd</sup> Nov)	81%
Friday – Saturday (28 <sup>th</sup> – 29 <sup>th</sup> Nov)	0%

#### **Environmental /food investigation:**

The environmental health inspection of the kitchen identified minor breaches of food safety and hygiene and confirmed that the oyster meat had been discarded. The restaurant management was required to clean particular areas of the kitchen. On a subsequent visit recommendation was made to apply a chlorine-based disinfectant to the entire kitchen and toilet areas.

As the package label for the oyster meat contained the instructions to cook the product before consumption, the preparation and cooking procedures of the oysters were observed and are outlined as follows:

Every morning the entrée chef removes between 2 to 4 one-kilogram bags of oyster meat from the freezer and places them in a cool room until an order is received. On ordering the required amount of oyster meat is removed from each bag, washed under tap water, placed into a poaching cell of a terracotta plate and grilled on each side for 4 to 5 minutes. In total the cooking process is 8 to 10 minutes. The oysters are served hot to the customer in the terracotta plate after addition of a lemongrass sauce and a fresh basil garnish.

#### **Laboratory testing**

Of the 8 stool samples 4 were positive for norovirus genotype II by PCR. Of the 2 secondary cases 1 was positive for norovirus. All the food handlers had negative stool tests for all pathogens including norovirus. Norovirus was not detected in the oysters by PCR methods at both IMVS and Flinders University.

#### **Discussion**

We demonstrated a strong association between consumption of cooked oysters and

gastroenteritis illness over a 2 to 3 week period. This association is supported by detection of norovirus in 4 stools of ill diners. The features of the illness fulfilled all Kaplan's criteria<sup>3</sup> for a Norwalk-like illness with stool cultures negative for bacterial pathogens, mean duration of illness 59 hours, vomiting in 52% of cases and mean incubation period of 34 hours. Norovirus was not detected in the oysters by PCR methods at 2 laboratories.

The exact duration of the outbreak was difficult to determine as the start date is uncertain. No illness occurred in people who ate on Friday 31 October and Saturday 1 November 2003. The restaurant is unclear when the frozen oyster meat was first used at the restaurant and interviews were only conducted on Fridays and Saturdays in the first 2 weeks of November due to time and resource limitations. The first case of illness associated with oyster consumption occurred on 7 November so it is postulated that the outbreak began between 1 and 7 November 2003. The end date is certain as the restaurant discarded the oysters on 25 November and no further cases of illness occurred in people who ate oysters at the restaurant after 25 November 2003.

The true magnitude of the outbreak is difficult to measure as only booked diners were contacted, and no contact details for other diners were available. Of the booked diners only 25%(192) were contactable. However, approximately 73 kilograms of oyster meat, enough to make 365 servings was delivered to the restaurant from 31 October to 25 November. If all the oyster meat was used, at least 365 people may have become unwell.

The environmental health inspection and information from other oyster related outbreaks in Australia and Japan support the conclusion that contamination of the oysters is likely to have occurred prior to handling by the restaurant. The environmental health inspection revealed no major hygiene issues at the restaurant, no illness in food handlers and negative stool tests for all food handlers. Studies in Japan<sup>4</sup> have revealed that 10% of Japanese oysters intended for raw consumption harbour norovirus and between 42% to 53% of Japanese foodborne norovirus outbreaks are caused by oyster consumption.<sup>5,6</sup>

In Australia, 2 outbreaks of norovirus associated with Japanese oyster consumption occurred in 2002 and 2003. At the same time as our outbreak, another investigation of norovirus associated with raw oyster consumption began in Esperance, Western Australia (WA). The oysters in both outbreaks originated from Japan and were imported by different companies to Australia. Trace-back of the oysters coordinated by OzFoodNet found the oysters from WA and NT originated from the same harvest area in the Hiroshima prefecture, Japan. It is unknown if this area was contaminated prior to harvesting. Studies in North America and New Zealand have linked contamination of oyster beds to sewage effluent from oyster harvesters and recreational boats.<sup>7,8,9</sup>

This is the first study in Australia to show norovirus infection associated with eating cooked oysters. All other outbreaks of norovirus associated with oyster consumption in Australia have occurred from consuming raw oysters.<sup>10,11,12,13</sup> However, 2 studies in North America<sup>14,15</sup> have reported illness from norovirus after eating cooked oysters. Products imported to Australia are not routinely tested for bacterial pathogens and toxins on entry by the Australian Quarantine Inspection Service (AQIS) if instructions recommending cooking are present. Testing is only conducted if the product is not ready for consumption however norovirus testing is not routinely undertaken (personal communication: Sophie Williamson, AQIS).

