The Issue of Leptospirosis in Grenada

MW Sperling

ABSTRACT

The aim of this study was to conduct a literature and secondary data review regarding leptospirosis and its impact in Grenada. The data analysed consisted of a published secondary source of animal investigations. The results of this investigation suggested that the burden of this disease is quite substantial and significant for the population of Grenada, as well as its global visitors. An examination into the literature related to public health policies and practices that could be suited to a developing nation like Grenada was then conducted. Recommendations were made regarding these analysed public health programmes revolving around surveillance, vector control, sanitation and education.

Keywords: Grenada, leptospirosis, public health

El Problema de la Leptospirosis en Granada

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RESUMEN

El objetivo de este estudio fue realizar una revisión de la literatura y los datos secundarios sobre la leptospirosis y su impacto en Granada. Los datos analizados consistieron en una fuente secundaria publicada de investigaciones en animales. Los resultados de esta investigación sugieren que la carga de morbilidad es sustancialmente importante y significativa para la población de Granada, así como para sus visitantes internacionales. Se llevó a cabo entonces un examen de la literatura relacionada con las políticas y prácticas de la salud pública que podrían ser adecuadas a una nación en vías de desarrollo como Granada. Se hicieron recomendaciones en relación con estos programas de salud pública, que giran en torno a vigilancia, control de vectores, saneamiento y educación.

Palabras claves: Granada, leptospirosis, salud pública

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INTRODUCTION

Leptospirosis has emerged as the most common bacterial zoonosis in the world. Although the bacteria itself is primarily found in the developing countries of tropical and subtropical climates, infection rates have been steadily increasing amongst developed nations as well. A major reason for this has been attributed to the recent explosion in international tourism (1). Infections in developed countries arise chiefly from occupational exposure, global travel, recreational undertakings, or importation of domestic and wild animals. Outbreaks in developing countries are mostly attributed to normal daily activities, poor sanitation, overcrowding and climactic conditions (2).

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Leptospirosis is caused by bacteria from the genus *Leptospira*. These bacteria are characterized as tightly coiled spirochaetes that are extremely motile. Although primarily found within a mammalian host, many of these serovars are capable of existing without one. Once inside the body, leptospires spread haematogenously and multiply at a growth rate which is equivalent to a generation time of roughly six to eight hours. Growth of the bacteria inside the host will continue until high concentrations of leptospires become present in the blood, liver, kidney, lung, brain, adrenals and even the eye in some cases (3). It is during this time that clinical illness becomes evident. The disease itself can initially presents itself with mild symptoms such as fever, chills and headache (4). If recognized and treated early, it can be managed with little consequence. However, failure to make a proper diagnosis can allow the bacteria to manifest more severe symptoms such as: hepatic failure, renal failure, pulmonary haemorrhage, myocarditis and meningoencephalitis (5).

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As of 2011, the global burden of leptospirosis was between 350 000 and 500 000 severe cases reported annually (3). These figures do not account for the mild cases of infection that many experts believe to be comparable to the global burden of dengue. Many of the "hot spots" for leptospirosis are located within the Caribbean region. Each of these island nations contains its own serovars which are closely linked with the animal and environmental biodiversity (5). Tourism in this area of the world has always been quite high and can be directly linked to this overall rise in global distribution of the disease. In both developing and developed countries, leptospirosis is often poorly recognized and overlooked. This is because of the wide range of symptoms that many patients is presented with, as well as the absence of reliable epidemiological data (5).

These circumstances are true of Grenada, which contains its own unique circulating serovars (6). From a public health perspective, it is important that an accurate estimation of the different vectors and dynamics responsible for the bacteria's harborage be identified. As of 2009, there were approximately 200 different serologic variants of the disease with varying reservoirs (1). *Leptospira* are primarily spread through either direct contact or contact with the urine of infected animals. This can occur through contact with water, soil, or even food that has been contaminated with infected urine. Various wild and domestic animal species have been identified as hosts of leptospirosis, and are able to maintain the leptospires in their kidneys to become chronic carriers. The type of mammal can vary depending on what region of the world, one is in. In Hong Kong, where leptospirosis infection has recently seen an increase in prevalence, the most common infected small animals are mice, rats, dogs and bats (6). The most common types of animals that harbour this spirochaete in the Caribbean region are cattle, pigs, horses, dogs and various rodents. There has also been recent evidence suggesting the possibility of bats being a significant vector for infection as well (7). A difficult aspect of this disease is that many of these animals that are carriers do not exhibit any symptoms (8).

The environmental conditions found in the tropics favour the survival and transmission of leptospirosis from animal to human (9). When a leptospiral contamination is accurately diagnosed, the bacteria can best be treated with antibiotics such as doxycycline and penicillin. Early diagnosis and treatment are extremely important to avoid the manifestation of more acute symptoms which can develop in approximately two to three days. These characteristics demonstrate the importance of accurately assessing the variance, distribution and prevalence of the disease in tropical climate nations such as Grenada.

