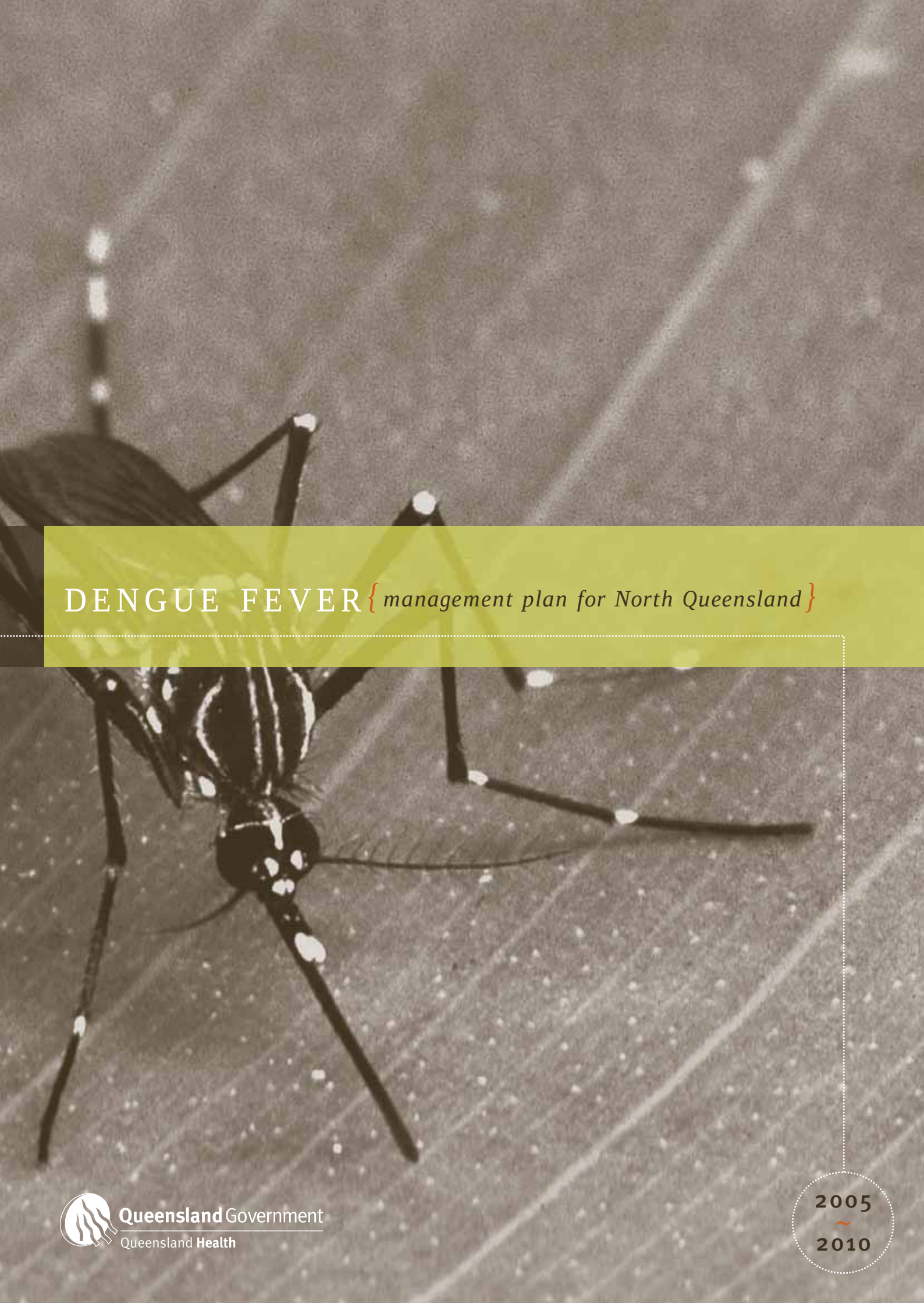

DENGUE FEVER { *management plan for North Queensland* }

Queensland Government
Queensland Health

2005 ~ 2010

Welcome to the Dengue Fever Management Plan for North Queensland 2005 ~ 2010.

The nature of dengue in our region is changing as it is throughout the tropical world. The World Health Organization (WHO) reports that an estimated 50-100 million dengue infections occur worldwide every year, including up to 500,000 cases of dengue haemorrhagic fever (DHF). Forty per cent of the world's population reside in areas where dengue transmission occurs. The disease is now endemic in the Americas, South-East Asia, the Western Pacific and tropical areas of Africa.

To meet this challenge, Queensland Health's Tropical Public Health Unit Network (TPHUN) and our stakeholders are constantly developing new and improved ways to manage dengue fever in our region. The severity and persistence of dengue outbreaks seems to be increasing. In 2003 and 2004 alone, there were six outbreaks of dengue fever in North Queensland. Four of these were controlled quickly with five or less cases each. The other two outbreaks were prolonged, claiming nearly 900 reported cases in total, and extending from Townsville up to the Torres Strait Islands. In 2004 two Torres Strait Islanders spent many weeks in intensive care with very severe DHF. A third Torres Strait Islander died from dengue fever – the first recorded death from dengue in Queensland for about 100 years.

Over the next five years the Torres Strait Islands will be heavily targeted for dengue control activities. The Torres Strait has become an important risk area for dengue due to its proximity to Papua New Guinea and high levels of mosquito breeding. As outbreaks in the Torres Strait continue, a higher number of residents become exposed to dengue which increases their risk of complications from secondary infection.

Several innovations and improved efficiencies are helping us manage dengue towards 2010. Disease surveillance personnel can now detect and diagnose dengue fever more quickly with the more readily available PCR tests. In addition, Queensland Health Scientific Services (QHSS) now use a new IgM capture ELISA test to quickly screen blood for 10 flaviviruses (including the four dengue viruses).

QHSS can also track the origins of our local outbreaks by comparing viruses isolated from outbreaks around the world.

In terms of mosquito control, Queensland Health continues to expand resources. In 2004 three new Dengue Action Response Team positions were created, and a post-doctorate dengue mosquito research laboratory at James Cook University in Cairns was established under the supervision of TPHUN's Director of Medical Entomology. A new palm-top database and geographical information system (GIS) for case monitoring, and management of mosquito surveillance and control activities, was also funded and established. Mosquito control research continues to be a priority with personnel testing 'lure and kill' strategies as an improved way to trap and kill mosquitoes. Personnel are also continuing to monitor mosquito pesticide resistance.