This investigation highlights serious concerns about the safety of imported Japanese oyster meat. The current cooking label, "cook before consumption" placed on these imported oysters did not prevent illness and food regulators and authorities are currently assessing the safety of this product.

Footnote:

In January 2004, another outbreak of norovirus associated with Japanese oyster meat occurred in Queensland. Trace-back revealed that the oysters were harvested in the same area as those in this investigation. In March 2004, voluntary withdrawal of the oysters with the same batch number as implicated in this outbreak occurred.

## Acknowledgments

Darwin Environmental Health and CDC staff, Peter Markey (CDC), Martyn Kirk (OzFoodNet), Kylie Carville (MAE scholar), Mahomed Patel (NCEPH), FSANZ, and AQIS.

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## OzFoodNet Highlights for 2003

*Karen Dempsey, OzFoodNet Enteric Disease Epidemiologist*

OzFoodNet, a network of epidemiologists employed by State and Territory health departments, was established by the Commonwealth Department of Health and Ageing in 2000 to enhance surveillance for foodborne disease in Australia and provide better evidence on how to prevent foodborne illness. The Northern Territory (NT) joined the OzFoodNet network, initially as an observer in 2002 and as a member in January 2003, following the employment of an epidemiologist at the Centre for Disease Control (CDC) based in Darwin. The purpose of the epidemiologist was to enhance enteric disease surveillance in Darwin and assist with foodborne and non-foodborne illness investigations throughout the NT.

During the past 12 months enhanced enteric disease surveillance was performed by contacting salmonellosis, shigellosis and hepatitis A cases to identify potential exposures such as daycare attendance, overseas or interstate travel, or being contacts of other cases. A history of food consumption during the 72 hours prior to onset of illness was also asked of all adults and children over the age of 5.

In addition, the Northern Territory Notifiable Diseases Surveillance System (NTNDSS) was scrutinised on a weekly basis for clusters of notifiable enteric disease pathogens including *Salmonella*, *Shigella*, *Campylobacter*, *Listeria*, *Yersinia*, Rotavirus and Hepatitis A virus (HAV).

While the NTNDSS is an important source of information for cluster identification, the data are often not timely, particularly for notifications of *Salmonella* infection which can take 2–3 weeks to identify the type (serovar) and at least a further 1–2 weeks for phage-typing if needed. Consequently there are often considerable delays before cluster investigations are conducted.

Outbreaks of gastroenteritis, on the other hand, require more immediate public health action and the success of investigations rely heavily on information reaching CDC in a timely fashion. For this reason health professionals are asked to inform CDC of all gastroenteritis where there is

potential for an outbreak i.e. 2 or more epidemiologically linked cases, particularly if food is thought to be the source.

As a result of information provided by sources such as health professionals and non-medical informants 12 enteric disease outbreaks were investigated during 2003. Health professionals notified their relevant CDC of 7 outbreaks (5 gastroenteritis and 2 HAV). Non-medical informants such as those providing childcare and members of the public notified the remaining 5 outbreaks (all gastroenteritis).

The exposure was considered to be contaminated food for 7 (64%) outbreaks. The remaining 5 (36%) outbreaks were not linked to food or water and transmission was likely to be person-to-person.

Norovirus was implicated as the causative agent in 7 (58%) outbreaks (4 were confirmed from stool testing and 3 were presumptive on the basis of clinical symptoms and incubation period).

*Salmonella* was the causative agent in 1 foodborne outbreak and implicated as the causative agent in the second. In this outbreak convalescent stool specimens were negative for any pathogens but food samples collected post outbreak were positive for *Salmonella* spp.

*Staphylococcus aureus* and HAV were confirmed as the causative agents in 3 outbreaks.

### Summary of outbreaks

#### January

Severe gastroenteritis was reported by 7 people within 1–3 days of eating at a Darwin food hall during the long weekend in January. Five were confirmed positive for *Salmonella* Typhimurium phage-type 135 by stool culture and 2 were epidemiologically linked. *Salmonella* was not detected in food samples but environmental health inspection of the premises identified several breaches of food safety and hygiene, potential cross-contamination factors and temperature control issues. Follow-up inspections revealed good compliance and there

have been no further cases (see *The Northern Territory Disease Control Bulletin* Vol 10, No. 2, June 2003 for full report).

