Mosquito Borne Diseases in Queensland

1 July 2012 – 30 June 2017

Communicable Diseases Branch

Queensland Government

Mosquito-borne diseases in Queensland, 1 July 2012 – 30 June 2017

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Summary

During the five year period from 1 July 2012 to 30 June 2017, a total of 20,413 mosquito-borne infections were notified in Queensland. The most frequently reported was Ross River virus infection (13,921), followed by Barmah Forest virus infection (3,986), dengue (1,895), and malaria (437). Notifications of all other mosquito borne diseases (174) were sporadic.

The majority (71.8%) of dengue notifications (1,360 of 1,895) were acquired overseas. There were 30 dengue outbreaks in Queensland over the reporting period. The two largest outbreaks both occurred in Cairns, with a total number of 146 (2012/13) and 136 (2013/14) cases, respectively.

All cases of chikungunya (65), Zika virus infection (50), and Japanese encephalitis virus infection (3) were acquired overseas.

Mosquito-borne diseases are important contributors to the overall numbers of notifiable conditions in Queensland. This, and the presence of competent vectors for local transmission, reinforces the need for ongoing surveillance and timely public health response.

Introduction

Mosquito borne diseases represent a significant global burden with a substantial proportion of the world's population at risk.[1, 2] A range of ecological, climatic, social, economic and behavioural factors influence the distribution of diseases and often their vectors; with the ease and availability of rapid international travel an important contributor. [3] The World Health Organization (WHO) maintains timely data on the global distribution of mosquito borne diseases.[2]

In Australia, national data on mosquito borne diseases of public health importance are maintained through the *National Notifiable Diseases Surveillance System* (NNDSS); with each state and territory contributing data under the requirements of the *National Health Security Act (2007).*[4] The *National Arbovirus and Malaria Advisory Committee* (NAMAC)[5], provides expert technical advice on mosquito borne diseases, and their vectors, to the Australian Government.[6]

The mosquito borne diseases notifiable to Queensland Health under the *Public Health Regulation (2005)*[7] include all alphavirus, bunyavirus, flavivirus infections, and malaria. Queensland faces important public health threats from mosquito borne diseases, with the presence of *Aedes aegypti* and *Ae. albopictus* in some regions of the state. These mosquitoes are competent vectors for dengue, chikungunya, and Zika virus infections and their presence creates the risk of local transmission in the event of an imported human case.[8]

Positive laboratory test results for alphavirus, bunyavirus, flavivirus infections, and malaria are received by the Notifiable Conditions Register (NoCS). Notifications of Ross River virus (RRv) and Barmah Forest virus (BFv) infections are classified as valid, probable, or invalid in NoCS, in accordance with their case definitions, based on laboratory data and have no further public health follow up. Notifications of all other mosquito borne diseases are followed up by relevant Public Health Units (PHUs) and classified according to their respective case definitions.

This report describes the epidemiology of mosquito-borne diseases notified in Queensland for the five year period covering 1 July 2012 to 30 June 2017.

Methods

Notification data were extracted from NoCS for cases of mosquito borne diseases (valid or probable) with onset from 1 July 2012 to 30 June 2017. Financial years were analysed to best capture the seasonality of mosquito borne diseases, especially in the tropical regions, and to maintain consistency with national reporting convention.

Annual notification rates were calculated for locally acquired diseases, such as BFv and RRv infections, and expressed as the number of notified cases per 100,000 population per year. Estimated Resident Populations (ERP) used as denominators for notification rate calculations (e.g. ERP for 2012 used for calculating notification rates for financial year 2012-13) were obtained from the Australian Bureau of Statistics[9]. Other mosquito-borne diseases were predominantly overseas acquired, and their annual notification rates are not reported.

We describe the number of notifications of mosquito borne diseases, rates (where appropriate), country of acquisition for imported cases, local transmission and outbreaks for locally acquired diseases, genotypes of dengue, and malaria species.

Results

There were 20,413 notifications of mosquito borne diseases in Queensland over the period 1 July 2012 to 30 June 2017 (Table 1).

Table 1: Notifications of mosquito-borne diseases in Queensland, 1 July 2012 to 30 June 2017 by financial year.

Virus / Disease	Financial Year					Total
	2012/13	2013/14	2014/15	2015/16	2016/17	
Alphaviurses						
➢ Barmah Forest virus infection	2,025	1,116	366	268	211	3,986
➢ Chikungunya	12	8	37	3	5	65
➢ Ross River virus infection	1,690	1,847	6,371	2,362	1,651	13,921
➢ Sindbis virus infection	0	0	1	3	2	6
➢ Unspecified, Alphavirus	0	0	0	0	7	7
Flaviviruses						
➢ Alfuy virus infection	0	0	0	0	1	1
➢ Dengue (DENV-1)	240	194	101	47	51	633
➢ Dengue (DENV-2)	31	34	59	171	143	438
➢ Dengue (DENV-3)	52	52	23	50	29	206
➢ Dengue (DENV-4)	7	11	2	28	39	87
➢ Dengue (Serotype not available)	92	172	92	102	73	531
➢ Japanese encephalitis virus infection	0	2	0	1	0	3
➢ Kokobera virus infection	2	2	0	2	1	7
➢ Murray Valley encephalitis virus infection	0	0	0	0	0	0
➢ Unspecified, Flavivirus	4	11	1	6	11	33
➢ West Nile virus (Kunjin subtype) infection	0	2	0	0	0	2
➢ Yellow fever virus infection	0	0	0	0	0	0
➢ Zika virus infection	-	7	3	28	12	50
Malaria						
➢ *Plasmodium falciparum*	53	48	26	31	50	208
➢ *Plasmodium knowlesi*	0	0	0	0	1	1
➢ *Plasmodium malariae*	5	2	3	2	1	13
➢ *Plasmodium ovale*	6	7	4	2	2	21
➢ *Plasmodium vivax*	49	31	36	23	26	165
➢ *Plasmodium* species not available	2	1	6	9	11	29
Total	**4,270**	**3,547**	**7,131**	**3,138**	**2,327**	**20,413**

The most frequently reported diseases were RRv infection (13,921), followed by BFv infection (3,986), dengue (1,895), and malaria (437).

Notifications of other mosquito-borne diseases, such as chikungunya, Zika virus infection, Japanese encephalitis virus infection and West Nile virus (Kunjin subtype) infection, were sporadic.

1. Ross River virus infection

Ross River virus infection was the most commonly notified mosquito borne disease across all years of this report, with a total of 13,921 notifications. It has distinct seasonal trends with peak notifications usually occurring in the March to May period each year. In the reporting period there was a large outbreak of RRv over the 2014/2015 season, with 6,371 notifications from 1 July 2014 to 30 June 2015 (Figure 1). Peak months were February and March 2015, with 1,791 and 1,823 notifications, respectively. This was the largest number of annual notifications of RRv in Queensland during the last 20 years. Cases were notified across the state and were reflective of population distribution. Many mosquito species, associated with various habitats, can transmit RRv. Research is underway in Queensland to better understand the role attributable to each species in the occurrence of seasonal outbreaks of disease.

From 1 January 2016, the national surveillance case definition for RRV infection was updated[10] so that a single IgM positive serology result would no longer meet the case definition for infection, reducing the likelihood of false positive notifications. This is likely to have improved the validity of RRv infection notifications but makes comparisons with incidence rates in previous years more difficult.