In 2004 educational strategies were enhanced with the support of *The Cairns Post* and their award-winning Dengue Blitz 04 campaign with a view for possible extension to other cities in North Queensland in the future. In-depth research on how to better educate the public is planned and a new series of educational resources will be produced.

Information technology improvements include new GIS technology, inter-related databases, handheld computers and a dengue website (www.health.qld.gov.au/dengue). These will assist in better tracking of mosquito breeding, outbreak measures and high risk areas for more effective and timely responses.

I wish to acknowledge the professionalism of Queensland Health and local government staff whose efforts to combat this disease, and the threat it poses to public health, contribute enormously to improving dengue management in our region.

Dr Ross Spark - *Director*
Tropical Public Health Unit Network
Queensland Health

{ acknowledgements }

The North Queensland Dengue Fever Management Plan 2005-2010 (DFMP) includes the contributions of a range of individuals and stakeholders. The DFMP Executive Committee has met on an annual basis since 1995 to review and update the DFMP. Members of this committee regularly communicate with a range of DFMP stakeholders, including local government elected members and mosquito control personnel, general practitioners, laboratory scientists, industry groups and community representatives.

The input of all of these groups is appreciated.

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DENGUE FEVER MANAGEMENT PLAN (DFMP) 2005-2010

Outbreaks of dengue fever in North Queensland have increased in frequency and intensity since the early 1990s. In 2003 and 2004, there were six outbreaks of dengue fever. Four of these were controlled quickly with five or fewer cases each. The other two outbreaks were prolonged, with a combined total of nearly 900 cases reported in Cairns, Townsville and the Torres Strait. Two Torres Strait Islanders were hospitalised in an intensive care unit with severe and life-threatening symptoms of dengue haemorrhagic fever (DHF). Another Torres Strait Islander died from complications of dengue fever. This was the first recorded death from dengue in Queensland for about 100 years.

Dengue is an infection caused by a virus in the family Flaviviridae. Other flavivirus diseases include yellow fever, Japanese encephalitis and Murray Valley encephalitis.

In terms of morbidity, mortality and economic cost, dengue fever is the most important mosquito-borne viral disease of humans. Dengue occurs in over 100 countries worldwide and is found primarily in urban settings in the tropics. Between 50 and 100 million cases of dengue are reported around the world each year and over 2.5 billion people are at risk of infection. Several hundred thousand dengue cases each year result in dengue haemorrhagic fever (DHF), which usually affects children under 15 years of age. The average fatality rate with DHF is 5 per cent, although with timely treatment this is often reduced to less than 1 per cent.

In Australia, dengue only occurs in North Queensland. Dengue is not endemic (ie. naturally occurring) in North Queensland. However, because the mosquito vector, *Aedes aegypti*, is common in North Queensland, outbreaks can occur when the virus is introduced via international travellers or residents returning home from overseas.

The Dengue Fever Management Plan (DFMP) has been developed by Queensland Health to guide and coordinate efforts to manage dengue fever in North Queensland.

The DFMP focuses on three central components:

- Disease Surveillance
- Mosquito Control and Surveillance
- Public Education.

Dengue control activities can differ according to the level of dengue activity in North Queensland. There are three levels of dengue activity:

1) Ongoing Prevention: where there is no current dengue activity in the zone.

2) Response to Sporadic Cases: where there is no current dengue activity in the zone, but the Tropical Public Health Unit Network (TPHUN) is notified of an imported case of dengue or a possible locally-acquired case.

3) Outbreak Response: where one or more locally-acquired cases occurs concurrently in the zone.

The DFMP also outlines ongoing research into dengue transmission and control.

AIM OF THE DFMP

The aim of the DFMP is to reduce the risk of outbreaks of dengue in North Queensland and to strengthen control measures for any future outbreaks in this zone, thereby minimising the likelihood of serious complications of dengue.

The plan aims to achieve this by improving disease surveillance, enhancing mosquito control and surveillance, and by educating the community and relevant professional groups.

The plan also documents the current procedures used for dengue control by Queensland Health, local government and Indigenous community councils in North Queensland.

1.




The Dengue Fever Management Plan for North Queensland 2005-2010 focuses on three central components of dengue management:

DISEASE SURVEILLANCE | MOSQUITO CONTROL AND SURVEILLANCE | AND PUBLIC EDUCATION.

This plan outlines the existing procedures for dengue management in North Queensland for each of the three component areas.

Dengue control activities can differ according to the level of dengue activity in North Queensland. There are three levels of dengue activity:

1. Ongoing Prevention: where there is no current dengue activity in the zone.
2. Response to Sporadic Cases: where there is no current dengue activity in the zone but the Tropical Public Health Unit Network (TPHUN) is notified of an imported case of dengue or a possible locally-acquired case.
3. Outbreak Response: where one or more locally-acquired cases occurs concurrently in the zone.

This plan has been developed by Queensland Health to guide and co-ordinate efforts to manage dengue fever in North Queensland. The plan calls for continued and improved collaboration among Queensland Health and other government and non-government stakeholders in dengue management; consequently the plan will be available to all interested parties.

For up to date information on dengue fever in North Queensland, visit Queensland Health's dengue fever website: www.health.qld.gov.au/dengue

2.




{ aim of the plan }

The aim of the Dengue Fever Management Plan is to reduce the risk of outbreaks of dengue in North Queensland and to strengthen control measures for any future outbreaks in this zone, thereby minimising the likelihood of serious complications of dengue.