### **February**

Mild to moderate gastroenteritis was reported by 11 people within 1–3 days of eating a ‘finger-food’ lunch at a workshop held in Darwin. A private catering company provided the food, most of which was eaten during the lunch break and then disposed of that afternoon. Primary symptoms were consistent with a viral infection, possibly norovirus. The cause was unconfirmed as stool specimens collected from convalescent cases were negative for all pathogens and there was no left over food for testing. Transmission was thought to be foodborne in view of the fact that environmental inspection of the caterer’s premises identified several breaches of food safety and hygiene and potential for cross-contamination from animals.

### **May**

An outbreak of gastroenteritis occurred among 15 children at a Darwin Childcare Centre following exposure to the vomitus of an ill child. There were a large number of secondary cases in adults and older siblings and the causative organism, norovirus, was isolated from several stool specimens. Transmission was thought to be person-to-person.

### **June**

Approximately 4–5 weeks after a 3-day visit to a Central Australian campsite a large number (21) of interstate residents tested positive for HAV. Extensive investigation was carried out by an NT environmental health officer. The source was not linked to commercially produced meals or water supplies and epidemiological evidence implicated a coleslaw salad eaten at a communal barbecue on the last evening of the visit.

### **August**

Gastroenteritis occurred among a group of bus travellers requiring the driver to detour to and seek treatment at a remote community health clinic. The Aerial Medical Service was required to evacuate 4 of the 5 cases to the Royal Darwin Hospital, as symptoms were severe and suggestive of food intoxication. Consumption of

a contaminated rice meal 3 to 4 hours prior to onset of illness was thought to be the cause. Although no leftover food was available for testing, the diagnosis of food intoxication was confirmed by the isolation of *Staphylococcus aureus* from the vomitus of 2 cases (see *The Northern Territory Disease Control Bulletin* Vol 10, No. 3, September 2003 for full report).

### **August**

Mild to moderate gastroenteritis was reported by 18 people within 1–3 days after eating at a party at a Darwin private residence. Cases were unable to provide stools but the incubation period and clinical symptoms fitted the description of a viral infection, possibly caused by norovirus. There were no leftovers for testing but epidemiological evidence implicated commercially produced pizza as the source. Environmental inspection of the pizza premises did not identify any breaches of food hygiene practices. However temperature control issues were observed which required immediate rectification.

### **September**

A family of 5 reported mild to moderate gastroenteritis following consumption of a meal at a Darwin sports club bistro. Primary symptoms fitted the description of a viral infection, possibly caused by norovirus. Inspection of the kitchen failed to identify any breaches of food safety and hygiene. Subsequent interviews revealed that 1 of the family members, a child, was symptomatic prior to the meal. The cause was confirmed as norovirus from stool specimens and transmission was thought to be person-to-person rather than foodborne.

### **October**

A cluster of HAV occurred among 2 groups of people living in close proximity in a Darwin suburb. Group 1 comprised 3 members of a family (1 adult and a child were symptomatic and 1 child tested positive on household contact testing). Group 2 comprised of a teenage male who became symptomatic for HAV the following day. Environmental inspection of the neighbourhood failed to identify a common exposure to the 2 groups and there were no links to commercially produced food or water supplies.

### October

Symptoms ranging from mild to moderate gastroenteritis were reported by 11 people following consumption of 'finger-food' items at a Darwin workshop. A private catering company provided the food, most of which was eaten during that afternoon and then disposed of later in the day. The cause was unconfirmed as no stool specimens were collected from cases and there were no left overs for testing. Clinical symptoms however fitted the description of a viral infection, possibly caused by norovirus. Food preparation was carried out at the caterer's home premises where infant children were being cared for. Inspection of the caterer's home identified considerable potential for cross-contamination from the infant children to food and norovirus was isolated from the stool of 1 of the children. Therefore it is believed that the outbreak was foodborne.

### November

Severe gastroenteritis was reported by 10 people within 1-3 days of eating at a Darwin private function catered for by a restaurant and a cake shop. Stools collected from 2 convalescent cases were negative for pathogens. Clinical symptoms suggested a bacterial cause. Inspection of both premises to assess food safety and hygiene standards identified major breaches at the restaurant requiring a 'Notice' to be served. It was suspected that a food item at high-risk for bacterial contamination such as poultry may have been the source and consequently 2 samples of quail, 1 processed and 1 unprocessed

were sent for testing. *Salmonella* spp. was isolated in the processed meat indicating the quail was most probably contaminated during the marinating and stuffing process (see *The Northern Territory Disease Control Bulletin* Vol 10, No. 4, December 2003 for full report).

### November

An outbreak of gastroenteritis occurred among 18 staff of a large Central Australian tourist resort, several travellers and 2 staff of a remote community health clinic. No links to food or water were identified and transmission was thought to be person-to-person. Norovirus was isolated from the stool of 1 case.

