

Surveillance for leptospirosis in the Americas, 1996–2005: a review of data from ministries of health

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ABSTRACT

Objective. To characterize current leptospirosis reporting practices in the Americas.

Methods. Information was collected from the official websites of national ministries of health from the Americas region and two international organizations; personal communications; and three international morbidity databases. For all sources other than the morbidity databases, the review was limited to official reports citing clinically suspected and laboratory confirmed leptospirosis cases or deaths during the period 1996–2005.

Results. A total of 73 out of 1 644 reports met the selection criteria and were included in the analysis. Published leptospirosis data were available from half of the countries/sovereign territories (24 out of 48), and 18 of them had mandatory notification policies for leptospirosis. The sum of the median number of leptospirosis cases notified annually by the 24 countries/territories was 4 713.5, but just three countries (Brazil, Costa Rica, and Cuba) accounted for 83.1% (3 920 cases) of the notifications. Eight (16.7%) countries reported deaths due to leptospirosis. The sum of the median number of deaths reported annually for the eight countries was 380, but 349 (91.8%) were reported by Brazil.

Conclusions. Notification practices in the Americas for leptospirosis are limited. Therefore, the numbers of cases and deaths reported are not representative for the region. The lack of leptospirosis data for many countries/territories may reflect weaknesses in certain aspects of national surveillance systems, including mandatory reporting policies, clinical laboratory infrastructure for performing case confirmation, and capacity to collect reported cases. Improved surveillance of leptospirosis cases and deaths in the Americas is needed to allow monitoring of regional epidemiological patterns and to estimate the burden of this important disease.

Key words

Leptospirosis; epidemiologic surveillance; disease notification; review; Americas.

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Leptospirosis is a globally important zoonotic disease caused by pathogenic spirochetes of the genus *Leptospira* (1). Leptospire have been serologically classified based on antigenic determinants into more than 230 serovars. More recent studies based on DNA relatedness have classified *Leptospira* into at least 17 species (1–4). *L. interrogans* can infect both wild and domestic animals. The most

common sources for human infection in the Americas are rodents, dogs, livestock, and wild mammals (5). Indirect contact with infected animals, via water or soil contaminated with infected urine, is a more common source for human infection than direct contact with infected animals (6, 7). Leptospire can survive for weeks or months in the environment under favorable conditions, such as tem-

peratures of 28°C to 32°C and a neutral or slightly alkaline pH (8). Severe disease causes multisystem complications such as acute renal failure and pulmonary hemorrhage, and the overall case fatality varies from 5% to 15% (6, 8).

Global incidence of leptospirosis is still not well known (9), but estimates indicate approximately 320 000 annual cases of leptospirosis worldwide (10, 11). There are no estimates of the annual number of leptospirosis cases for the Americas region overall. National ministries of health (MoHs) are the most common source of data for generating regional estimates for leptospirosis and other diseases (5, 12). The surveillance systems for each country/territory cover large and heterogeneous geographic areas. The effectiveness of surveillance is often limited by weaknesses in various aspects of the system, including mandatory reporting policies, clinical laboratory infrastructure for performing case confirmation, and surveillance mechanisms for collecting reported cases. Additional challenges in the case of leptospirosis include 1) difficulties in recognizing the disease due to its often undifferentiated clinical presentation, and 2) the challenging technical requirements of its laboratory confirmation (13).

Despite their limitations, national surveillance systems provide useful data about leptospirosis incidence trends, aid in outbreak identification, and support government interventions. However, the Americas region is particularly challenging in terms of leptospirosis epidemiology due to the wide diversity of environmental, socioeconomic, and cultural conditions. Within this context, reviewing surveillance systems and case notification practices used in different countries/territories in the Americas can help 1) identify information deficits and inconsistent data within sub-regions, and 2) define strategies for better measurements of the burden of disease. The aim of this study was to characterize data on leptospirosis incidence and mortality in the Americas collected and reported by MoHs and international morbidity databases.

MATERIALS AND METHODS

Search strategy

Two different search strategies were used to locate leptospirosis surveillance data for the Americas region: 1) review

of national MoH and international organization websites, and 2) review of international morbidity databases.