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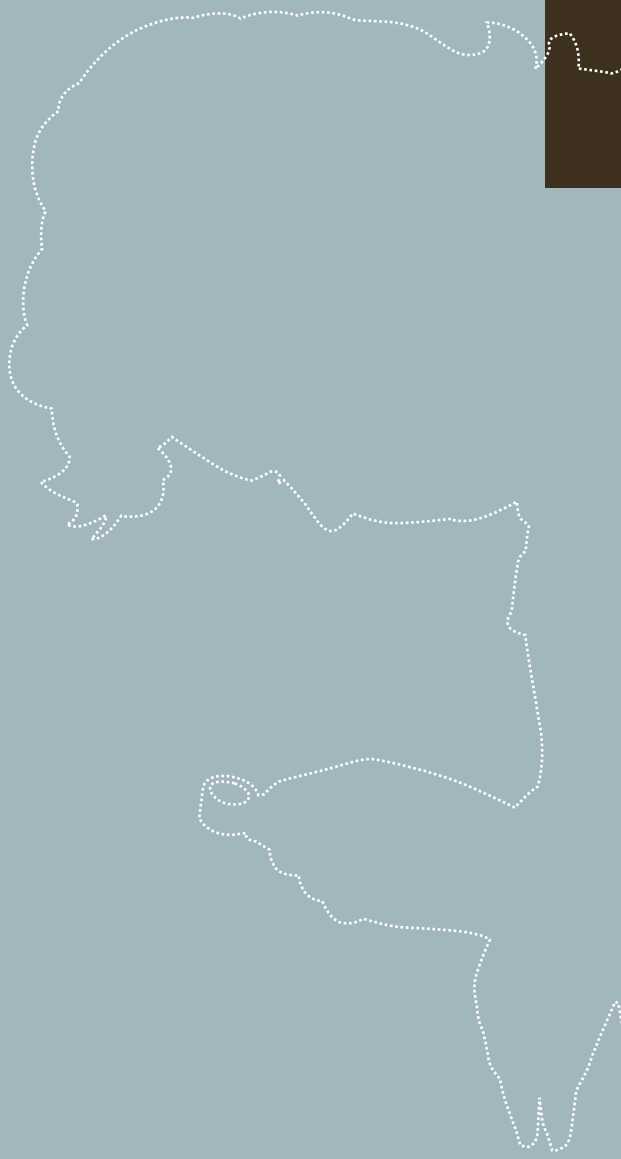
The plan also documents the current procedures used for dengue control by Queensland Health, local government and Indigenous community councils in North Queensland.



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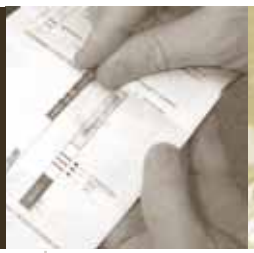



3.1 WHAT IS DENGUE?

Dengue fever (or simply, dengue) is an infection caused by one of four dengue viruses in the family Flaviviridae. Other diseases caused by flaviviruses include yellow fever, Japanese encephalitis and Murray Valley encephalitis. In terms of morbidity, mortality and economic costs, dengue fever is the most important mosquito-borne viral disease of humans.

There are four types of dengue viruses - Dengue 1, 2, 3 and 4 - and there are genetic variants of these serotypes in different geographic locations. A person living in a dengue endemic area could theoretically have as many as four dengue infections during his or her lifetime - one infection with each dengue virus type. Infection with one serotype confers immunity against subsequent infection with that serotype. Infection with the dengue virus may be subclinical (asymptomatic) or may cause illness ranging from a mild fever to a severe, even fatal, condition such as dengue haemorrhagic fever (DHF) or dengue shock syndrome (DSS).

Typical dengue fever symptoms include: sudden onset of fever (lasting three to seven days), intense headache (especially behind the eyes), muscle and joint pain (ankles, knees and elbows), loss of appetite, vomiting and diarrhoea, skin rash, minor bleeding (nose or gums) and extreme fatigue. Hospitalisation may be required depending on the severity of symptoms. DHF manifests generally as plasma leakage leading to shock and can be fatal, particularly among young children. There is no vaccine to provide immunity from dengue.

Refer to *Dengue haemorrhagic fever: diagnosis, treatment, prevention and control* (2nd edition. Geneva: World Health Organization, 1997) for detailed information on dengue symptoms and treatment. (www.who.int/csr/resources/publications/dengue/Denguepublication/en/)

3.2 INTERNATIONAL CONTEXT OF DENGUE

Dengue occurs in over 100 countries worldwide (see Figure 1) and is found primarily in urban settings in the tropics. Fifty to 100 million cases of dengue are reported around the world each year and over 2.5 billion people are at risk of infection.

Several hundred thousand dengue cases each year result in DHF, which usually affects children under 15 years of age. The average fatality rate with DHF is 5 per cent (Gubler 1997), although with timely treatment this is often reduced to less than 1 per cent. The incidence of dengue worldwide is increasing. Papua New Guinea (PNG), for example, has become a significant source of dengue with frequent incursions into the Torres Strait Islands. The main reasons for escalating incidents of dengue are increasing urbanisation and the increasing use of:

- consumer goods
  (eg. disposable man-made containers that are ideal for dengue mosquito breeding)
- automobiles
  (eg. unused car tyres are ideal for dengue mosquito breeding)
- air travel
  (eg. transporting people infected with the dengue virus introduces the virus to other dengue risk areas).

3.

FIGURE 1.

Global distribution of recent dengue activity

3.3 GEOGRAPHY OF DENGUE IN AUSTRALIA

Dengue has historically been reported in the Northern Territory, New South Wales and Queensland, but has only been reported in North Queensland in recent decades.

Transmission of the virus is limited by the distribution of its vector, the mosquito *Aedes aegypti*, to North Queensland (see Figure 2). Dengue is not endemic in Queensland. However, *Ae. aegypti* is common in North Queensland and the area is prone to outbreaks.

The North Queensland zone covered by this plan has a population of approximately 600,000 people.

In 2004, *Ae. aegypti* was detected in Tennant Creek in the Northern Territory. The Commonwealth Government subsequently funded the Northern Territory Government for a surveillance and eradication program.

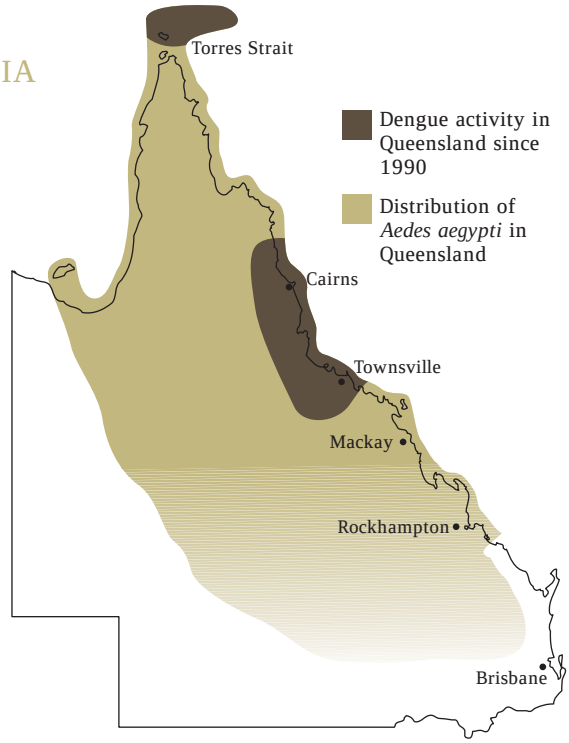


FIGURE 2.
Distribution of *Aedes aegypti* and dengue activity in Queensland

3.4 TRANSMISSION OF DENGUE IN NORTH QUEENSLAND - *Aedes aegypti*

In Queensland, the dengue virus is almost exclusively transmitted by the highly domesticated *Ae. aegypti* mosquito. The mosquito is unusual in that it does not breed in swamps or drains, and does not often bite at night.

