Review of leptospirosis notifications in Queensland and Australia: January 1998 – June 1999

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Abstract

The World Health Organization/Food and Agricultural Organization Collaborating Centre for Reference and Research on Leptospirosis, Western Pacific Region, accredited since 1958, is part of Queensland Health Scientific Services, which provide tertiary level support in epidemiology, surveillance, training and diagnosis for hospitals and pathology laboratories across the State. Databases for leptospirosis on a global, Australian and State-wide basis are maintained on site and support public health authorities in Australia, WHO and the International Leptospirosis Society. Queensland data collated and analysed from leptospirosis questionnaires, and a brief overview of Australian data based on questionnaire responses for notified cases from 1998 to June 1999, are summarised. The increase in leptospirosis notifications (77%) during 1998 possibly signalled greater awareness of the disease by clinicians. There was a significant increase in leptospirosis notifications for children and students and a high rate of hospitalisation of cases. An outbreak in North Queensland during the first half of 1999 resulted in 184 notifications with over 50% of cases hospitalised. Polymorphic presentation of the disease with severe pulmonary haemorrhage is associated in particular with the serovar australis. Serovar zanoni continues to be a major cause of severe clinical leptospirosis. Several cases were diagnosed in tourists. One of these cases presented with severe respiratory distress and required 14 days in hospital. *Commun Dis Intell* 2000;24:153-157.

Keywords: leptospirosis, surveillance, clinical, occupation, activity, rat, dog, cattle

Introduction

Leptospirosis was first recognised in Australia in 1934 among cane-cutters of Ingham, North Queensland.[1] It is an acute febrile disease occurring in humans and animals worldwide.[2] There are more than 250 pathogenic serovars of *Leptospira interrogans*. The disease is potentially lethal, with involvement of the hepatic, renal and central nervous systems. The source of infection is water or soil that has been contaminated with the infected urine of wild, feral or domestic animals.[3]

Leptospirosis occurs in all parts of Australia with the highest incidence of the disease in Queensland and Victoria.[4] Leptospirosis is a notifiable disease in all States and Territories of Australia. A laboratory based notification system was introduced in Queensland from 1988, requiring all laboratory diagnoses to be reported to the Communicable Diseases Branch of Queensland Health. Prior to 1988 all notifications were practitioner initiated.

Methods

The World Health Organisation/Food and Agricultural Organization Collaborating Centre for Reference and Research on Leptospirosis has sought information on incidence of leptospirosis from 1985 to date in Australia through notifications and a mail questionnaire. The response rate of clinicians, laboratory staff and public health units to the questionnaire in Queensland was exceptional at over 99%. Response rates are steadily increasing for the Australia-wide aspect of the program.

Since 1988 notifications of leptospirosis for Queensland have been based on isolation of the organism, or positive serology. The latter was defined as a four-fold or greater change in Leptospira Microscopic Agglutination Test (MAT) titre, or a single raised MAT titre equal to or greater than 400. This may be supported through demonstration of elevated leptospiral IgM using an Enzyme Linked Immunosorbent Assay (ELISA). The National Health and Medical Research Council (NHMRC) notification criteria for leptospirosis are similar to, but vary from, those of Queensland Health. The NHMRC criterion of requiring a 'single raised agglutination titre with clinically compatible illness' may not accurately represent all leptospirosis cases due to the non-specific nature of symptoms of leptospirosis in humans and unspecified determination of a raised agglutination titre value. The NHMRC notification criteria also do not specify the MAT as the serological test of preference. The MAT is the internationally recognised method for the diagnosis of leptospirosis and is most commonly constructed with a panel of serovars representative for a region.[5] Other serological test methods cannot provide a determination of the infecting serovar or serogroup.

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The reference laboratory receives either tertiary specimens for confirmation by MAT, or primary specimens on which an ELISA and/or the MAT are performed. Specimens are tested against a panel of 21 serovars. This panel of 21 serovars is representative of all the known serogroups in the Western Pacific Region. Due to known cross-reactions at the serogroup level, these 21 serovars provide the optimum regional panel for testing local and overseas sera. This panel includes representatives previously recovered from humans in Australia.

In 1996 the laboratory commenced a program of placing Ellingshausen-McCullough-Johnson-Harris (EMJH) agar (specific isolation medium for *Leptospira*) in Queensland Public Health Hospitals in areas where leptospirosis cases were relatively common. It was requested that all suspect leptospirosis cases and cases with pyrexia of unknown origin have blood collected and cultured for attempted isolation of *Leptospira*. A specimen collection chart to indicate the ideal times for collection of samples for culture and serology was produced, and copies forwarded to clients.