### November

Several groups of people reported symptoms of mild to moderate gastroenteritis within 1-3 days after eating at a popular Darwin restaurant. The restaurant had recently trialed a brand of imported oysters over a 2-3 week period, starting 7 November. No cases occurred prior to this date nor were any identified after the restaurant ceased serving this brand. A cohort study identified grilled oysters as the source (strong statistical association: risk ratio >16) and norovirus genotype II was isolated in stools of several cases. Although microbiological testing failed to isolate norovirus in oyster samples, traceback of the oysters linked this outbreak to a simultaneous outbreak in Western Australia, also involving imported oysters (see *The Northern Territory Disease Control Bulletin* Vol 11, No. 1, December 2003 for full report).

**Table 1. Northern Territory enteric disease outbreaks 2003**

Onset	Cases	Admitted	Died	Study type	Interviewed	Specimen type (no. tested)	Specimen pathogen	Food tested	Food pathogen	Transmission
January	7	0	0	Case series	7	Stool (5)	<i>Salmonella</i> Typhimurium PT135	Yes	Nil isolated	Foodborne
February	11	0	0	Cohort	23	Stool (3)	Nil isolated	No		Foodborne
May	15 primary 18 secondary	Unknown	0	Case series	33	Stool (5)	Norovirus	No		Person-to-person
June	21	Unknown	0	Cohort	216	(Blood) 21	Hepatitis A	No		Foodborne
August	5	4	0	Case series	5	Stool (3) Vomitus (2)	<i>Staphylococcus aureus</i>	No		Foodborne
August	18	0	0	Cohort	21	0	Not tested	No		Foodborne
September	5	0	0	Case series	5	Stool (2)	Norovirus	No		Person-to-person
October	4	2	0	Case series	20	Blood (4)	Hepatitis A	No		Unknown
October	11	0	0	Cohort	13	Stool (4)	Norovirus	No		Foodborne
November	10	0	0	Cohort	17	Stool (2)	Nil isolated	Yes	<i>Salmonella</i> spp.	Foodborne
November	21	Unknown	0	Case series	21	Stool (3)	Norovirus	No		Person-to-person
November	48	0	0	Cohort	133	Stool (8)	Norovirus genotype II	Yes	Nil isolated	Foodborne

## Comments on 2002 and 2003 Notifications page 36

### Summary of Notifiable Diseases 2003

#### Top 10 notifiable diseases

In 2003, the new addition to the top 10 notifiable diseases was influenza, for which there were 151 cases notified, the most since it became notifiable in 1999. The number of cases of cryptosporidiosis fell from 217 (ranked 7th) in 2002 to 96 in 2003 to be ranked 13th. Chlamydial genital infection was the most common notifiable disease. Chlamydial conjunctivitis (trachoma) was ranked 7th compared with 10th in 2002.

**Table 1. Top ten notifiable diseases in 2003 compared to the previous 4 years**

	Rankings				
	2003	2002	2001	2000	1999
Chlamydial Genital Infection	1	2	2	3	3
Gonorrhoea	2	1	1	2	1
Trichomoniasis	3	3	3	1	2
Salmonellosis	4	6	6	4	5
Syphilis	5	5	5	5	6
Campylobacteriosis	6	8	7	8	7
Chlamydial conjunctivitis	7	10	15	22	22
Rotaviral infection	8	4	4	6	4
Hepatitis C (unspecified)	9	9	10	9	8
Influenza	10	15	14	13	16

#### Campylobacteriosis

During 2003 there were 268 cases of campylobacteriosis, higher than the 208 reported in 2002 but only slightly more than the mean annual number for the previous 4 years. The increase mainly occurred in Alice Springs region with other regions reporting similar numbers to last year.

#### Chlamydial conjunctivitis (trachoma)

Notifications of chlamydial conjunctivitis were much higher in 2003 compared with 2002, particularly in the Darwin region where the

numbers doubled during 2003. Over the past 4 years the number of notified cases of chlamydial conjunctivitis has increased significantly and is likely to be related to a change in testing regimens, although an increase in clinical cases cannot be excluded.

#### Cryptosporidiosis

Cryptosporidiosis cases were low through out the Territory, but particularly low in Darwin where only 19 cases were reported for the entire year. The epidemics of the wet seasons 2000-01 and 2001-02 did not occur in 2002-03.

#### Influenza

There were more cases of influenza in 2003 than in any of the previous years since 1999 when it became a notifiable disease. The number of cases (151) was more than twice the previous 4 year mean (74). This may have been due to an increase in testing, but may also have been due to more infection. Further study is being done on the 2003 flu epidemic.