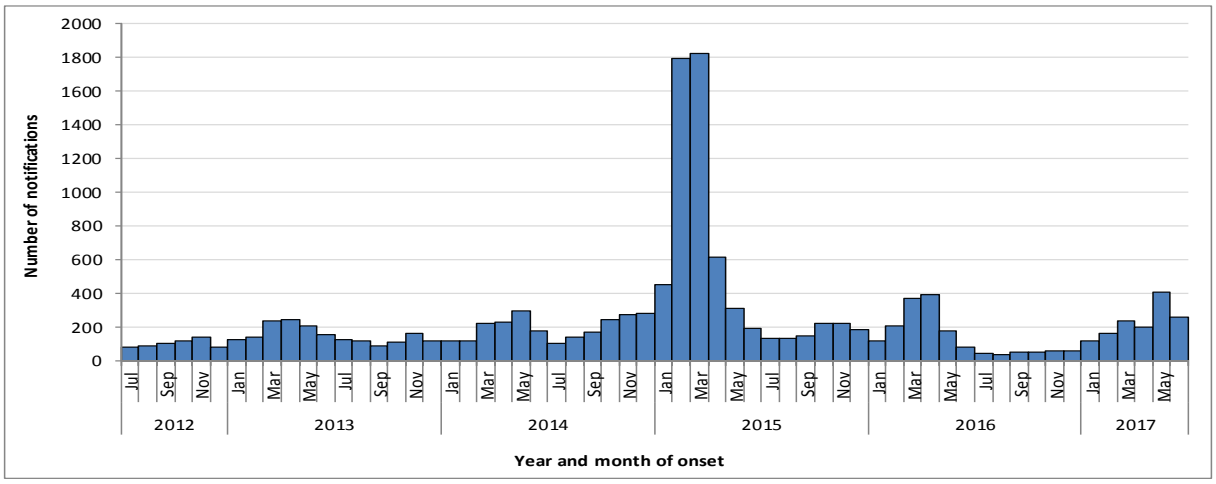

Figure 1 : Notifications of RRv infection in Queensland, 1 July 2012 to 30 June 2017, by year and month of onset.

Of 13,921 notified cases of RRv infection, 7,711 (55.4%) were female and 6,210 (44.6%) were male. Age distribution of cases was similar for males and females and reflected population distribution. The annual notification rate (Table 2) ranged from 34.0 to 134.9 per 100,000 population per year and was the highest during the 2014/2015 outbreak season across all Hospital and Health Service (HHS) areas; returning to pre-outbreak levels the following financial year.

Table 2: Rates of notified RRv infection (per 100,000 population per year) by HHS of usual residence and financial year, 1 July 2012 to 30 June 2017

Hospital and Health Service	2012/13	2013/14	2014/15	2015/16	2016/17
Torres and Cape	107.9	90.7	164.3	61.4	56.6
Cairns And Hinterland	90.6	78.6	163.1	87.0	44.7
North West	63.2	89.4	143.9	37.1	52.8
Townsville	90.1	85.3	126.5	75.0	43.4
Mackay	68.2	67.4	80.4	92.8	39.7
Central Queensland	60.9	77.3	146.6	82.2	51.9
Central West	131.4	158.6	290.1	169.4	121.2
Wide Bay	34.0	58.4	109.3	62.4	58.3
Sunshine Coast	37.7	71.0	158.2	85.7	80.2
Metro North	29.6	26.8	151.4	37.5	23.8
Metro South	19.0	16.9	126.6	28.2	17.5
Darling Downs	29.5	25.9	89.3	37.4	37.5
West Moreton	28.7	19.0	152.8	44.2	29.8
South West	76.2	137.5	208	113.9	109.4
Gold Coast	17.5	20.5	125.6	30.1	18.9
State-wide	**37.0**	**39.7**	**134.9**	**49.4**	**34.0**

Figure 2 presents LGA distribution patterns of RRv infection in Queensland between 1 July 2012 and 30 June 2017. The map displays the average annual notification rate of RRv infection per 100,000 population per year during this time period by local government area (LGA).

The Brisbane LGA had the highest average annual notification count, with the highest average annual notification rate in the Barcoo LGA.

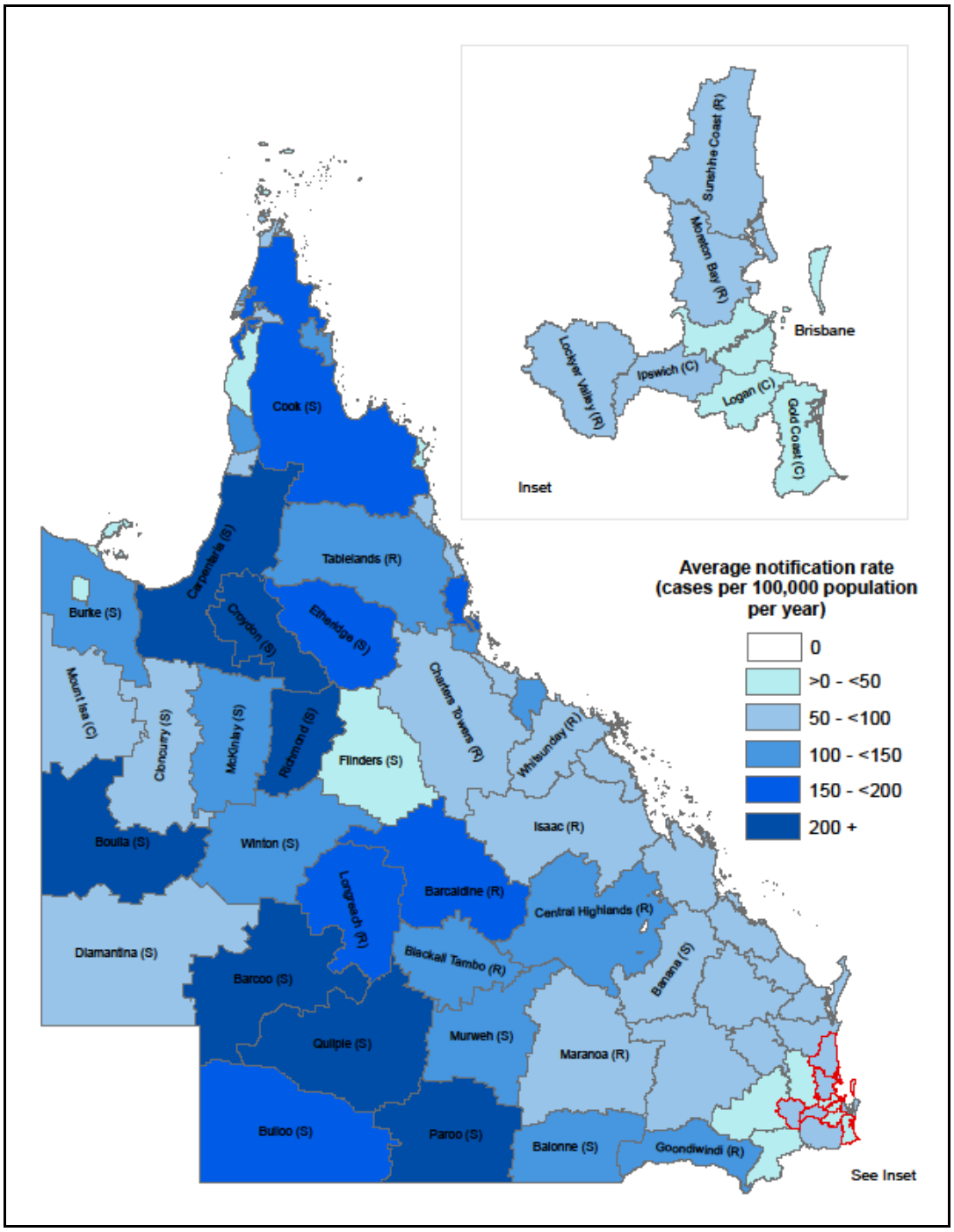

Figure 2: Average annual notification rates of RRv per 100,000 population per year by Local Government Area, Queensland, 01 July 2012 – 30 June 2017

2. Barmah Forest virus infection

Over the reporting period, there were 3,986 notifications of BFv with a seasonal pattern, peaking from January to May each year (Figure 3). A peak in notifications during the 2012/2013 season occurred in May, with 327 notifications; approximately 10 times the average for the other four years in the reporting period.

This increase was attributed to false positive test results associated with a commercial test kit, which was subsequently recalled.[11, 12] A similar increase in BFv notifications was observed in other states and territories, likely due to use of the same test. This should

be kept in mind when interpreting the 2012/2013 financial year notification counts and rates.

Notifications of BFv infection decreased from 1,116 cases in 2013/14 (24.0 cases per 100,000 population per year) to 211 cases in 2016/17 (4.4 per 100,000 population per year). The average annual rate over the reporting period but excluding the 2012/2013 data, was 10.5 notifications per 100,000 population per year. State-wide and HHS rates are summarised in Table 3. Rates in the south east of the state, where the largest proportion of the population is located, were consistently lower than other HHSs. Rates were more variable in HHS areas with lower populations where small changes in case numbers had a large impact on notification rates.