Breeding and larval habitat

Ae. aegypti frequents backyard rubbish and junk. It breeds primarily in artificial containers holding water inside and outside the home: cans, buckets, jars, pot plant dishes, birdbaths, boats, tyres and tarpaulins. In north Queensland, elevated sites such as roof gutters (Montgomery and Ritchie 2002) and rainwater tanks are also important breeding sites (Hanna et al 1998).

It can also breed in natural containers such as bromeliads and fallen palm fronds. Subterranean sites such as wells, telecommunication pits and drain sumps are also important breeding sites, especially in drier conditions.

Adult mosquito

Ae. aegypti is sometimes referred to as the 'cockroach of mosquitoes' because, unlike most mosquitoes that prefer swamps and bushland, *Ae. aegypti* is truly domesticated and prefers to live in people's homes.

The adult mosquito likes to rest in dark places such as in wardrobes and under beds. It is very cautious when biting, flushing readily at the slightest disturbance and prefers to bite humans during daylight hours.

A dengue mosquito becomes infected with dengue when it bites a human who is viraemic with the dengue virus (ie. there are enough dengue virus in the person's blood to infect a mosquito). In 8-10 days the infected mosquito is able in turn to transmit the virus to people.

One dengue-infected female mosquito is capable of biting and infecting several people during one feeding session. Mosquito control activities consequently need to be initiated promptly.

A patient with dengue can transmit the virus to mosquitoes within three to four days of contracting dengue. Thus the cycle of transmission may take only 14 days (as illustrated in Figure 3).

Aedes aegypti mosquito © Paul Zborowski

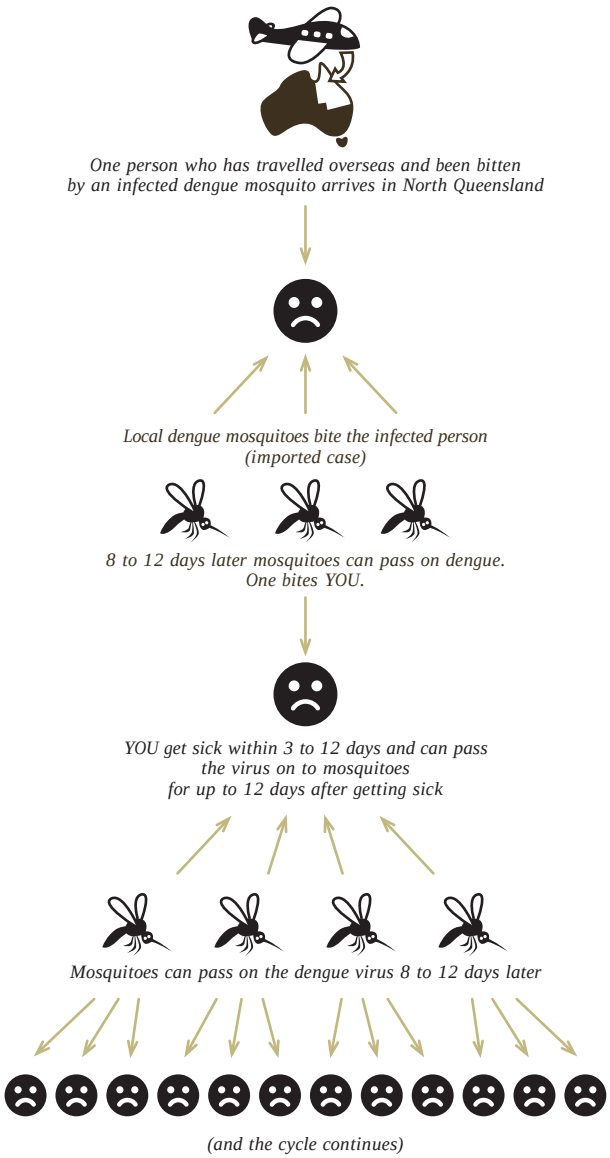


FIGURE 3.
Cycle of dengue transmission

3.5 HISTORY OF DENGUE OUTBREAKS IN NORTH QUEENSLAND

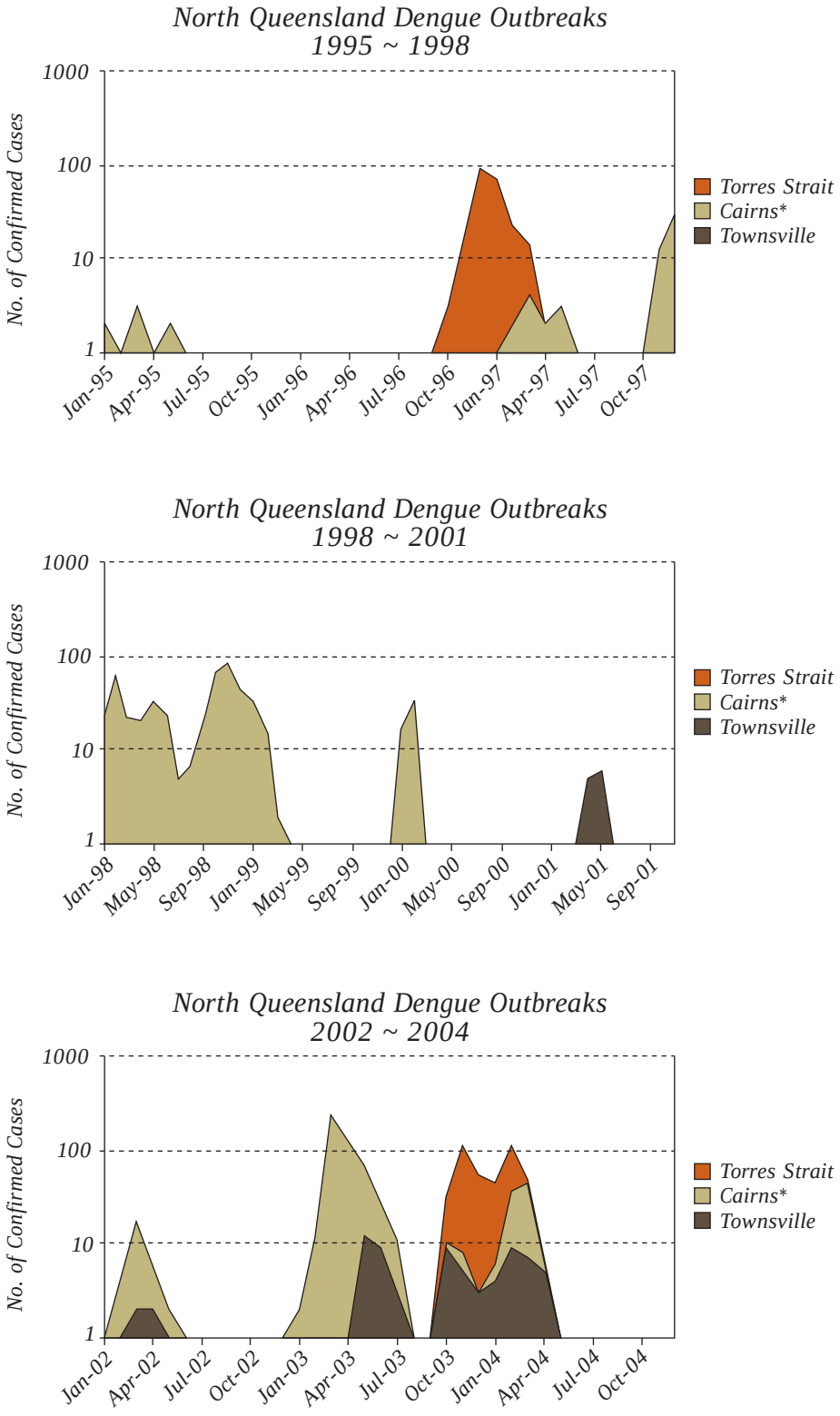
Queensland has a history of dengue epidemics dating back to 1879, most of which occurred in North Queensland. Thirteen notable dengue epidemics have occurred in Queensland since 1885. The first fatality attributed to dengue occurred in Charters Towers in 1885 and the first fatality attributed to DHF occurred in the same town during the 1897 epidemic, when Hare (1898) recorded 60 fatalities (30 of those were children).