#### Melioidosis

The number of cases of melioidosis rose from 22 in 2002 to 27 last year reversing the trend from previous years. Interestingly, there were 7 cases notified in the winter months (July to September) – these were mostly relapses or late presentations of earlier infection.

#### Ross River Virus infection

The number of cases of Ross River Virus infection rose in 2003 from a very low number in 2002 but was still slightly less than the mean for the previous 4 years.

#### Rotaviral infection

There were 237 cases of rotaviral infection in 2003, considerably less than the previous 4 year mean of 422. Over the past decade there have been annual outbreaks of rotaviral infection with larger outbreaks occurring every other year. The large outbreak predicted for 2003 did not occur.

## Salmonella

Across the NT the incidence of salmonellosis in 2003 was similar to 2002 with the majority of cases reported in Darwin region. The most common serovars were those considered to be environmental: *Salmonella* Ball, *Salmonella* Saintpaul and *Salmonella* Anatum, although foodborne transmission was responsible for several cases of *Salmonella* Typhimurium PT 135 notified during the first two months of 2003. As expected salmonellosis incidence increased

during the wet season months and declined during the dry season winter months.

## Shigellosis

Shigellosis cases were more commonly reported in Alice Springs than any other region due to a cluster of cases which occurred in outlying communities in the southern part of the NT and the northern part of South Australia in January and February 2003. This led to 19% more cases than the previous 4 year mean (131 vs 110).

## Comments on annual STI notifications

### Chlamydia

This year saw an 11% increase in notifications NT wide and this is the seventh year in a row that Chlamydia notifications have increased. A very similar trend has been observed Australia wide. There was an increase in the Katherine, Barkly and Alice Springs regions (Alice by 31%) with number in Darwin nearly unchanged and a small decrease in EAR.

### Gonorrhoea

The NT had an 8% reduction in notifications in 2003 compared to 2002. This was the second year in a row that notifications have declined after several years of increases. All regions except the Barkly experienced a fall in notifications with the largest being in Darwin and Katherine.

### Syphilis

Syphilis notifications dropped by 22% this year. A fall was seen in all regions with reductions of 46% in Darwin and 36% in Katherine.

### Congenital syphilis

There were 8 cases in 2003 compared to 13 in 2002 (a year with double the previous highest annual total since 1992). The number in 2003 is more in keeping with that usually reported. In the past 2 years all but 1 of the cases of congenital syphilis were reported from Alice Springs as were 72% of all cases since 1992.

### Trichomonas

A 17% reduction has been observed in NT wide notifications this year. All regions reported reductions except for Alice Springs where an increase of 19% was seen.

### Discussion

Knowledge of the amount of testing for STIs is crucial to an understanding of rates of disease. Our experience suggests that testing in a particular community or region can vary substantially from one year to the next with changes in staff and variation in local programs. Until now there has been no systematic effort to obtain data from pathology companies regarding testing activity. The AIDS/STD program is currently negotiating with the pathology services to receive this data and should soon be able to report on testing activity as part of regular analysis of STI rates.

A full understanding of the changes in rates of all the STIs is hampered by the lack of testing data. However, the increases in chlamydia in the last 2 years at least are likely to be real increases. Generally, both organisms are tested for at the same time. Therefore, it would be unlikely that chlamydia would increase while gonorrhoea decreases if the sole explanation lay with the amount of testing.

Diagnoses of syphilis are also subject to variations in testing. However, because the diagnosis is a complex clinical one and is not based simply on a positive or negative test,

notification is also dependent on the knowledge and behaviour of health practitioners. In all regions of the NT except for Darwin there are centralised syphilis registers which collate clinical, serology and treatment information. These registers provide a stable and reliable system for the diagnosis and notification of syphilis. In Darwin, where such a register does not exist, it is likely that rates are also affected in an unquantifiable way by the diagnostic and notification behaviour of practitioners. Similar factors could also account for variations in rates

of congenital syphilis. This is an extremely complex diagnosis to make and there is not uniform protocol throughout the NT for investigating and diagnosing the condition. Diagnosis is highly dependent on the interest and knowledge of practitioners, especially hospital paediatricians. There is an evaluation of syphilis surveillance in Darwin under way and the AIDS/STD program will be examining the issues of a syphilis register in Darwin and congenital syphilis in the coming year.