From 1 January 2016, the national surveillance case definition for BFv infection was updated[13] so that a single IgM positive serology result would no longer meet the case definition for infection reducing the likelihood of false positive notifications.

Of 3,986 notified cases of BFv infection, 2,213 (55.5%) were female and 1,773 (44.5%) were male. Age distribution of cases was similar for males and females and reflected population distribution.

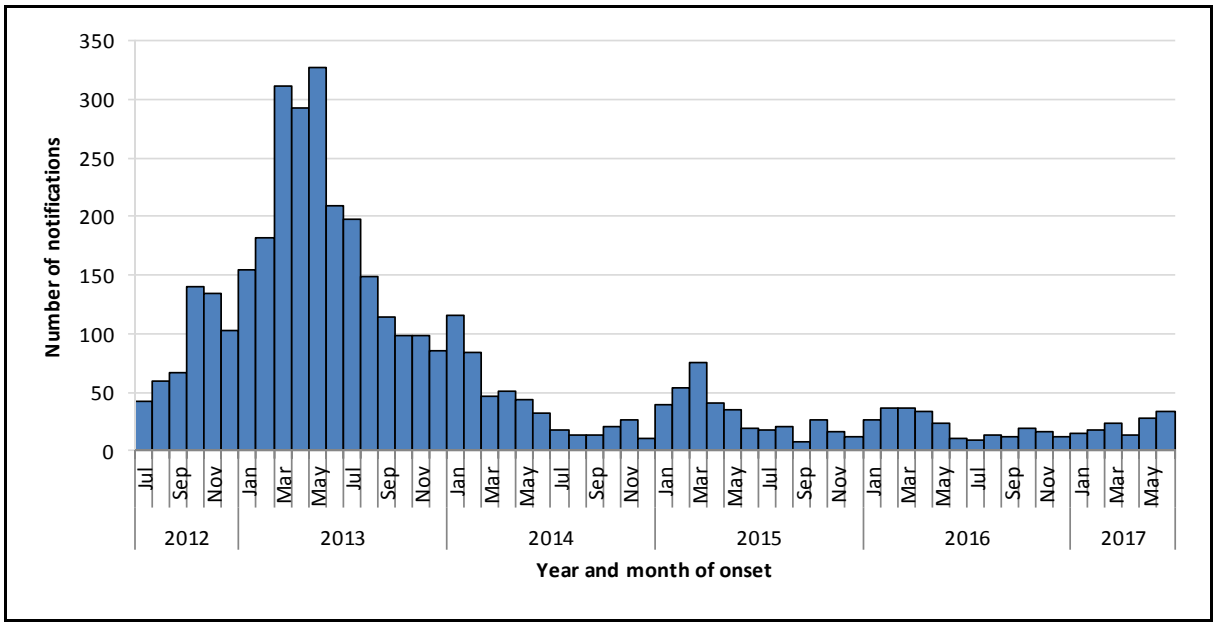

Figure 3: Notifications of BFv infection in Queensland, 1 July 2012 to 30 June 2017, by year and month of onset

Table 3: Rates of notified BFv infection (per 100,000 population per year) by HHS of usual residence and financial year, 1 July 2012 to 30 June 2017

Hospital and Health Service	2012/13	2013/14	2014/15	2015/16	2016/17
Torres and Cape	83.9	63.1	19.6	57.6	15.1
Cairns and Hinterland	71.6	35.4	8.9	20.4	9.1
North West	44.2	51.1	9.8	20.2	0.0
Townsville	77.7	43.3	9.7	13.4	10.9
Mackay	76.3	38.0	13.6	13.1	6.3
Central Queensland	74.0	46.6	10.9	11.3	5.5
Central West	41.1	50.1	0.0	0.0	9.3
Wide Bay	61.3	33.2	16.0	7.0	8.9
Sunshine Coast	87.3	46.2	13.5	6.3	9.8
Metro North	41.4	20.6	7.1	2.5	2.8
Metro South	21.7	11.2	5.3	1.8	1.4
Darling Downs	22.5	14.2	4.0	3.6	2.1
West Moreton	27.1	17.0	4.1	2.2	1.8
South West	91.4	34.4	7.7	7.9	8.1
Gold Coast	23.0	12.6	5.1	2.4	3.2
Grand Total	44.3	24.0	7.7	5.6	4.4

Figure 4 presents local distribution patterns of BFv infection in Queensland between 1 July 2012 and 30 June 2017. The map displays the average annual notification rate of BFv infection per 100,000 population per year during this time period by local government area (LGA).

The Sunshine Coast LGA had the highest average annual notification count, with the highest average annual notification rate in the Wujal Wujal LGA.

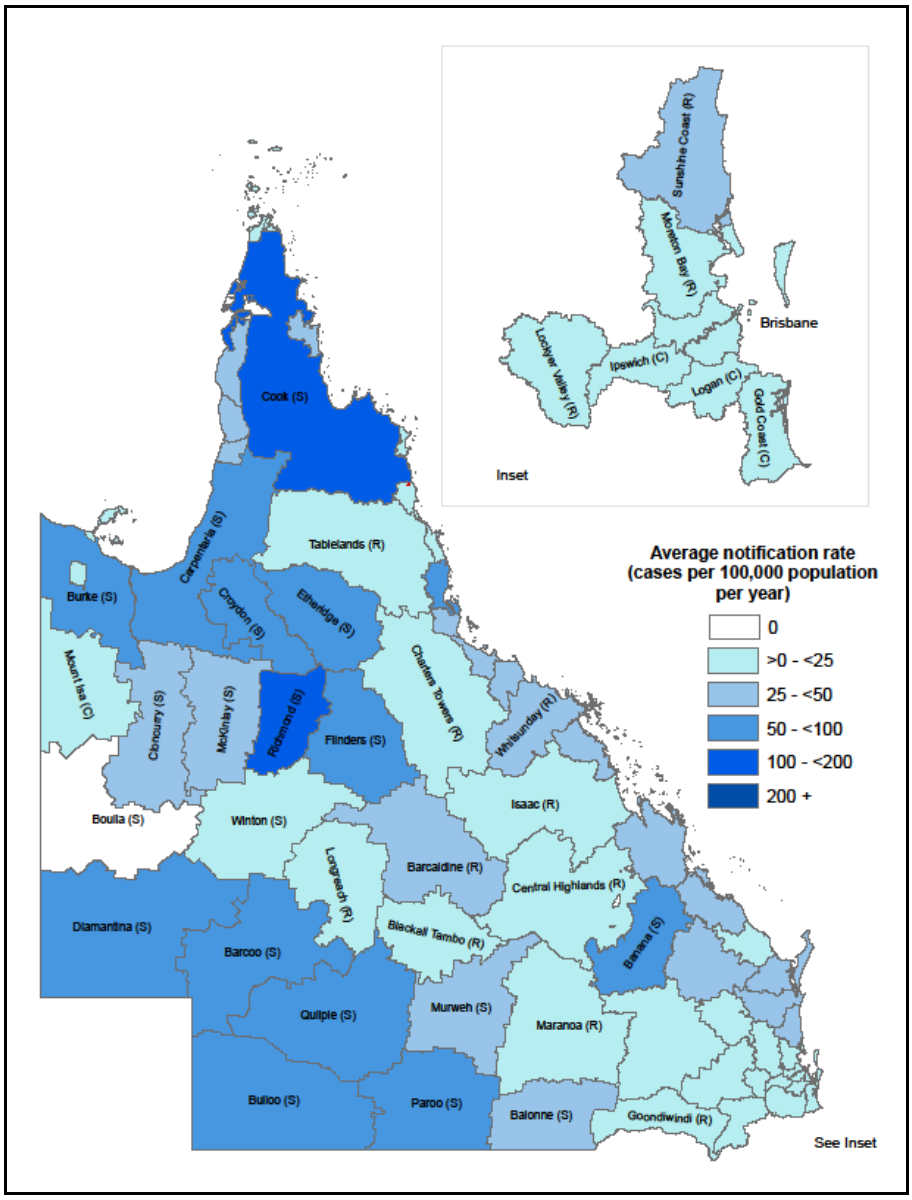

Figure 4: Average annual notification rates of BFv per 100,000 population per year by Local Government Area, Queensland, 01 July 2012 – 30 June 2017

3. Dengue

From 1 July 2012 to 30 June 2017, 1,895 dengue cases were notified, with the majority (71.8%) of infections acquired overseas. The annual count has shown an overall increasing trend during this time.