Table 1 details the dengue outbreaks in North Queensland in the past 10 years and Figure 4 shows the outbreaks in North Queensland between 1995 and 2004.

TABLE 1. OUTBREAKS IN NORTH QUEENSLAND 1990 ~ 2004

YEAR	LOCATION	REPORTED CASES	DURATION	DENGUE TYPE
1990-91	Cairns Townsville Torres Strait	27	8 weeks	Dengue 1
1992-93	Townsville Charters Towers	900	64 weeks	Dengue 2
1995	Cairns	4	14 weeks	Dengue 2
1996-97	Torres Strait Cairns	208	28 weeks	Dengue 2
1997-98	Cairns	12	11 weeks	Dengue 2
1997-99	Cairns Mossman Port Douglas	498	70 weeks	Dengue 3
2000	Cairns	49	6 weeks	Dengue 2
2001	Townsville	9	3 weeks	Dengue 2
2002	Kuranda	21	10 weeks	Dengue 2
2002	Townsville	2	2 weeks	Dengue 1
2002	Cairns	2	3 weeks	Dengue 4
2003	Cairns	3	2 weeks	Dengue 1
2003	Mareeba	1	1 week	Dengue 1
2003	Cairns	5	3 weeks	Dengue 2
2003-04	Cairns Townsville Torres Strait	536	69 weeks	Dengue 2
2003-04	Torres Strait Cairns	356	41 weeks	Dengue 2
2004	Torres Strait	1	1 week	Dengue 2
2005	Torres Strait	56	10 week	Dengue 4

FIGURE 4.
Outbreaks in North Queensland 1995 ~ 2004 - Cases/Month in logscale



* Includes Mossman/Port Douglas (1997/99), Kuranda (2002)

3.6 HISTORY OF IMPORTED CASES IN NORTH QUEENSLAND

It only takes one imported case of dengue to start an outbreak. Because dengue is not endemic to Australia, local dengue outbreaks in North Queensland all begin with a single imported case - a 'patient zero'.

Queensland Health currently relies on surveillance by medical practitioners and diagnostic laboratories to detect imported cases.

Since 1999 Queensland Health has been notified of an average of 10 imported cases to North Queensland per year. Approximately 60 per cent of these cases were from Papua New Guinea (PNG) and East Timor, with most of the remainder coming from Thailand, Bali and South Pacific nations.

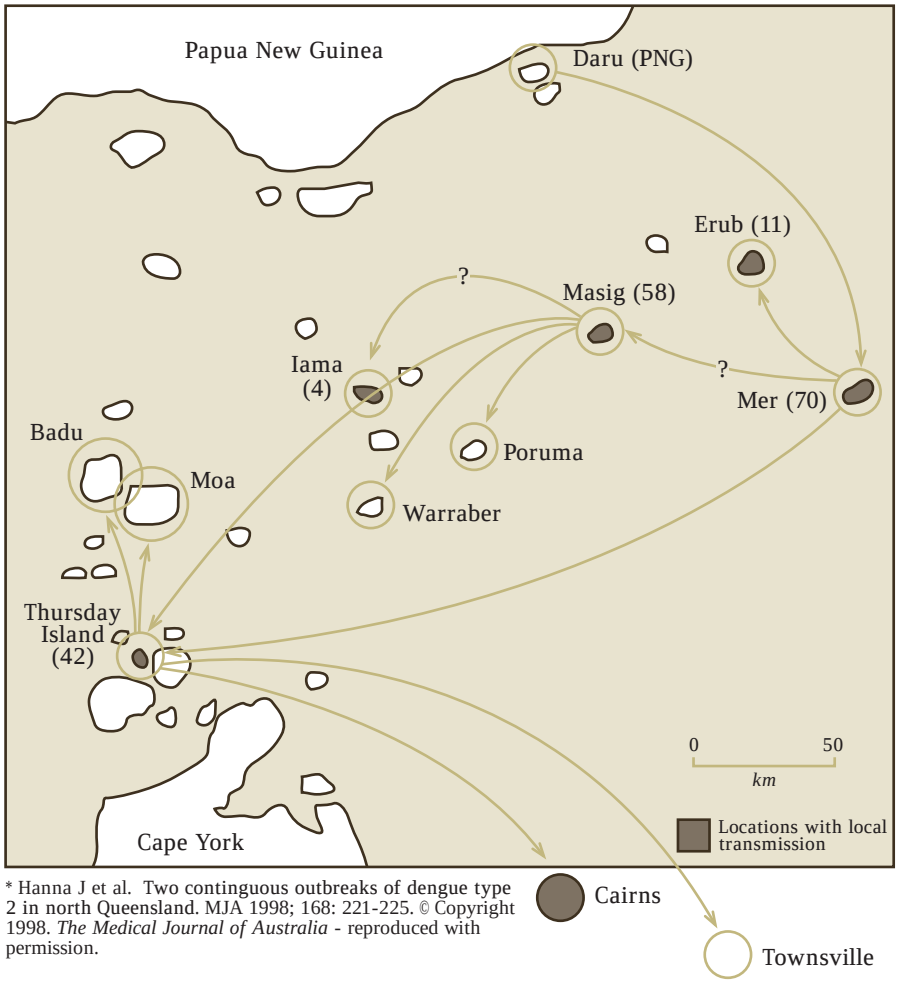
There is a high level of dengue activity in PNG at any given time. For example, all four serotypes of dengue were active in PNG in early 2004 (Dr Greg Smith, Public Health Virology, Queensland Health Scientific Services, personal communication). The Torres Strait Islands are geographically very close to PNG and the islands receive many visitors from PNG. This increases the risk of importations of dengue to the Torres Strait, making it one of the priority 'hot spots' for dengue surveillance and control.