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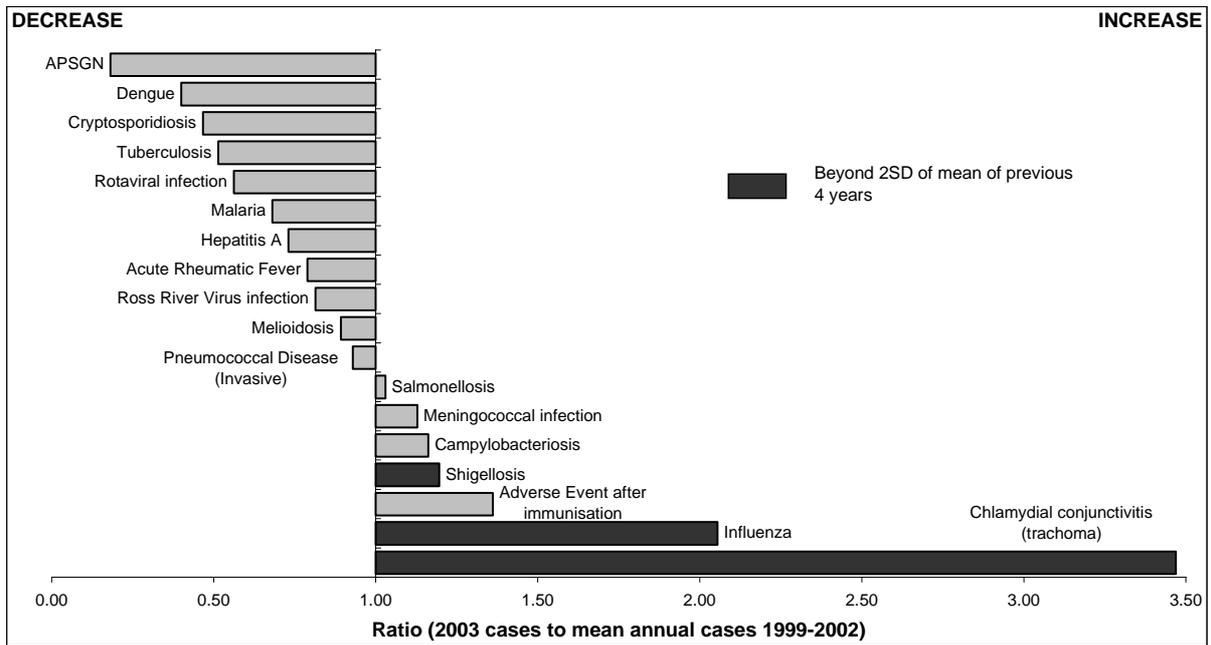
### Notified cases of vaccine preventable diseases<sup>†</sup> in the NT by onset date 2003 AND 2002

DISEASES	TOTAL		No. cases among children aged 0-5 years	
	2003	2002	2003	2002
Congenital rubella syndrome	0	0	0	0
Diphtheria	0	0	0	0
<i>Haemophilus influenzae</i> type b	2	3	2	2
Hepatitis B	15	12	0	0
Measles	1	0	1	0
Meningococcal Group C*	0	1	0	0
Mumps	0	1	0	0
Pertussis	5	37	1	11
Pneumococcal Disease <sup>†</sup>	72 <sup>†</sup>	65 <sup>†</sup>	21 <sup>†</sup>	21 <sup>†</sup>
Poliomyelitis, paralytic	0	0	0	0
Rubella	0	1	0	0
Tetanus	0	0	0	0