The number of locally acquired cases has shown a distinct and consistent downward trend since the beginning of the reporting period. Notifications during 2016/2017 (18) represented 5.4% of the total compared with 2012/2013 (207), during which 49.1% of notifications were locally acquired.

Table 4: Notifications of dengue in Queensland, 1 July 2012 to 30 June 2017, by local or overseas acquisition (changes made to table)

Place of acquisition	2012/13	2013/14	2014/15	2015/16	2016/17	Total (%)
Queensland	207	203	70	33	18	**531 (28.0)**
Overseas	215	259	207	364	315	**1360 (71.8)**
Not available	0	1	0	1	2	**4 (0.2)**
Total (%)	**422 (22.3)**	**463 (24.4)**	**277 (14.6)**	**398 (21.0)**	**335 (17.7)**	**1895**

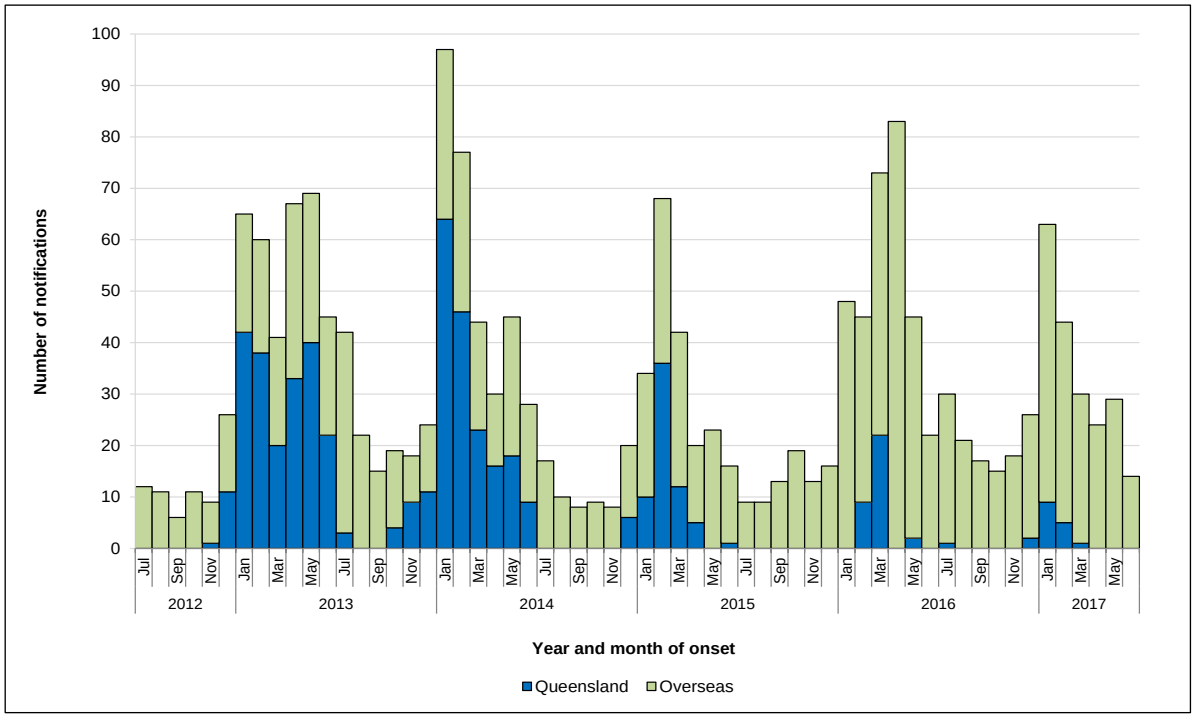

Figure 5: Notifications of dengue in Queensland with onset from 1 July 2012 to 30 June 2017, by month, year and place of acquisition

3.1 Locally acquired dengue

Dengue is not endemic in Queensland but outbreaks are triggered by imported viraemic cases entering a dengue receptive area.[8, 14] During the reporting period, 531 (28.0%) of notifications were locally acquired.

Of the 531 locally acquired dengue notifications, 408 (76.8%) were resident in the Cairns and Hinterland Hospital and Health Service area, 92 (17.3%) in the Townsville Hospital and Health Service area, 26 (4.9%) in the Torres and Cape Hospital and Health Service area, and 5 (1%) were resident in other areas of the state, but had been in northern Queensland during their exposure period.

An outbreak of locally acquired dengue in Queensland may consist of a single case or more than one linked case. During the reporting period there were 30 dengue outbreaks, with the highest number in the Cairns (13, 43.0%) LGA, followed by

Townsville (7, 23.0%) and Cassowary Coast (3, 10.0%) LGAs (Table 5). The two largest outbreaks were caused by serotype 1 and occurred in the Cairns LGA, with 146 (2012/2013) and 136 (2013/2014), respectively. Dengue serotypes 1 (18, 60.0%), 2 (8, 27.0%), 3 (3, 10.0%) and 4 (1, 3.0%) were represented in outbreaks across this time period.

Table 5: Summary of dengue outbreaks in Queensland by LGA and serotype, 1 July 2012 to 30 June 2017

Year	LGA predominantly affected	Number of cases in outbreak*	Number of days between the onset date of the first and the last case	Serotype
2012	Cairns	7	23	3
2012/2013	Cairns	146	210	1
2013	Cairns	3	8	2
2013	Douglas	13	59	1
2013	Cassowary Coast	9	58	1
2013	Townsville	19	80	1
2013	Hinchinbrook	4	13	1
2013	Townsville	3	8	1
2013	Cairns	6	16	1
2013/2014	Douglas	17	88	3
2013/2014	Cairns	136	119	1
2014	Townsville	18	150	1
2014	Charters Towers	29	73	1
2014/2015	Cairns	29	127	1
2015	Cassowary Coast	38	47	1
2015	Cairns	2	3	1
2015	Townsville	1	0	1
2016	Townsville	1	0	2
2016	Charters Towers	9	36	2
2016	Torres Strait Island	19	29	2
2016	Cairns	2	15	4
2016	Cairns	1	0	2
2016	Townsville	1	0	2
2016	Cairns	1	0	2
2016	Cairns	1	0	3
2016/2017	Torres Strait Island	6	26	1
2017	Cassowary Coast	6	38	1
2017	Townsville	1	0	2
2017	Cairns	2	0	1
2017	Cairns	1	0	1

The profile from pooled outbreak data indicated mean and median ages of 39.1 and 40.0 years respectively, with an age range of 1 – 86 years. Figure 6 displays the age group and sex distribution for these data. Some variation in age and gender distribution was noted between outbreaks and dengue serotypes.

Indigenous status was available for 528 of the 531 locally acquired notifications, with 60 (11.4%) identifying as Aboriginal and/or Torres Strait Islander people and 468 (88.6%) non-Indigenous.