The questionnaire component of the study commenced in 1991. It sought information on occupation, animal contacts, outdoor recreational activities, travel, age, gender, symptoms and location of residence prior to onset of symptoms. Questionnaires were sent to the referring doctors of those patients whose leptospiral serology was positive or from whom a leptospire was isolated.

Results

Queensland

For the year 1998 there was a total of 108 notifications in Queensland - a 77% increase in cases compared with 1997 when 61 cases were reported. The 108 notifications represent an incidence rate of 3.2 per 100,000 population, compared with a rate of 2.2 per 100,000 for 1997. The Queensland notifications represent 60% of all Australian cases for 1998. From 1 January 1999 to 30 June 1999 a total of 184 notifications was reported to Queensland Health. The average age at diagnosis for Queensland was 35.0 years for males and 35.7 years for females, with an average of 35.1 years for all notifications.

The most common case symptoms reported for Queensland and Australia for 1998 to the end of June 1999 are shown in Table 1. These symptoms resemble those of many other pyrexia of unknown origin, and frequently leptospirosis may not be considered in the diagnosis by the clinician.

Hospitalisation information has only recently been collected through the questionnaires. Of 216 respondents, 128 (59.3%) had been hospitalised for an average of 5 days. The maximum time of hospitalisation was 27 days and the minimum one day. Serovars australis and zanoni accounted for the majority of hospitalisations. It is hoped that previous notifications can be followed up and hospitalisation information collated for 1998 for Australia as a whole.

Of the 292 Queensland notifications, all reported contact with animals. Significant exposures were to rats at 170 (58.2%), dogs at 132 (45.2%) and cattle at 110 (37.7%) (Figure 1). Figure 1 also compares reported animal contacts for Australian notifications. In many instances exposure could be related to activity e.g. rats, feral pigs and mice with the banana and related fruit industries, and cattle with abattoirs and meat processing industries. The banana industry accounted for the majority of notifications at 74 (25.3%) (Table 2). Clinicians need to be aware of occupations and activities not traditionally implicated in the disease since 31.9% of the notifications were associated with these.

In occupations based on the animal industry, serovars hardjo, pomona and zanoni accounted for the majority of cases (Figure 2). Serovars zanoni and australis were implicated in most of the cases in the agricultural industries. Overall, the serovars hardjo, zanoni and australis accounted for 182 (62%) of the notifications (Figure 3).

In the review period, 78 *Leptospira* isolates were recovered from 539 isolation attempts (14.5% recovery) (Table 3). There were 38 isolations from patients without follow up convalescent serology. Without these cultures, 13.0% (38 of 292) of notifications would have been missed.

Figure 1. Notifications of leptospirosis, Queensland and Australia, 1 January 1998 to 30 June 1999, by frequency of animal contacts

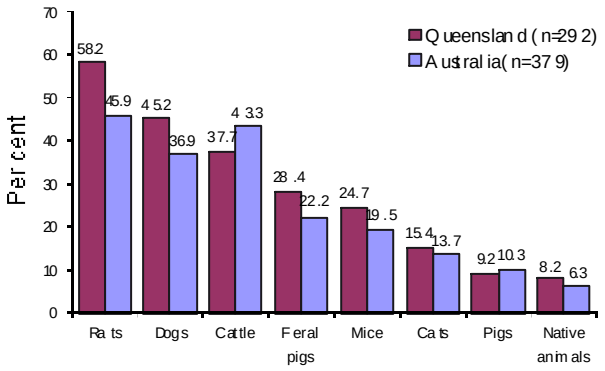


Figure 2. Notifications of *Leptospira*, Queensland, 1 January 1998 to 30 June 1999, by serovar in animal industry-based occupations (n=76)

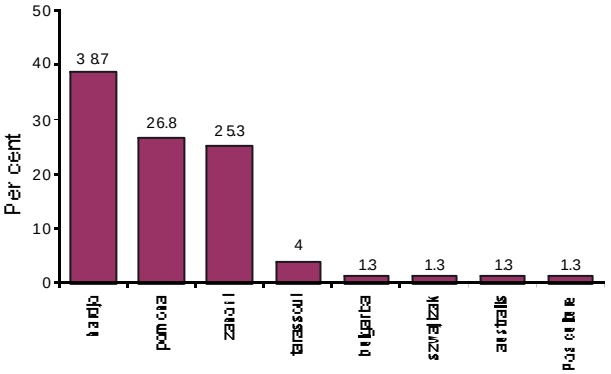


Table 1. Notifications of leptospirosis in Queensland and Australia, 1 January 1998 to 30 June 1999, by frequency of reported symptoms