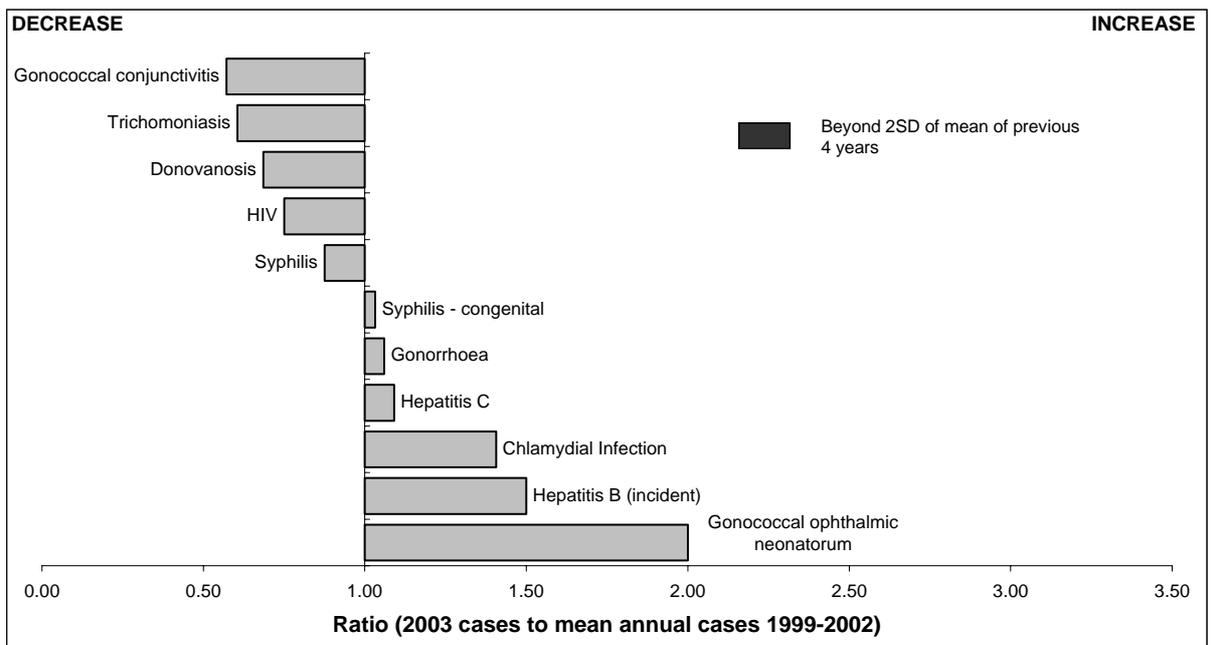
\* Meningococcal C cases for 2002 comprised 1 of the total 9 cases reported for all Meningococcal serogroups. Meningococcal C conjugate vaccine program commenced in March 2003 for those aged 1-5 years and those 15-19 years.

<sup>†</sup> Pneumococcal Disease numbers represent *all* serotypes of pneumococcal disease not just those contained in the pneumococcal conjugate (7vPCV) and polysaccharide (23vPPV) vaccines and therefore not all are vaccine preventable.

**Change in 2003 notifications compared to the mean of the previous 4 years: selected diseases**



**Change in 2003 notifications compared to the mean of the previous 4 years: sexually transmitted infections and blood borne diseases**



### NT notifications of diseases by onset date and district 2003 and 2002

DISEASES	ALICE SPRINGS		BARKLY		DARWIN		EAST ARNHEM		KATHERINE		TOTAL	
	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002
Acute Rheumatic Fever	16	30	1	0	9	23	9	12	8	18	43	83
Adverse Vaccine Reaction	2	2	3	1	22	18	3	4	2	0	32	25
Amoebiasis	0	0	0	0	1	2	0	0	0	1	1	3
Arbovirus infections												
Barmah Forest Virus	1	1	0	1	9	14	2	5	2	2	14	23
Dengue	0	0	0	0	19	30	1	0	0	2	20	32
Ross River Virus	0	1	7	2	86	40	9	4	18	16	120	63
Atypical Mycobacteria	0	0	0	0	0	1	0	0	0	0	0	1
Campylobacter	116	70	12	4	123	112	5	7	12	15	268	208
Chlamydia	706	539	35	24	591	596	119	140	151	144	1602	1443
Chlamydial Conjunctivitis	41	3	25	0	156	74	7	45	13	24	242	146
Congenital Syphilis	7	13	1	0	0	0	0	0	0	0	8	13
Cryptosporidiosis	49	44	1	11	19	110	17	20	8	32	94	217
Donovanosis	3	1	0	2	2	1	0	0	1	5	6	9
Gastroenteritis	0	0	0	0	0	1	0	0	0	0	0	1
Glomerulonephritis	2	1	0	0	0	1	1	1	1	3	4	6
Gonococcal Disease	688	697	46	40	406	452	118	132	134	193	1392	1514
Gonococcal Conjunctivitis	0	5	2	0	4	0	0	1	0	0	6	6
Gonococcal Ophthalmic. Neonatal	0	0	1	0	0	0	0	0	0	0	1	0
Haemolytic Uraemic Syndrome	0	0	0	0	1	1	0	0	0	0	1	1
Haemophilus Influenzae type b	1	1	0	0	1	2	0	0	0	0	2	3
Haemophilus Influenzae not type b	0	1	0	0	1	2	1	0	0	1	2	4
Hepatitis A	14	8	0	5	17	14	1	1	8	19	40	47
Hepatitis B (incidence)	1	3	1	2	10	5	1	1	2	1	15	12
Hepatitis C (prevalence)	30	25	4	3	168	157	3	3	11	14	216	202
HIV infections	0	3	0	0	5	6	0	0	1	0	6	9
HTLV-1	34	14	0	0	4	5	0	0	2	2	40	21
Influenza	61	17	0	0	78	29	11	4	1	3	151	53
Legionnaires Disease	1	0	1	0	1	1	0	0	0	0	3	1
Leprosy	0	0	0	0	0	0	0	0	0	1	0	1
Leptospirosis	0	0	0	0	4	3	0	0	0	0	4	3
Malaria	4	1	0	0	35	20	1	0	0	3	40	24
Measles	0	0	0	0	1	0	0	0	0	0	1	0
Melioidosis	4	1	0	1	21	18	0	1	2	1	27	22
Meningococcal Infection	8	1	0	0	1	4	0	3	2	1	11	9
Mumps	0	0	0	0	0	1	0	0	0	0	0	1
Ornithosis	0	0	0	0	1	2	0	0	1	0	2	2
Pertussis	1	3	0	0	0	32	3	2	1	0	5	37
Pneumococcal Disease	31	31	8	2	23	20	3	1	7	11	72	65
Q Fever	0	0	0	0	1	1	0	0	0	0	1	1
Rotavirus	73	130	14	19	98	157	17	49	35	69	237	424
Rubella	0	0	0	0	0	1	0	0	0	0	0	1
Salmonella	73	66	16	6	192	181	20	10	59	67	360	330
Shigella	98	46	10	7	13	36	4	5	6	9	131	103
Syphilis	180	190	4	4	64	120	19	16	46	72	313	402
Trichomonas	269	226	12	14	152	240	85	86	47	117	565	683
Tuberculosis	6	3	0	0	13	22	3	0	6	13	28	38
Typhoid	0	0	0	0	1	0	0	0	0	0	1	0
Vibrio Food Poisoning	0	0	0	0	1	0	0	0	0	0	1	0
Yersiniosis	0	0	0	0	0	7	1	0	0	0	1	7
<b>Total</b>	<b>2520</b>	<b>2177</b>	<b>204</b>	<b>148</b>	<b>2354</b>	<b>2562</b>	<b>464</b>	<b>553</b>	<b>587</b>	<b>859</b>	<b>6129</b>	<b>6299</b>