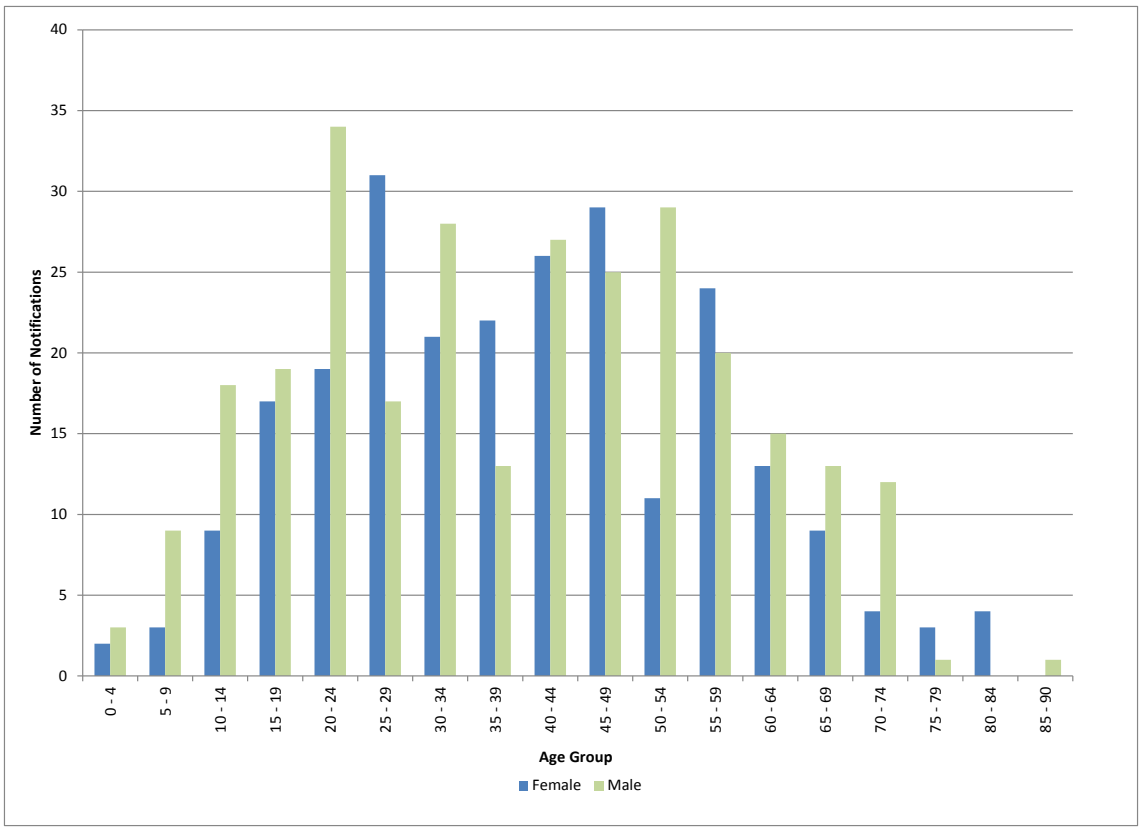

Figure 6: Notifications of locally acquired dengue 1 July 2012 to 30 June 2017, by sex and age group

3.2 Overseas acquired dengue

During the reporting period there were 1,360 (71.8%) notifications of overseas acquired dengue, with an increasing trend observed over this time (Table 4). Of these 1,360 notifications, 980 (72.1%) were notified in residents from the southeast HHS areas of Metro North, Metro South, Gold Coast, Sunshine Coast, and West Moreton; and 167 (12.3%) were notified in Cairns and Hinterland HHS area (Figure 7).

Country of acquisition was available for all but seven notifications. The most common region of acquisition across all years was South-East Asia (863, 63.5%) with the most common countries within South-East Asia being Indonesia (482, 55.9%), Thailand (171, 19.8%), and the Philippines (76, 8.8%). The two most common countries of acquisition, Indonesia and Thailand, accounted for 48% of all overseas acquired dengue in the reporting period. No further information is available on the specific locations in these countries that these infections were acquired. The second most common region of acquisition was Oceania (359, 26.4%), with the majority of notifications acquired within this region being Papua New Guinea (140, 39.0%), Vanuatu (59, 16.4%), Fiji (58, 16.2%), and the Solomon Islands (55, 15.3%). Imported cases from Pacific nations reflected known outbreaks in the region (Table 6).

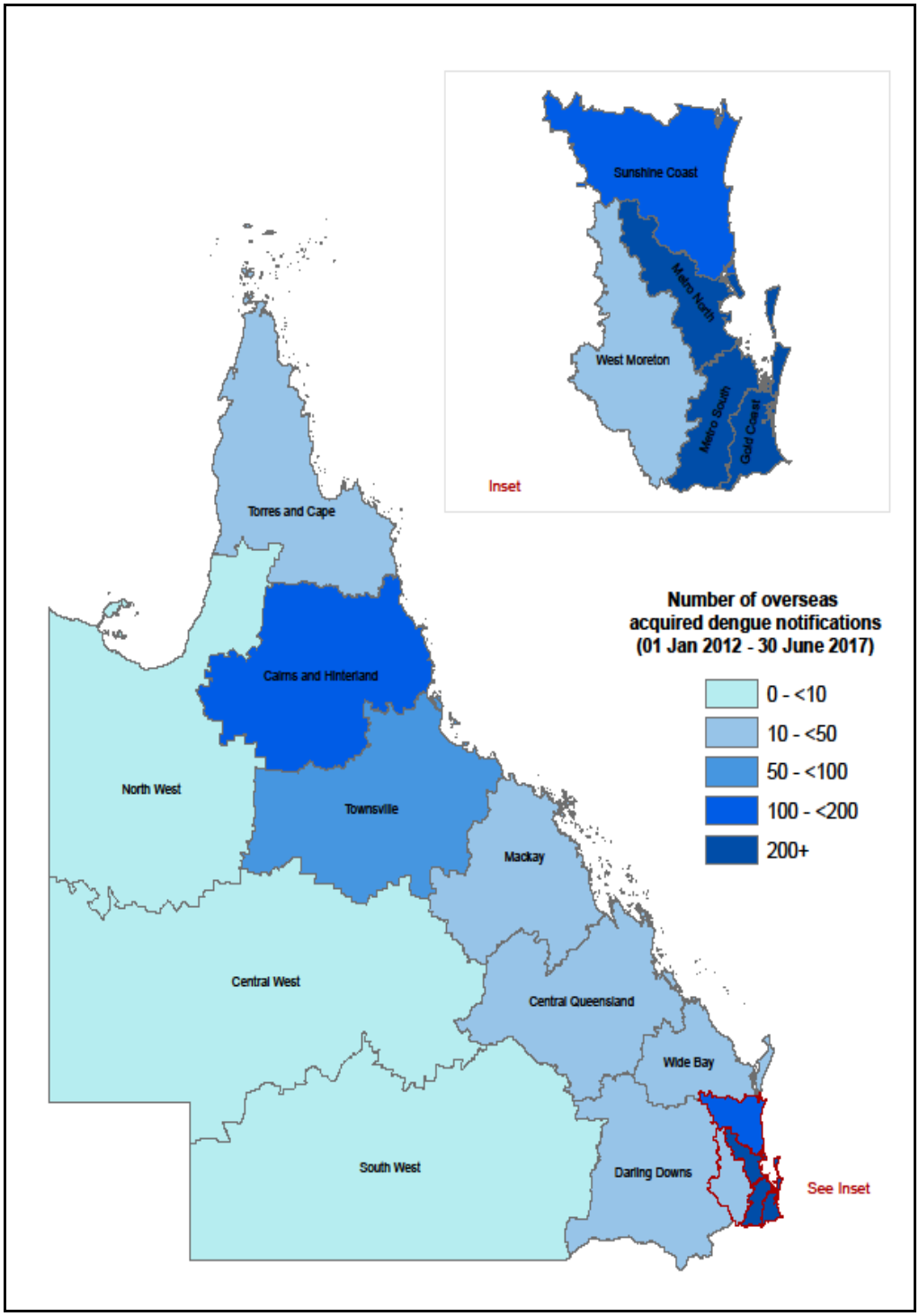

Figure 7: Number of overseas acquired dengue notifications by HHS area, Queensland, 01 July 2012 – 30 June 2017

Table 6: Number of notifications of overseas acquired dengue in Queensland, by region and country of acquisition and year, 1 July 2012 to 30 June 2017