	Notifications for Queensland (n = 292)		Notifications for Australia (n = 381)	
Symptom	Number	%	Number	%
Headache	225	77.1	280	73.5
Severe fever	217	74.3	254	66.7
Chills	208	71.2	253	66.4
Sweats	205	70.2	253	66.4
Myalgia	201	68.8	259	68.0
Nausea/vomiting	179	61.3	213	55.9
Arthralgia	150	51.4	183	48.0
Back pain	102	34.9	127	33.3
Conjunctival suffusion	71	24.4	80	21.0
Mild fever	63	21.6	92	24.1
Renal involvement	48	16.4	60	15.7
Respiratory symptoms	48	16.4	59	15.5
Vision disturbance	35	12.0	37	9.7
Diarrhoea	22	7.5	25	6.6
Rash	18	6.2	23	6.0
Pulmonary haemorrhage	13	4.5	15	3.9

Table 2. Notifications of leptospirosis, Queensland and Australia, 1 January 1998 to 30 June 1999, by occupation or activity

	Notifications for Queensland		Notifications for Australia	
Occupation or activity	Number	%	Number	%
Banana farmers[1]	74	25.3	74	19.4
Meatworkers[1]	36	12.3	67	17.6
Dairy farmers[1]	25	8.6	43	11.3
Children/students	20	6.8	20	5.2
Farmers[1]	15	5.1	20	5.2
Agricultural/rural workers[1]	10	3.4	10	2.6
Cane farmers[1]	9	3.1	9	2.4
Graziers[1]	9	3.1	11	2.9
Building labourers	8	2.7	8	2.1
Transport workers	7	2.4	7	1.8
Station hands[1]	6	2.1	9	2.4
Home duties	4	1.4	4	1.0
Nursery worker/landscaper	4	1.4	4	1.0
Tradesperson	4	1.4	5	1.3
White water rafting guides	4	1.4	4	1.0
Unemployed	4	1.4	5	1.3
Mechanic	3	1.0	4	1.0
Clerical duties	3	1.0	3	0.8
Retired	2	0.7	3	0.8
Tourist	2	0.7	4	1.0
Other	28	9.6	32	8.4
Unknown	15	5.1	35	9.2
Total	292	100	381	99.7

1. Occupations traditionally associated with leptospirosis

Figure 3. Notifications of *Leptospira*, Queensland, 1 January 1998 to 30 June 1999, by serovar as percentages (n = 292)

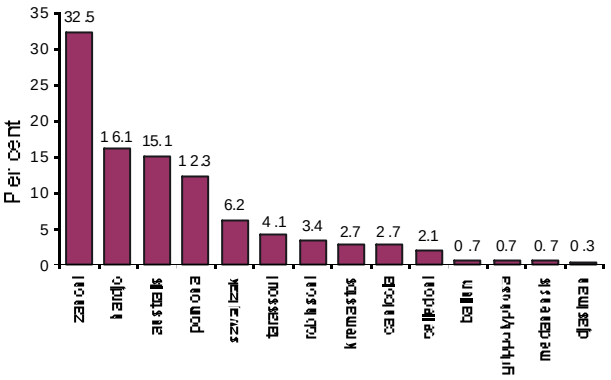
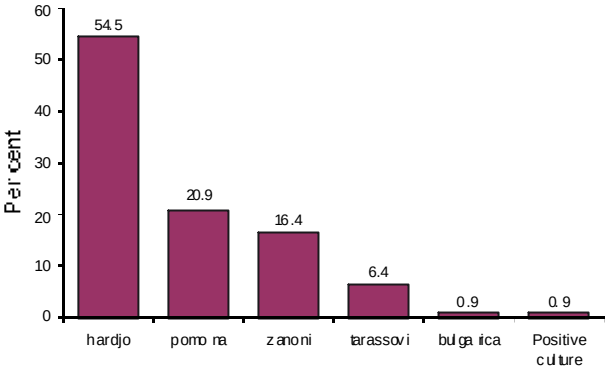


Figure 4. Notifications of leptospirosis, in Australia, 1 January 1998 to 30 June 1999, by serovars as a percentage for dairy and meatworker industries (n = 110)



The outbreak in North Queensland during the first six months of 1999 resulted in 184 notifications, compared with 47 for the same period in 1998. This increase was possibly due to heavy, prolonged rainfall and flooding in the region and an increased rodent population. Isolation and/or serology detected at least 14 different serovars of *Leptospira* for this period, australis and zanoni accounting for 92 (31.6%) of the notifications.

Australia as a whole

The Australian leptospirosis surveillance program is well under way and there has been a significant increase in the questionnaire response rate with an 82% return rate on the reported notifications for the year. This is, however, biased by the large number of notifications recorded for Queensland with a questionnaire return rate of 99%.