Review of MoH/international organization websites. From 15 to 31 August 2007, an Internet search was conducted using the key words "Ministry of Health" and "[country/sovereign territory name]" to identify the official MoH website for each country/territory in the Americas. For territories, the MoH website of either the territory or the mother country was used. When available, the "search" function of the official MoH websites was used to locate published surveillance information by searching on the key words "surveillance," "epidemiological service," "statistics," and "publications," and selecting all bulletins and reports on notifiable diseases published from 1 January 1996 to 31 December 2005. An additional search was then conducted on the key words "*Leptospira*" and "leptospirosis." The websites of the Pan American Health Organization (PAHO) (www.paho.org) and the Caribbean Epidemiology Centre (CAREC) (www.carec.net) were also searched to locate information on leptospirosis provided by MoHs in the Americas region. Finally, the MoH of each country/territory in the region was contacted via e-mail and asked for information on leptospirosis suspected cases, confirmed cases, and deaths. In their e-mail, the authors also asked if leptospirosis was a disease of mandatory notification. All bulletins and reports published within the 1 January 1996 to 31 December 2005 time frame were downloaded and stored in folders by country/territory.

Review of international morbidity databases. The authors located and obtained three major databases for leptospirosis: the World Organisation for Animal Health (*Office International des Epizooties*, OIE, www.oie.int) database; the CAREC database (provided by E. Boisson); and LeptoNet (www.leptonet.net).

Selection criteria

Bulletins and reports from the websites of MoHs and international organizations were reviewed and included in the study if they met all of the following criteria: 1) reported clinically suspected or laboratory-confirmed leptospirosis cases or deaths, 2) reported information stratified by year, and 3) reported informa-

tion for the entire unit of geographical evaluation (country/sovereign territory). The following reports/bulletins were excluded from the analysis: 1) those that only covered non-human animals (e.g., wildlife); 2) those on general leptospirosis issues, such as diagnostic methodologies or genomic, microbiologic, or molecular techniques; and 3) those with duplicated information from the same source. The inclusion and exclusion criteria were not applied to the material from the international morbidity databases.

Data extraction and descriptive analysis

Data about the data source (organization/institution), country/territory, study period, and number of clinically suspected and laboratory-confirmed leptospirosis cases and deaths were extracted and entered into an Excel database. For each country/territory in the Americas, a summary statistic was calculated for annual median number of cases and deaths. Median number of cases and deaths were then summed to obtain sub-regional and regional total number of cases. Case fatality was estimated when information on cases and deaths, reported by the MoH, was available. Population data were based on calculations for the year 2000 from the United Nations Population Division (<http://esa.un.org/unpd/wpp/Excel-Data/population.htm>). Pearson correlation coefficients were used as measures of the strength of the linear relationship between numbers of cases from two different surveillance systems. Correlation analyses were performed using Epi Info™ for Windows software (Centers for Disease Control and Prevention, Atlanta, GA, USA).

RESULTS

The above-mentioned search strategies identified 1 644 reports published during the 10-year period between 1 January 1996 and 31 December 2005. Of those 1 644 reports, 1 350 (82.1%) were obtained from MoH websites, 257 (15.6%) from the PAHO website, 32 (1.9%) from the CAREC website, 5 (< 1.0%) from personal communication, and 2 (< 1.0%) from the international morbidity databases (one each from the OIE database and LeptoNet). Other than the data obtained from the morbidity databases, all information retrieved for review was evaluated ac-

TABLE 1. Median annual number of confirmed leptospirosis cases reported by Ministry of Health official websites, first year of mandatory reporting, period of available information, and data source, by country/territory, Americas region, 1996–2005