Figure 5 shows the outbreak pattern that occurred in the Torres Strait in 1996 - 1997. The outbreak started with one person who returned to Mer in the Torres Strait after contracting dengue in Daru in PNG. Because of high *Ae. aegypti* populations on Mer, this one case led to a further 70 cases on the island. Subsequent travel of viraemic patients between islands led to infections on at least six other islands in the Torres Strait. Within seven months, 201 cases were confirmed, reaching locations as far south as Townsville (Hanna et al. 1998).

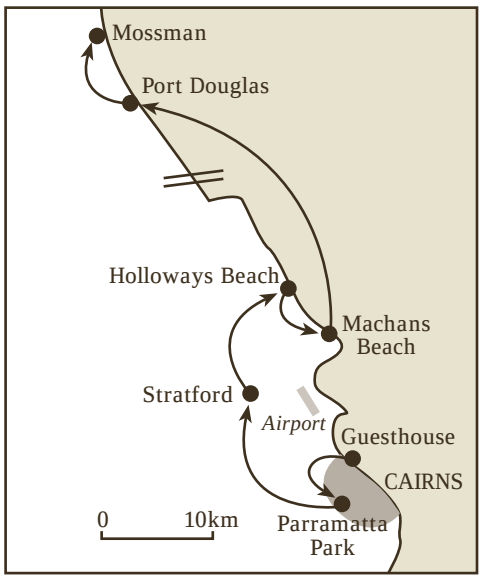
Figure 6 shows the spread of a dengue epidemic that began in December 1997 in a Cairns guesthouse. The first confirmed dengue case of the outbreak was a man who had not travelled recently, but reported that several people at the guesthouse had a similar illness (Hanna et al 2001). A resident of Parramatta Park who was a frequent visitor to the guest house became unwell in mid-December. Meanwhile residents of premises adjacent to the guesthouse and workers on a nearby construction site also became unwell. In March the outbreak spread to two Cairns 'Northern Beach' suburbs and in May to Port Douglas (60km north of Cairns) and Mossman. The outbreak was brought under control 70 weeks after it started and resulted in 498 confirmed cases of dengue 3.

FIGURE 5.

Map of dengue transmission in Torres Strait: 1996 ~ 97*



* Hanna J et al. Two continguous outbreaks of dengue type 2 in north Queensland. MJA 1998; 168: 221-225. © Copyright 1998. *The Medical Journal of Australia* - reproduced with permission.



The central business district of Cairns is shaded. Mossman is around 70km from Cairns.

FIGURE 6.

Map of dengue transmission in North Queensland during dengue 3 epidemic: 1997 ~ 99**

** Hanna J et al. An epidemic of dengue 3 in far north Queensland, 1997-1999. MJA 1998; 174: 178-182. © Copyright 1998. *The Medical Journal of Australia* - reproduced with permission.

4.




This plan outlines the existing procedures for dengue management in North Queensland for each of the three component areas. Dengue control activities can differ according to the level of dengue activity in North Queensland. The three levels of dengue activity are:

4.1 ONGOING PREVENTION

Ongoing prevention actions are taken by TPHUN, local government and Indigenous community councils when there is no current dengue activity in the zone.

4.2 RESPONSE TO SPORADIC CASES

These actions are taken when there is no current dengue activity in the zone, but TPHUN is notified of an imported case of dengue (clinically suspected or confirmed) or a possible locally-acquired case (not yet confirmed).

When there is no current dengue activity in the zone, most possible locally-acquired cases are false alarms, ie. the person does not have dengue fever. However, because they could be genuine cases, they require immediate follow-up and mosquito control action.

Once a locally-acquired case becomes confirmed, an outbreak is declared, even though initially there may only be one confirmed case.

4.3 OUTBREAK RESPONSE

These actions are taken when one or more locally-acquired cases occurs concurrently in the zone.

Dengue activity in North Queensland is confirmed either by PCR, viral culture, a positive dengue type-specific IgM result or even by a clear epidemiological link in a person who is not tested. (Refer to Section 5.4 Laboratory Surveillance).

An outbreak is a localised epidemic. As mentioned above, even a single confirmed case of locally-acquired dengue in North Queensland is enough to declare an outbreak.

5.




Disease surveillance is the first defence against dengue. Over the past five years there has been a shift in emphasis from 'dengue surveillance' to surveillance for 'imported cases' of dengue. This is because a viraemic traveller (an imported case) could readily initiate an outbreak in North Queensland.

The TPHUN's Communicable Disease Control (CDC) relies on general practitioners, emergency department doctors and laboratories to notify them of possible cases of dengue, particulary in people who have recently arrived from tropical countries. Doctors are asked to notify TPHUN immediately upon clinical suspicion, rather than wait for laboratory results.

If the patient has no travel history, this may indicate that the patient became infected by a dengue-infected mosquito in their local area (local transmission), and therefore the area may be in the early stages of an outbreak. Again, doctors are asked to notify on clinical suspicion.

Communicable Disease Control staff communicate constantly with physicians, patients and mosquito control officers.

5.1 ONGOING PREVENTION

Routine prevention is the action taken by TPHUN, local government and Indigenous community councils when there is no current dengue activity in the North Queensland zone. Surveillance for dengue encompasses clinical and laboratory surveillance.