A comparison of notifications by State or Territory for 1998 is shown in Table 4. (Personal communication, Communicable Diseases Network Australia New Zealand – National Notifiable Diseases Surveillance System).

Table 3. *Leptospira* in Queensland, 1 January 1998 to 30 June 1999, byserovar isolated from patients

Serovar	Serovar isolations	
	Number	%
zanoni	37	47.4
australis	14	19.9
robinsoni	6	7.7
tarassovi	5	6.4
hardjo	4	5.1
szwajizak	3	3.8
kremastos	3	3.8
pomona	3	3.8
celledoni	2	2.6
medanensis	1	1.3
Total	75	100

The average age of leptospirosis cases notified was 34.7 years for males and 33.0 years for females. The average age of all notifications in Australia was 34.7 years.

The most common symptoms for the disease reported through the questionnaires are shown in Table 1. Again, the polymorphic nature of the disease could easily result in clinicians discounting leptospirosis in their differential diagnoses.

Animal related industries accounted for 28.5% of the national notifications (meatworkers 17.2%, dairy workers 11.3%) while the banana industry accounted for 19.5% (Table 2). Students and children accounted for 5.2% of the notifications. The data clearly demonstrate the broad range of occupations or activities associated with leptospirosis.

The leptospiral serovars most commonly reported were hardjo, zanoni, pomona and australis. In the dairy and meat working industries, serovars hardjo and pomona accounted for the majority of notifications with 60 (55.6%) and 22 (20.3%) respectively (Figure 4). Two overseas cases (from Malaysia and Indonesia) were both diagnosed with serovar djasiman.

Only two of the 381 Australian cases reported no contact with animals. The most frequent animal contact was with rats at 174 (45.9%) and cattle at 164 (43.3%) (Figure 1). Of

Table 4. Notifications of leptospirosis, 1998, by State or Territory

State or Territory	Number of notifications
ACT	0
NSW	48
NT	3
Qld	109
SA	1
Tas	1
Vic	25
WA	10
Total (Australia)	197

interest is the high proportion of contacts with dogs at 140 (36.9%). The total number of reported contacts with mice was 74 (19.5%). Of the 140 (36.9%) dog contacts reported, 113 (79%) also had rat and/or mice contact, and of the 52 (13.7%) cat contacts, 36 (69.2%) also had rat and/or mice contact.

Discussion

Leptospirosis continues to be increasingly responsible for ill health, affecting people employed in a wide range of occupations and activities, some of which are not traditionally associated with the disease in Australia. The large increase in notifications in Queensland during this period could be explained by high and consistent rainfall and reported increases in rodent numbers. Leptospirosis is still under-reported with greater awareness of the disease needed in children at the initial clinical assessment. Children accounted for at least 5% of leptospirosis notifications in Australia. The agricultural industry continues to emerge as the major national source of notifications along with the dairy and meatworking industries. While rats and mice are recognised sources of infection worldwide, the real public health risk associated with dogs has yet to be fully determined. To date the reference laboratory has not been able to recover leptospires from the urine of dogs, with the only isolation of *Leptospira* being from blood. It is possible that dogs in Australia do not have a role as maintenance hosts, or that local serovars are not yet canine-adapted. More detailed investigations into clinical aspects of each case and its sources of infection will further enhance our understanding of the health impact of the disease, indicate improvements to management of the patient in our hospital and medical systems, and assist in the implementation of effective control and preventative measures.

Acknowledgments

We would like to thank all the contributors for their time and assistance in sending out the questionnaires and collection of these data. Some of these are the Queensland Public Health Units, Monash University (Victoria), Westmead Hospital (New South Wales), PathCentre (Western Australia), Sullivan Nicolaides Pathology, and Queensland Medical Laboratory.

References

1. Emanuel ML, Mackerras I M, Smith DJW. The epidemiology of leptospirosis in North Queensland; general survey of animal hosts. *J Hyg (Camb)* 1964;62:451-484.
2. Faine S. *Leptospira* and leptospirosis . Boca Raton: CRC Press, 1994.
3. Faine S ed. Guidelines for the control of leptospirosis. Offset Publication No 67. Geneva: World Health Organization, 1982.
4. Herceg A, Oliver G, Myint Het al. Annual report of the National Notifiable Diseases Surveillance System. *Commun Dis Intell* 1996;20:440-464.
5. Minutes of the Meeting, 6-10 August 1982, Boston, Massachusetts, International Committee on Systematic Bacteriology, Subcommittee on the Taxonomy of *Leptospira. Int J Syst Bacteriol* 1984;34:258-259.