Region / country of acquisition	Financial Year					Total (%)
	2012/13	2013/14	2014/15	2015/16	2016/17	
SOUTH-EAST ASIA	**149**	**176**	**161**	**220**	**157**	**863 (63.5)**
➢Indonesia	61	93	101	147	80	482 (55.9)
➢Thailand	49	33	29	22	38	171 (19.8)
➢Philippines	16	14	6	30	10	76 (8.8)
➢Malaysia	3	8	12	4	8	35 (4.1)
➢East Timor	5	12	4	1	9	31 (3.6)
➢Others	15	16	9	16	12	68 (7.9)
OCEANIA	**40**	**61**	**28**	**109**	**121**	**359 (26.4)**
➢Papua New Guinea	21	5	13	80	21	140 (39.0)
➢Vanuatu	0	12	0	0	47	59 (16.4)
➢Fiji	6	35	0	1	16	58 (16.2)
➢Solomon Islands	8	2	4	12	29	55 (15.3)
➢Samoa	0	0	1	13	1	15 (4.2)
➢Others	5	7	10	3	7	32 (8.9)
SOUTHERN AND CENTRAL ASIA	**15**	**11**	**10**	**18**	**29**	**83 (6.1)**
➢India	10	3	6	10	10	39 (47.0)
➢Sri Lanka	4	6	0	6	13	29 (34.9)
➢Maldives	1	0	4	2	3	10 (12.0)
➢Bangladesh	0	1	0	0	3	4 (4.8)
➢others	0	1	0	0	0	1 (1.2)
AMERICAS	**8**	**2**	**5**	**7**	**3**	**25 (1.8)**
➢Brazil	1	0	3	2	0	6 (24)
➢Costa Rica	2	1	0	0	0	3 (12)
➢Colombia	1	0	0	0	1	2 (8)
➢El Salvador	1	1	0	0	0	2 (8)
➢Mexico	0	0	0	2	0	2 (8)
➢Others	3	0	2	3	2	10 (40)
NORTH AFRICA & THE MIDDLE EAST	**2**	**6**	**1**	**7**	**0**	**16 (1.2)**
➢Country - Not stated	2	6	1	7	0	16 (100.0)
SUB-SAHARAN AFRICA	**0**	**2**	**0**	**1**	**2**	**5 (0.4)**
➢Congo	0	1	0	0	0	1 (20.0)
➢Mozambique	0	1	0	0	0	1 (20.0)
➢Senegal	0	0	0	0	1	1 (20.0)
➢Somalia	0	0	0	1	0	1 (20.0)
➢Others	0	0	0	0	1	1 (20.0)
NORTH-EAST ASIA	**1**	**0**	**0**	**0**	**1**	**2 (0.1)**
➢China	➢1	➢0	➢0	➢0	➢0	➢1 (50.0)
➢Japan	➢0	➢0	➢0	➢0	➢1	➢1 (50.0)
UNKNOWN REGION	**0**	**1**	**2**	**2**	**2**	**7 (0.5)**
TOTAL (%)	**215 (15.8)**	**259 (19.0)**	**207 (15.2)**	**364 (26.8)**	**315 (23.2)**	**1360**

The increase in overseas acquired dengue notifications may be influenced by many factors including increased travel through regions of endemic and epidemic virus activity. There has been an increasing trend in the number of short term departures by Australian residents to the three most common regions of dengue acquisition: South East Asia, Oceania, and Southern and Central Asia.[15]

Serotype was available for 935 (68.8%) of the 1,360 overseas acquired dengue notified cases (Table 7). Determination of serotype is generally attempted, but may not always be possible due to timing of specimen collection and potential cross reactivity between serotypes.

Overall, the most common imported serotype was serotype 2 (30.1%), followed by serotype 1 (18.8%), serotype 3 (13.7%), and serotype 4 (6.3%). Dengue notifications with unspecified serotype represented 31.3% of the total. The percentage of overseas acquired notifications caused by serotype 2 has shown a steady and consistent rise since 2012/2013 (Figure 8), increasing from 13.0% to 44.4%; while serotype 1 has decreased from 30.7% to 12.4%.

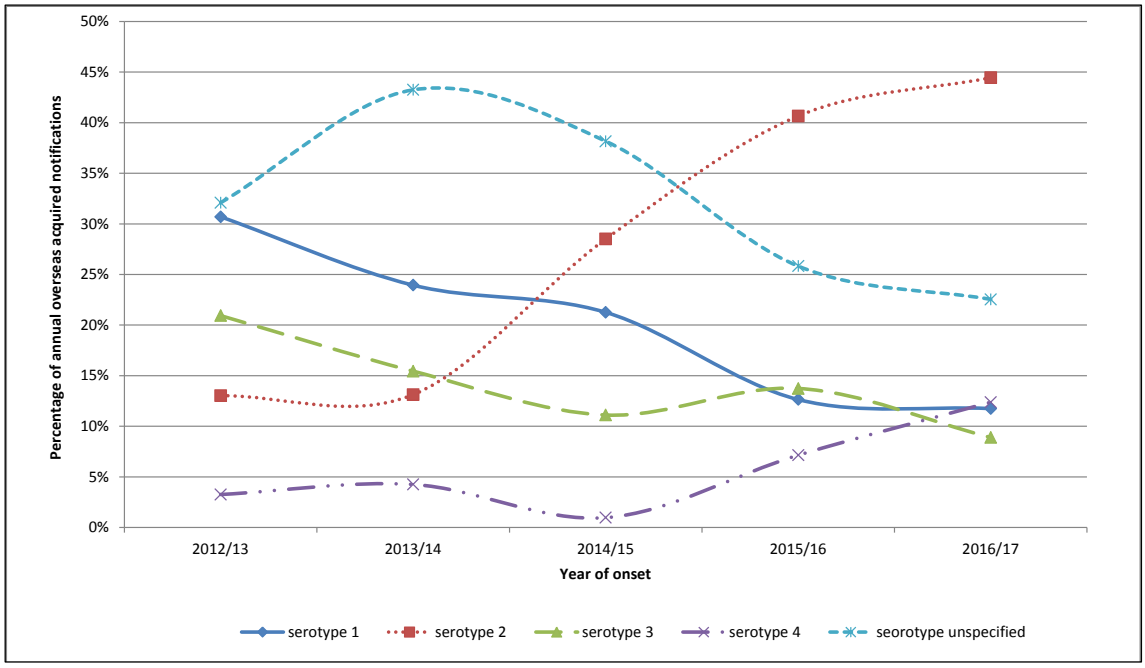

Figure 8: Notifications of overseas acquired dengue 1 July 2012 to 30 June 2017, by year and serotype.

Table 7: Notifications of overseas acquired dengue in Queensland, 1 July 2012 to 30 June 2017 by region and country of acquisition and serotype

Region / Country of acquisition	Serotype					Total (%)
	1	2	3	4	Unspecified	
SOUTH-EAST ASIA	**201**	**209**	**103**	**62**	**288**	**863 (63.5)**
➢ Indonesia	112	116	61	31	162	482 (55.9)
➢ Thailand	42	37	19	8	65	171 (19.8)
➢ Philippines	16	24	6	11	19	76 (8.8)
➢ Malaysia	5	11	6	4	9	35 (4.1)
➢ East Timor	7	4	7	3	10	31 (3.6)
➢ Others	19	17	4	5	23	68 (7.9)
OCEANIA AND ANTARCTICA	**32**	**162**	**69**	**12**	**84**	**359 (26.4)**
➢ Papua New Guinea	17	71	14	11	27	140 (39.0)
➢ Vanuatu	2	42	5	0	10	59 (16.4)
➢ Fiji	5	19	16	1	17	58 (16.2)
➢ Solomon Islands	1	21	16	0	17	55 (15.3)
➢ Samoa	2	3	8	0	2	15 (4.2)
➢ Others	5	6	10	0	11	32 (8.9)
SOUTHERN AND CENTRAL ASIA	**14**	**25**	**8**	**6**	**30**	**83 (6.1)**
➢ India	4	11	7	1	16	39 (47.0)
➢ Sri Lanka	6	8	1	5	9	29 (34.9)
➢ Maldives	4	4	0	0	2	10 (12.0)
➢ Bangladesh	0	2	0	0	2	4 (4.8)
➢ Others	0	0	0	0	1	1 (1.2)
AMERICAS	**5**	**3**	**1**	**2**	**14**	**25 (1.8)**
➢ Brazil	1	0	0	0	5	6 (24)
➢ Costa Rica	1	1	0	0	1	3 (12)
➢ Colombia	0	0	0	1	1	2 (8)
➢ El Salvador	0	0	1	0	1	2 (8)
➢ Mexico	0	0	0	0	2	2 (8)
➢ Others	3	2	0	1	4	10 (40)
NORTH AFRICA & THE MIDDLE EAST	**2**	**4**	**3**	**2**	**5**	**16 (1.2)**
➢ Country- not stated	2	4	3	2	5	**16 (100.0)**
SUB-SAHARAN AFRICA	**0**	**1**	**0**	**1**	**3**	**5 (0.4)**
➢ Congo	0	0	0	0	1	1 (20)
➢ Mozambique	0	0	0	0	1	1 (20)
➢ Senegal	0	0	0	0	1	1 (20)
➢ Somalia	0	0	0	1	0	1 (20)
➢ Others	0	1	0	0	0	1 (20)
NORTH-EAST ASIA	**0**	**1**	**0**	**0**	**1**	**2 (0.1)**
➢ China	0	0	0	0	1	1 (50)
➢ Japan	0	1	0	0	0	1 (50)
UNKNOWN REGION	**1**	**4**	**2**	**0**	**0**	**7 (0.5)**
TOTAL (%)	**255 (18.8)**	**409 (30.1)**	**186 (13.7)**	**85 (6.3)**	**425 (31.3)**	**1360**

4. Chikungunya

A total of 65 cases of chikungunya were notified over the reporting period (Table 8), with all cases acquired overseas. The majority were from Samoa (21, 32.3%), Papua New Guinea (11, 16.9%), and Indonesia (8, 12.3%); together accounting for 61.5% of notifications. Of all notifications, 13 (20.0%) were in residents of chikungunya receptive HHSs in Queensland: namely Cairns and Hinterland (11) and Townsville (2).