### Points to note regarding notifications page 36:

Anthrax, Murray Valley Encephalitis, Kokobera, Kunjin, Botulism, Brucellosis, Chancroid, Cholera, Congenital Rubella Syndrome, Diphtheria, Hepatitis C (incidence), Hepatitis D & E, Hydatid Disease, Listeriosis, Lymphogranuloma venereum, Plague, Poliomyelitis, Rabies, Tetanus, Typhus, Viral Haemorrhagic Fever, Yellow Fever and SARS are all notifiable but had "0" notifications in this period.

## NT Malaria notifications October – December 2003

*Merv Fairley, CDC, Darwin*

Three notifications of malaria were received for the third quarter of 2003. The following table provides details about where the infection was thought to be acquired, the infecting agent and whether chemoprophylaxis was used.

Number of cases	Origin of infection	Reason exposed	Agent	Chemoprophylaxis
1	PNG	holiday	<i>P. vivax</i>	no
1	Indonesia	holiday	<i>P. vivax</i>	no
1	PNG	working	<i>P. falciparum</i>	no

\*\*\*\*\*

## Disease Control staff updates

### CDC

**Alice Springs:** **Rosalie Schultz** commenced as the Public Health Medical Officer in February. Rosalie has recently completed 2 years work in the Solomon Islands with her husband.

**Darwin:** **Peter Markey** reverts to his position as Head of Surveillance with the return of **Vicki Krause**, Director of CDC, from sabbatical.

### AIDS/STD

**Darwin:** Head of the AIDS/STD Program, **Jan Savage** has taken 12 months leave traveling Australia bringing **Heather Lyttle** to the position. Heather brings expertise in public health and is a specialist sexual health physician who has most recently been working in the Western Australian Sexual Health Program.

**Katherine:** **Deane Martin** has commenced as AIDS/STD Educator in the position previously held by Greg Henschke.

**Alice Springs:** **Sheralyn Wagner** is the new Receptionist, **Eleanor Hooke** (Remote Liaison CNC) finished in her position after several years and will be traveling and pursuing other interests. **Wendy Jelinek** has taken over from Eleanor in the temporary Remote Liaison CNC position Warwick Beever (Remote Liaison - Men's -CNC) has taken 12 months leave to undertake a research position with Menzies School of Health Research, Central Australia.

### Immunisation

**Darwin:** We welcome **Nan Miller** back from her 2 year immunisation project in Papua New Guinea. **Chris Nagy** who has filled Nan's position has returned to Community Health.

### Environmental Health

**Paul Drossou** has transferred to the Darwin urban team from Darwin rural. **Kelly Monahan** has been appointed permanently to Darwin Urban.

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