Grenada's Ministry of Health has undertaken several efforts to help curb the risk of leptospirosis infection. The vectors most associated with infection include various micromammals such as the Grenadian mongoose, bats, amphibians, pigs, goats and chickens (6). In 2008, the Vector Control Division of the Ministry of Health conducted an investigation into the number of leptospirosis cases within numerous species of dog. As a result, an initiative was enacted in 2009 to implement and enforce the Dog Registration and Control Act. These efforts were able to get 4481 stray dogs off of the streets to help curb the public health impact of not just leptospirosis, but rabies and other vector-borne zoonosis as well (10). These studies and developments demonstrate the substantial degree of concern within Grenada pertaining to leptospirosis.

The purpose of this study was to assess the risk of leptospirosis and recommend a number of public health interventions that could be suited to Grenada. An assessment regarding the epidemiological risk of infection in terms of vector seroprevalence was conducted. A literature review into various public health interventions which were successful in reducing the threat of leptospirosis in other nations throughout the globe was then carried out. Several of these interventions were recommended for Grenada based on their overall success and use of limited resources with maximum results.

METHODS

Data were collected from a secondary source involving a study conducted by Keenan *et al* regarding the percentages of serologically positive rat species located within each parish of Grenada (11). The results from this study were used to identify which areas of Grenada had the highest percentage of serologically positive vectors, as well as the overall serological prevalence.

Study population

The population of animals included adult rats of the *R norvegicus* species that were found to be infected with leptospirosis. Data came from a secondary source of published studies conducted by Keenan *et al* which took place between April 23, 2005 and October 2006 (11). Two hundred and sixty-one rats were trapped from both urban and rural areas, representing each of the six parishes of Grenada. Sera were sent to the Leptospira Laboratory in Barbados, West Indies, for anti-*Leptospira* antibody detection. The Leptospira Laboratory interpreted a microscopic agglutination test (MAT) titre of ≥ 100 and an immunoglobulin G (IgG) enzyme-linked immunosorbent assay (ELISA) titre of ≥ 160 as positive. A positive sample was determined to be one that was positive by MAT, ELISA or both.

Data management

Percentages within a 95% confidence interval regarding the number of serologically positive rats captured within each parish were calculated. These percentages were then placed in a table to demonstrate which parishes had the highest percentage of rats infected with leptospirosis. The overall serological prevalence of all the rats was also determined (Table).

Table: *Leptospira* seroprevalence in *R norvegicus* rats in Grenada by parish, as determined by MAT titres of 1:100 or greater or IgG ELISA titres of 1:160 or greater

	Positive	Negative	Total tested	Per cent positive	Per cent positive 95% CI
St Patrick*	12	5	17	70.59	46.52, 86.66
St John	14	17	31	45.16	29.09, 62.34
St Mark	11	24	35	31.43	18.56, 48.11
St Andrew	10	24	34	29.41	16.85, 46.30
St George	7	32	39	17.95	9.05, 32.78
St David*	10	71	81	12.35	6.89, 21.29
Total	**64**	**173**	**237**	**27.00**	**21.76, 33.00**

Source: (11)
*Seroprevalence rate differs statistically from the rest of the parishes as a group.
MAT: microscopic agglutination test; IgG: immunoglobulin G; ELISA: enzyme-linked immunosorbent assay

RESULTS

Of the total number of rats captured, twenty-four of them were unable to be tested due to insufficient serum sample. Of the remaining 237 samples, 179 were tested by both MAT and IgG ELISA; four were tested by only the MAT and 54 were tested by only ELISA. Sixty-four of the serum samples were positive by either MAT or ELISA, for an overall seroprevalence rate of 27%. The ELISA test identified 24.5% (57/233) of rats positive at dilutions of 1:160 or greater. The MAT identified 7.1% (13/183) of the rats positive at a dilution of 1:100 or greater. Of the 179 rats tested by both methods, six were positive by both, six by MAT only and 34 by ELISA only (11).

The results of this investigation showed that the parish of St John contained the highest total number of seropositive rats (14 out of 31) while St Patrick had the highest percentage (70.59%). The parish of St George was found to have the lowest absolute number of seropositive rats (7 out of 39) and St David was found to have the lowest percentage [12.35%] (11).

DISCUSSION

In a developing country such as Grenada, public health prevention strategies play a critical role in helping to keep people safe from infectious disease. The results of the investigation conducted by Keenan *et al*, as well as review of the literature on *Leptospira* contraction demonstrate a clear threat of leptospirosis in Grenada, with varying degrees of risk amongst the different parishes. These data also present a blueprint for how the nation can take steps to help decrease this threat.

Data concerning the percentage of serologically positive vectors is an effective tool by which disease exposure can begin to be curtailed through the implementation of an effective surveillance system. However, a functional disease surveillance system with appropriate laboratory support is often lacking in endemic countries (2). Support and resources for epidemiological surveillance can be acquired in collaboration with the World Health Organization Collaborating Centre for Leptospirosis in Rio De Janiero. This institute is involved in contributing assistance to the Pan American Health Organization/World Health Organization (PAHO/WHO) regional laboratories. This includes training courses, research activities and providing diagnostic services to help meet the needs of the network of public health laboratories of countries in the region (12). Strong records of epidemiological data such as incidence and prevalence, as well as population based trends are vital to public health prevention of leptospiral infection.