Table 8: Notifications of chikungunya in Queensland, 1 July 2012 to 30 June 2017, by country of acquisition

Country of acquisition	Financial Year					Total (%)
	2012/13	2013/14	2014/15	2015/16	2016/17	
Samoa	0	0	21	0	0	**21 (32.3)**
Papua New Guinea	10	1	0	0	0	**11 (16.9)**
Indonesia	1	5	1	0	1	**8 (12.3)**
Fiji	1	0	0	3	0	**4 (6.2)**
Cook Islands	0	0	3	0	0	**3 (4.6)**
India	0	1	0	0	2	**3 (4.6)**
Nauru	0	0	3	0	0	**3 (4.6)**
Kiribati	0	0	2	0	0	**2 (3.1)**
Philippines	0	0	1	0	1	**2 (3.1)**
Bangladesh	0	0	0	0	1	**1 (1.5)**
French Polynesia	0	0	1	0	0	**1 (1.5)**
Jamaica	0	0	1	0	0	**1 (1.5)**
Nicaragua	0	0	1	0	0	**1 (1.5)**
Tonga	0	1	0	0	0	**1 (1.5)**
Overseas acquired (travel to multiple endemic countries)	0	0	3	0	0	**3 (4.6)**
Total (%)	**12 (18.5)**	**8 (12.3)**	**37 (56.9)**	**3 (4.6)**	**5 (7.7)**	**65**

5. Malaria

During the reporting period there were 437 malaria cases notified in Queensland (Table 9). Overseas acquisition was confirmed for 416 (95.2%) notifications. There was one notification of locally acquired *Plasmodium vivax* infection during 2012/2013 in a resident of the Torres Strait (far north Queensland) with no history of travel outside this area. Data on place of acquisition were unavailable for the remaining 20 (4.6%) notifications at the time of reporting.

Plasmodium falciparum and *P .vivax* were the predominant species, accounting for 84.7% of all malaria notifications. In 2016/17, there was one notification of *P. knowlesi* which was reported to have been acquired in the Philippines; and represents the first case of this species notified in Queensland. *Plasmodium falciparum* was most commonly reported in travellers returning from Sub-Saharan Africa and Oceania, while *P. vivax* infections were most commonly acquired in Oceania and Southern/Central Asia.

Infections in travellers to Sub-Saharan Africa were acquired from numerous countries in the region; most commonly from Uganda (26, 13.8%), Sudan (25, 13.3%), and Tanzania (20, 10.6%). In contrast, Papua New Guinea was disproportionately

represented in notifications from Oceania (138, 87.9%). Country of acquisition data are summarised in Table 9.

Table 9: Notifications of malaria in Queensland, by Plasmodium species and region and country of acquisition, 1 July 2012 to 30 June 2017

Region/Country of acquisition	Species						Total (%)
	P. falciparum	*P. knowlesi*	*P. malariae*	*P. ovale*	*P. vivax*	Unspecified	
SUB-SAHARAN AFRICA	**144**	**0**	**11**	**17**	**10**	**6**	**188 (42.8)**
➢ Uganda	18	0	3	2	3	0	26
➢ Sudan	17	0	1	5	2	0	25
➢ Tanzania	17	0	1	1	0	1	20
➢ Kenya	9	0	2	2	0	0	13
➢ Zambia	7	0	0	3	0	1	11
➢ others	76	0	4	4	5	4	93
OCEANIA AND ANTARCTICA	**47**	**0**	**1**	**1**	**93**	**14**	**156 (35.9)**
➢ Papua New Guinea	44	0	1	1	79	13	138
➢ Solomon Islands	3	0	0	0	13	1	17
➢ Australia	0	0	0	0	1	0	1
SOUTHERN AND CENTRAL ASIA	**2**	**0**	**0**	**0**	**40**	**7**	**49 (11.2)**
➢ India	2	0	0	0	33	7	42
➢ Pakistan	0	0	0	0	7	0	7
SOUTH-EAST ASIA	**7**	**1**	**0**	**2**	**9**	**1**	**20 (4.6)**
➢ Indonesia	7	0	0	2	8	1	18
➢ Philippines	0	1	0	0	0	0	1
➢ Viet Nam	0	0	0	0	1	0	1
NORTH AFRICA AND THE MIDDLE EAST	**1**	**0**	**1**	**0**	**0**	**0**	**2 (0.5)**
➢ Country unknown	1	0	1	0	0	0	2
AMERICAS	**0**	**0**	**0**	**0**	**1**	**0**	**1 (0.2)**
➢ Peru	0	0	0	0	1	0	1
NORTH-EAST ASIA	**0**	**0**	**0**	**0**	**0**	**1**	**1 (0.2)**
➢ Korea, Republic of (South)	0	0	0	0	0	1	1
UNKNOWN REGION	**7**	**0**	**0**	**1**	**9**	**3**	**20 (4.6)**
TOTAL (%)	**208(47.6)**	**1 (0.2)**	**13 (3.0)**	**21(4.8)**	**162 (37.1)**	**32(7.3)**	**437**

6. Zika virus infection

Queensland laboratories began testing for Zika virus in 2014, so there were no notifications in Queensland prior to this time, although there may have been undetected imported cases (Table 10). Fifty notifications of Zika virus infection were received by Queensland Health between 1 January 2014 and 30 June 2017. All notifications were overseas acquired infections. The seven notifications during 2013/2014 were in travellers returning to Australia from the Cook Islands between March and May 2014.

An updated surveillance case definition for Zika virus infection was implemented in Queensland on 01 January 2016, which included serology results as laboratory suggestive evidence and an additional (probable) category of notification. All notifications before this time were confirmed cases. Probable notifications accounted for seven (25.0%) and five (41.7%) of cases during the 2015/2016 and 2016/2017 financial years respectively.

The 2015/2016 financial year accounted for the highest number of Zika virus notifications (28, 56%) during the reporting period. This observation is consistent with the documented global spread of the disease through Southern and Central America and the Asia Pacific region. Queensland also applied enhanced laboratory surveillance from February to May 2016, where all samples tested for dengue virus were also tested for Zika virus.

The geographical distribution and country of acquisition of notified infections are summarised in Table 10 and Figure 9.