Refer to *Dengue haemorrhagic fever: diagnosis, treatment, prevention and control* (2nd edition. Geneva: World Health Organization, 1997) for detailed information on dengue symptoms and treatment. (www.who.int/csr/resources/publications/dengue/Denguepublication/en/)

Because of the risk of a viraemic traveller initiating an outbreak, surveillance for clinical cases of dengue is very important. It enables action to be taken promptly to reduce the risk of local transmission.

Any delay in notification of suspected dengue can mean the difference between managing a sporadic case of dengue and managing an outbreak with multiple cases.

It is also very important that the appropriate tests are requested depending on when the case became unwell. TPHUN's CDC staff will assist practitioners in determining the appropriate tests to order (see Appendix 2 for examples of test results and Appendix 3 for details on tests types). Figure 7 shows the types of tests for laboratory confirmation of dengue fever depending on the timing of the onset of the illness.

5.

FIGURE 7.

TESTS FOR LABORATORY CONFIRMATION OF DENGUE FEVER

TEST TYPE	PCR	*MAY NEED* PCR *AND* IgM	IgM	IgG
NUMBER OF DAYS AFTER ONSET OF SYMPTOMS	*1-3 DAYS*	*4-6 DAYS*	*7-12 DAYS*	*13 DAYS PLUS*

Doctors seeing people who live or work in geographical 'hot spots' for dengue fever need to be particularly aware of the importance of testing and notification.

CDC works to educate GPs and emergency departments about the need for early dengue notification and appropriate testing. There are a number of challenges:

LACK OF KNOWLEDGE OF THE DISEASE:

- High number of transient doctors who may be unfamiliar with the disease (as it is mostly seen only in North Queensland).
- Doctors may not understand the range of clinical symptoms possible (mild to severe) meaning that milder cases may not be recognised.

LACK OF KNOWLEDGE OF VALUE OF EARLY NOTIFICATION:

- Many doctors do not notify TPHUN until they receive laboratory diagnosis because they are unaware that TPHUN instigate mosquito control measures upon notification (even if a case is only suspected).

LACK OF KNOWLEDGE OF THE VALUE OF TESTS:

- Doctors may not request tests during an outbreak because they may be confident of diagnosing dengue clinically. Some doctors may not be aware of the value of laboratory confirmation. This confirmation of dengue helps CDC track the extent of an outbreak and therefore helps prevent further cases. Also it is important for a patient to have a correct laboratory diagnosis of his/her illness.

LACK OF KNOWLEDGE OF THE TYPES OF TESTS AND THEIR RELIABILITY:

- Doctors may ask simply for the laboratory to 'screen for dengue' (see Section 5.4 for details on types of laboratory tests). This request leads to a dengue IgM test being performed, whereas a PCR test may be more appropriate depending on the timing of the onset of the disease.

Equally, public education must continue to reinforce the importance of people seeking medical attention if they have dengue symptoms.

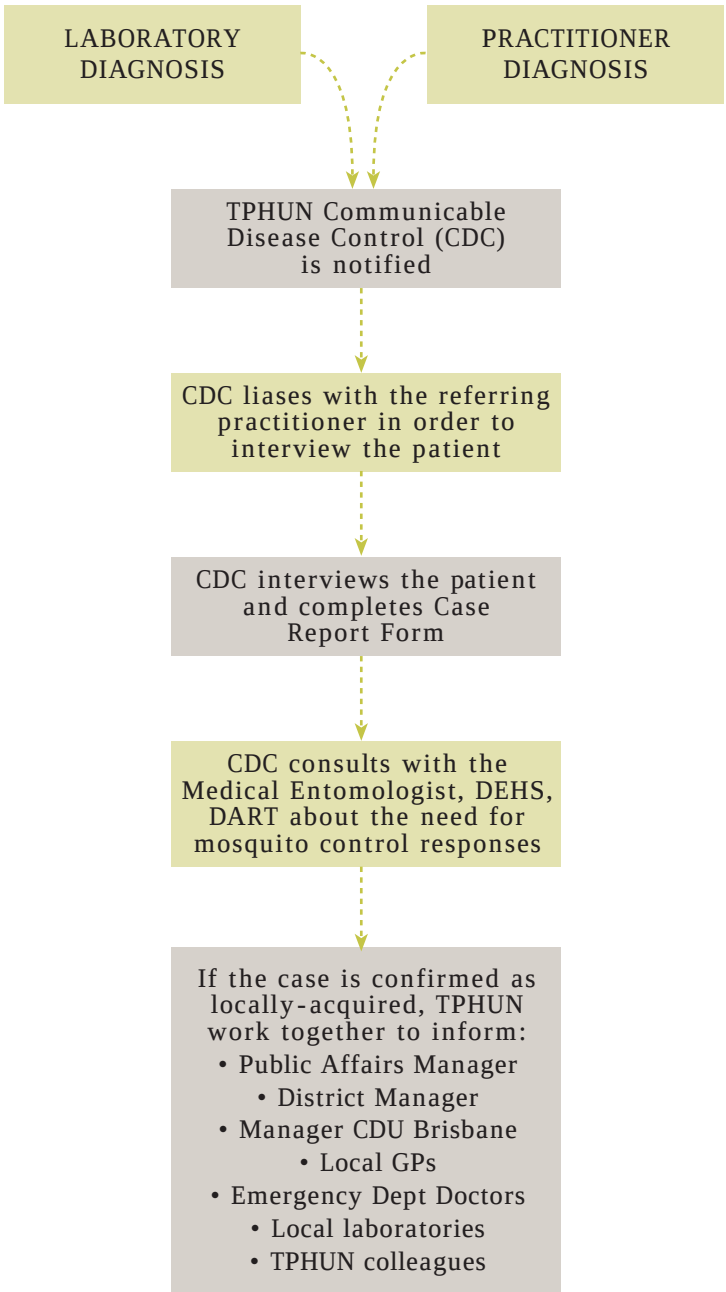
Queensland Health is continually developing and implementing strategies to address these issues.

5.2 RESPONSE TO SPORADIC CASES

Flowchart 1 illustrates the procedure followed by CDC when a clinically suspected locally-acquired case of dengue is reported or an imported case of dengue (either clinically suspected or laboratory-confirmed) is reported.

For every dengue notification, CDC attempts to interview the patient and complete the Case Report Form (Appendix 1). This form records the patient details, laboratory results, clinical details, likely source of infection and details of places visited/resided in while the patient was viraemic in North Queensland.

FLOWCHART 1. NOTIFICATION AND FOLLOW UP OF SPORADIC CASES BY CDC*



* See glossary for explanation of abbreviations

The potential for local transmission of dengue is then assessed.