Researchers have also identified social control involving risk communications, improvement in sanitation and living conditions, rodent control, and both prophylactic and therapeutic medical and veterinary interventions as being critical components of public health (2). Approaches that address these risk factors include increased awareness, health promotion, health education, advocacy and capacity building. For example, leptospirosis has traditionally been considered an occupational disease. Social control measures that target agriculture and other at-risk workers are therefore critical. These include such things as the requirement of wearing trousers or long skirts. In Japan, the amount of agricultural related deaths from leptospirosis infection dropped from 200 per year in 1960 to less than 20 per year today. Many attribute this to the requirement to wear rubber boots in agricultural related work (2). In New Zealand, a strong education campaign was conducted in conjunction with immunizing cattle. Both of these concurrently were successful in reducing the incidence of leptospirosis (2). Similar occupational-oriented campaigns could be successfully implemented in Grenada with special emphasis being placed in the parishes of St John and St Patrick.

In areas of Grenada with high levels of poverty, environmental sources of transmission include such things as open refuse deposits, animal reservoirs, flooding and open sewers; infection is thus associated with exposure in and around the household (2). Health education campaigns that target the household occupants as well as advocacy on the social determinants of health and concrete actions to reduce health inequity can be implemented to reduce leptospirosis incidence

(2). Awareness and education are essential among the administrative, educational, and health professional levels within the fields of human and veterinary medicine.

Keenan *et al* demonstrated that rodents were a substantial source of infection within Grenada. Vector control activities must consider the epidemiological implications, ecology and dynamic population of the rodents. In India, the timing of rodent control was shown to be a vital consideration in the prevention of disease transmission. The rodent breeding period begins with the southwest monsoon and rodent control measures in the pre-monsoon period brought about more effective vector control results (2). A policy moulded after this one could help Grenada attain maximum results with limited resources by ecologically targeting a specific vector.

Programmes of animal vaccination and chemoprophylaxis with doxycycline were determined to be ineffective for Grenada. Chemoprophylaxis only provides a short window of protection while a campaign to vaccinate domestic and wild animal species would cost too much in terms of resources to successfully implement. Programmes aimed at vector control, education, awareness and assisted-epidemiological surveillance would be best suited for a developing nation such as Grenada to address the threat of leptospirosis infection. These interventions will help to get the maximum amount of results while utilizing a minimum amount of resources which is a reality that must be taken into account when discussing public health in developing nations.

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REFERENCES

1. Lau C, Smythe L, Weinstein P. Leptospirosis: an emerging disease in travellers. Travel Med Infect Dis 2010; **8:** 33–9.
2. Victoriano AFB, Smythe LD, Gloriani-Barzaga N, Cavinta LL, Kasai T, Limpakarnjanarat K et al. Leptospirosis in the Asia Pacific region. BMC Infect Dis 2009; **9:** 147.
3. Faine S. Guidelines for the control of leptospirosis. Geneva: World Health Organization; 1982.
4. Verma A, Stevenson B. Leptospiral uveitis – there is more to it than meets the eye! Zoonoses Public Health 2012; **59 (Suppl 2):** 132–41.
5. Hartskeerl RA, Collares-Pereira M, Ellis WA. Emergence, control and re-emerging leptospirosis: dynamics of infection in the changing world. Clin Microbiol Infect 2011; **17:** 494–501.
6. Desvars A, Cardinale E, Michault A. Animal leptospirosis in small tropical areas. Epidemiol Infect 2011; **139:** 167–88.
7. Lam HY, Kan PG. A re-emerging ancient disease: a case report. Hon Kong J Emerg Med 2005; **12:** 237–41. Available from: http://www.hkcem.com/html/publications/Journal/2005-4/p237-241.pdf
8. Vashi NA, Reddy P, Wayne DB, Sabin B. Bat-associated leptospirosis. J Gen Intern Med 2010; **25:** 162–4.
9. Centers for Disease Control and Prevention [Internet]. Leptospirosis. Atlanta, GA: CDC [rev. 2012 Jan 13; cited 2013 Jul]. Available from: http://www.cdc.gov/leptospirosis/infection/index.html
10. Ministry of Health, Grenada. Leptospirosis and rabies investigation. St George's: Ministry of Health; 2012**:** 4–9.
11. Keenan J, Sharma R, Dicker R, Rayner J, Stone D. Seroprevalence of *Leptospira* in *Rattus norvegicus* in Grenada, West Indies. West Indian Med J 2009; **58:** 114–7.
12. World Health Organization [Internet]. WHO Collaborating Centre for Leptospirosis. Geneva, Switzerland; (rev. 2008 Mar 25; cited 2013 May). Available from: http://apps.who.int/whocc/Detail.aspx?cc_ref=BRA-65&cc_title=leptospirosis.