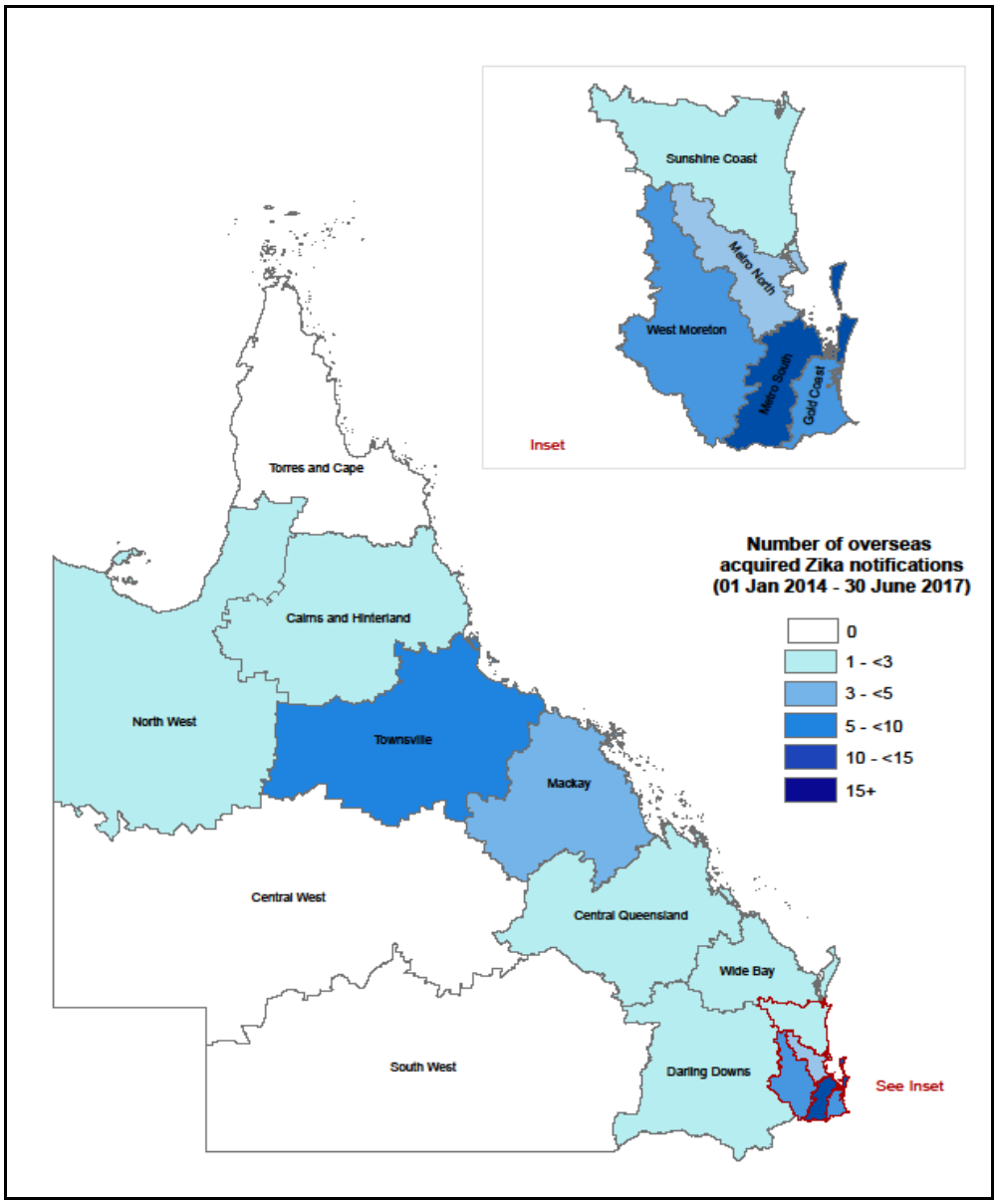

Figure 9: Number of overseas acquired Zika notifications by HHS area, Queensland, 01 Jan 2014 – 30 June 2017

Table 10: Notifications of Zika virus infection in Queensland by country of acquisition and year of onset, 1 Jan 2014 to 30 June 2017.

Country of acquisition	Financial Year				Total (%)
	2013/14	2014/15	2015/16	2016/17	
Fiji	0	0	4	4	**8 (16)**
Mexico	0	0	3	5	**8 (16)**
Tonga	0	0	8	0	**8 (16)**
Cook Islands	7	0	0	0	**7 (14)**
Samoa	0	0	5	0	**5 (10)**
El Salvador	0	0	2	0	**2 (4)**
Solomon Islands	0	1	0	1	**2 (4)**
Vanuatu	0	2	0	0	**2 (4)**
Viet Nam	0	0	1	1	**2 (4)**
Colombia	0	0	1	0	**1 (2)**
Cuba	0	0	0	1	**1 (2)**
Dominican Republic	0	0	1	0	**1 (2)**
Guyana	0	0	1	0	**1 (2)**
Indonesia	0	0	1	0	**1 (2)**
South East Asia (travel to multiple endemic countries)	0	0	1	0	**1 (2)**
Total (%)	**7 (14)**	**3 (6)**	**28 (56)**	**12 (24)**	**50**

7. Japanese encephalitis virus infection

During the reporting period, there were three notifications of Japanese encephalitis virus infection in Queensland: two confirmed and one probable (Table 11). All were overseas acquired.

Table 11: Line list of Japanese encephalitis virus infection notifications in Queensland by onset date, country of acquisition and validity, 1 July 2012 to 30 June 2017

Onset date	Country of acquisition	Validity
July 2013	Taiwan	Confirmed
September 2013	Philippines	Probable
November 2015	Indonesia	Confirmed

8. Murray Valley encephalitis virus infection

During the reporting period there were no notifications of Murray Valley encephalitis (MVE) virus infection. The last confirmed case of MVE in Queensland occurred in March 2012 in a teen-age boy from Cairns and Hinterland HHS who acquired the infection in Papua New Guinea.

9. West Nile virus (Kunjin subtype) infection

There were two cases of West Nile virus (Kunjin subtype) infection notified during the reporting period, both acquired overseas and reported in the financial year 2013/2014 (Table 1). One case acquired the infection in East Timor and the other in Papua New Guinea.

10. Yellow fever

During the reporting period there were no notifications of yellow fever. The principal vector, *Aedes aegypti*, is endemic in north Queensland and has been found in parts of central and southern Queensland. [161615151413] No local transmission of yellow fever virus has been reported.

11. Other alphavirus and flavivirus infections

Notifications of uncommon alphavirus and flavivirus infections, as well as those from both genera that could not be further identified ('unspecified'), are summarised in Table 12.

Table 12: Notifications of other alphavirus and flavivirus infections in Queensland, by organism and region of origin, 1 July 2012 to 30 June 2017

	Other alphavirus		Other Flavivirus			Total
Region of acquisition	Sindbis	Unspecified	Alfuy	Kokobera	Unspecified	
South-East Asia	1	1	0	0	12	14
Oceania And Antarctica	2	2	0	1	8	13
Sub-Saharan Africa	0	1	0	0	2	3
Americas	0	0	0	0	1	1
North-East Asia	0	0	0	0	1	1
Southern And Central Asia	0	0	0	0	1	1
Not stated	3	3	1	6	8	21
Total	**6**	**7**	**1**	**7**	**33**	**54**

Country of acquisition was reported for 29 (72.5%) of the alphavirus and flavivirus unspecified notifications. The most common country was Thailand (7, 24.1%), followed by Indonesia (4, 13.8%), and Papua New Guinea (3, 10.3%).

Conclusion:

The most frequently notified mosquito borne diseases were RRv, BFv, dengue, and malaria. There have been fewer notifications of BFv and RRv infection in recent years, most likely due to changes in the case definitions. Notifications of other mosquito borne diseases were sporadic. Yellow fever, Japanese encephalitis virus infection, Chikungunya, Zika virus infection and malaria are not endemic to Queensland but

notifications are associated with return from travel to overseas regions where endemic and epidemic disease activity occurs.

The number of overseas acquired dengue notifications has shown an increasing trend over recent years, likely reflecting increases in the number of Australians travelling to dengue endemic countries. In contrast, the number of locally acquired dengue notifications has shown a consistent decline since 2014/2015. Influencing factors are likely to include local vector control activities and trial implementation of the *Eliminate Dengue Program*[17] reflecting ongoing efforts to prevent dengue becoming endemic in Queensland.

The highest number of chikungunya notifications was reported in 2014/15, reflecting the impact of outbreaks in neighbouring pacific nations. Notifications of chikungunya have remained low since that time. There have been no reports of locally acquired chikungunya infection.

Zika virus infection was first reported in Queensland 2013/2014 in a traveller returning from the Cook Islands. The highest number of notifications during the reporting period occurred in 2015/2016, with numbers remaining low since that time. Increased traveller awareness and reduced Zika activity in the Pacific, where the majority of Queensland imported cases have been acquired, are likely to have contributed to this trend. There have been no reports of locally acquired Zika virus infection.

Additional information about mosquito borne diseases in Queensland can be found on the Queensland Health website and in associated reports. [8, 18] National data are available in NAMAC annual reports.[19]

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