This assessment is influenced by:

- the clinical signs and symptoms
- laboratory results, including the full blood count (a substantial thrombocytopenia often occurs in dengue)
- the patient's recent travel history (eg. from dengue endemic countries or from an area in North Queensland currently experiencing dengue activity)
- the patient's recent movements (eg. to high-risk premises such as a backpacker hostel or hospital)
- whether there has been recent dengue activity in the zone.

The assessment is made by CDC in consultation with other TPHUN staff, which may include the Medical Entomologist, the Dengue Action Response Team (DART) or the relevant Director of Environmental Health Services (DEHS). CDC will liaise with the doctor and the laboratory to ensure that the necessary laboratory test(s) are performed on apparent sporadic cases as soon as possible. If the blood sample has been collected within the first five days of illness and it has been shown to be IgM negative, PCR will be requested on an urgent basis. If the sample is IgM positive, confirmatory test(s) will be undertaken by Queensland Health Scientific Services (QHSS), Brisbane, also on an urgent basis. QHSS may confirm a result as dengue infection using flavivirus-specific IgM EIA. If the result is negative a further blood sample may be requested. Mosquito control measures will be discontinued if the results remain negative. (Refer to Section 5.4 - Laboratory Surveillance.)

When an imported case is confirmed as being viraemic in North Queensland, the medical practitioners that serve the population near the case's place of convalescence will be informed. They will be requested to consider dengue in the differential diagnosis of people with a febrile illness, to arrange for urgent dengue tests and promptly notify TPHUN of any clinically-suspect cases. Delays in notification (see Table 2) may allow local transmission of dengue to occur.

TABLE 2. IMPORTATIONS OF DENGUE INTO NORTH QUEENSLAND (1999)

AGE/ SEX	IMPORTED FROM	IMPORTED TO	TPHUN NOTIFIED BY DOCTOR AT INITIAL CONSULTATION	DELAY BETWEEN CONSULTATION & NOTIFICATION	VIRAEMIC DAYS IN NQ
22/M	Thailand/ Malaysia	Cairns *(Feb)*	No	2 days	3
30/F	Bali	Mareeba *(March)*	No	9 days	9
74/M	PNG	Cairns *(June)*	No	5 days	?
47/M	PNG	Cairns *(June)*	No	6 days	3
45/F	PNG	Cairns *(June)*	No	6 days	3

5.3 OUTBREAK RESPONSE

Flowchart 2 illustrates the procedures followed by CDC upon recognising an outbreak of dengue.

During an outbreak, CDC continues to communicate regularly with GPs, hospital emergency department doctors and local pathology laboratories to ask them to be on alert for dengue cases and/or pathology results consistent with dengue. This way CDC can be alerted early to new cases and new outbreak locations. It is important that medical practitioners continue to request dengue testing, as appropriate, throughout the duration of the outbreak.

During an outbreak, CDC completes the Case Report Form (Appendix 1) for all possible and confirmed cases. Details continue to be discussed with the medical entomologists about vector control measures that might be needed.

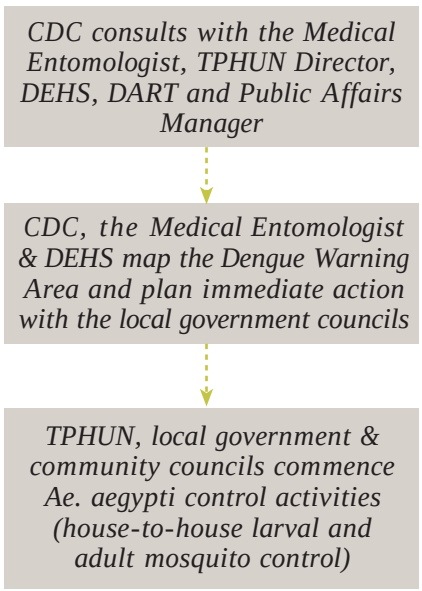
Any IgM positive result from a patient residing/working in an area experiencing an outbreak of dengue will be accepted as a true positive diagnosis not requiring any confirmatory tests.

During an outbreak, increased medical practitioner awareness of dengue may mean that clinical cases are reported in patients from outside (and with no links to) the affected area. These possible cases may require mosquito response measures while further laboratory tests (as described in Section 5.4) are undertaken on an 'urgent' basis.

All potential and confirmed dengue cases are recorded on a database system which was introduced in 2003. The system can be used by personnel in disease surveillance, mosquito surveillance and control, environmental health and public education. Summary reports can list distribution of dengue by suburbs, range of symptoms and highlight the latest cases. This helps in tracking outbreaks.

CDC should prepare a 'timeline' including the essential dates, cases and activities, for each of the larger outbreaks. This timeline should be progressed as each particular outbreak continues, and serves as important reference material when the outbreak is eventually reviewed. An example of a timeline is shown in Appendix 4; this timeline (with fictitious street names) was that actually prepared to track the dengue serotype 2 outbreaks that occurred in Cairns in 2003-2004.

FLOWCHART 2. PROCEDURES FOR OUTBREAK CASE NOTIFICATION*



* See glossary for explanation of abbreviations

5.

5.4 LABORATORY SURVEILLANCE

Staff in the Queensland Health Scientific Services laboratory

Dengue is a notifiable disease (Health Act 1937) in Queensland and laboratories are required to notify TPHUN of positive dengue results.

Queensland Health Scientific Services (QHSS) in Brisbane is home to the State's arbovirus reference laboratory. Dengue tests are also performed by private and public laboratories in Queensland.

5.4.1 Types of tests

There are a number of tests available to diagnose dengue. The suitability of each test depends on the timing during the illness that a blood sample is collected (see Figure 7). Some tests are more appropriate in the early stage of dengue fever and some are appropriate for later stages of the illness. The two types of tests are (1) those that detect the dengue virus and (2) those that detect antibodies to the dengue virus. See Appendix 3 for more details on types of tests for laboratory confirmation of dengue fever.

5.4.2 Dengue virus genotyping

QHSS is now able to genetically track the potential origins of outbreaks. These origins are then illustrated in a phylogenic tree which, like a family tree, links the genetic relatedness of different dengue viruses.

This technology allows scientists to determine whether North Queensland outbreaks are likely to be related. For example, there were two dengue 2 outbreaks in Cairns in 2003, and genotyping of the dengue isolates revealed that the two outbreaks were not caused by the same virus. One was genetically similar to a virus circulating in PNG and the other was similar to a virus circulating in Thailand.

For more information on testing, refer to Appendix 3.