| Region and country/territory | Population (in 000s) ^a | Median annual no. of cases (range) | Mandatory reporting (initial year) | Period of available information | Case data source (references) |
|--------------------------------|-----------------------------------|------------------------------------|------------------------------------|---------------------------------|-------------------------------|
| Caribbean | | | | | |
| Anguilla | 11 | 0.0 | Yes (... ^b) | 1996–2005 | (14) |
| Antigua and Barbuda | 77 | ... | ... | — ^c | — |
| Aruba | 91 | ... | ... | — | — |
| Bahamas | 305 | ... | ... | — | — |
| Barbados | 252 | 19.0 (10–31) | ... | 1996, 2000–2005 | (15, 16) |
| Bermuda | 63 | ... | ... | — | — |
| British Virgin Islands | 21 | ... | ... | — | — |
| Cayman Islands | 40 | ... | ... | — | — |
| Cuba | 11 087 | 558.5 (305–1 449) | Yes (...) | 1996–2005 | (17) |
| Dominica | 68 | ... | ... | — | — |
| Dominican Republic | 8 830 | 18.5 (18–19) | Yes (1998) | 2001–2002 | (18–20) |
| Grenada | 101 | ... | ... | — | — |
| Guadeloupe | 429 | 50.0 (10–140) | Yes (...) | 1996–2005 | (21–30) |
| Haiti | 8 648 | ... | ... | — | — |
| Jamaica | 2 568 | ... | ... | — | — |
| Martinique | 385 | 54.5 (34–78) | Yes (...) | 1996–2005 | (21–30) |
| Montserrat | 5 | ... | ... | — | — |
| Netherlands Antilles | 181 | ... | ... | — | — |
| Puerto Rico | 3 819 | ... | ... | — | — |
| St. Kitts and Nevis | 46 | ... | ... | — | — |
| St. Lucia | 157 | 0.0 (0–2) | Yes (...) | 1996–2005 | (31) |
| St. Vincent and the Grenadines | 108 | 4.5 (3–6) | Yes (...) | 2003–2004 | (32) |
| Trinidad and Tobago | 1 295 | ... | ... | — | — |
| Turks and Caicos Islands | 19 | ... | ... | — | — |
| U.S. Virgin Islands | 109 | ... | ... | — | — |
| Central America | | | | | |
| Belize | 252 | ... | ... | — | — |
| Costa Rica | 3 931 | 196.0 (13–357) | Yes (...) | 1996–2005 | (33, 34) |
| El Salvador | 5 945 | 40.0 (40) | Yes (1988) | 1999 | (35, 36) |
| Guatemala | 11 231 | 13.0 (5–41) | Yes (2005) | 2003–2005 | (37–39) |
| Honduras | 6 230 | ... | ... | — | — |
| Nicaragua | 5 101 | 14.0 (2–73) | Yes (...) | 2002–2005 | (40) |
| Panama | 2 951 | 0.0 (0–1) | Yes (2001) | 2000–2002 | (41–43) |
| North America | | | | | |
| Canada | 30 687 | ... | No | — | — |
| Mexico | 99 531 | 65.5 (40–145) | Yes (...) | 2000–2005 | (44–49) |
| United States | 287 842 | ... | No | — | — |
| South America | | | | | |
| Argentina | 36 939 | 131.0 (14–377) | Yes (1960) | 1996–2005 | (50–54) |
| Bolivia | 8 317 | ... | No | — | (55) |
| Brazil | 147 174 | 3 165.5 (2 433–5 579) | Yes (1985) | 1996–2005 | (56, 57) |
| Chile | 15 419 | 24.0 (18–33) | Yes (2002) | 2002–2005 | (58, 59) |
| Colombia | 39 773 | 30.5 (15–43) | No | 1997–2000 | (60, 61) |
| Ecuador | 12 310 | 61.0 (1–398) | ... | 1996–2005 | (62, 63) |
| French Guiana | 165 | 11.0 (6–18) | ... | 1998–2005 | (21–30) |
| Guyana | 756 | ... | ... | — | — |
| Paraguay | 5 350 | 5.5 (4–6) | No | 1999–2002 | (64) |
| Peru | 26 004 | 102.0 (77–390) | No | 1998–2004 | (65) |
| Suriname | 467 | ... | ... | — | — |
| Uruguay | 3 321 | 53.5 (8–184) | Yes (2004) | 1998–2001, 2003, 2005 | (66–68) |
| Venezuela | 24 408 | 96.0 (16–239) | Yes (2004–2005) | 1996–1998, 2004–2005 | (69–71) |

^a Data obtained from United Nations (<http://esa.un.org/unpd/wpp/Excel-Data/population.htm>).

^b Data not available.

^c Not applicable.

cording to the above-mentioned inclusion criteria. A total of 73 reports (4.4%) met the inclusion criteria and were considered in the study.

Half of the countries/territories in the Americas (24 out of 48) reported confirmed leptospirosis cases for at least one year during the study period (Table 1).

Clinically suspected cases were reported by only seven countries (14.6%) and were not included in further analysis. There was no observed increase in the number of countries/territories reporting leptospirosis during the study period, and only 11 (45.8%) of the 24 countries/territories with available information reported

cases during the period 2001–2005. Only 18 (75.0%) of the 24 countries/territories that had available information for the study period had confirmed mandatory notification policies. In South America, 10 of 13 (76.9%) countries/territories reported information on leptospirosis. Data were not found for Bolivia, Guyana, or

Suriname. Of the 10 South American countries/territories reporting data, three of them (Argentina, Brazil, and Ecuador) reported leptospirosis cases regularly every year from 1996 to 2005. Five South American countries had confirmed mandatory notification for leptospirosis (Argentina, Brazil, Chile, Uruguay, and Venezuela). In Central America, 5 out of the 7 (71.4%) countries had available information. Within that sub-region, Costa Rica was the only country that reported leptospirosis regularly from 1996 to 2005, and one of five (along with El Salvador, Guatemala, Nicaragua, and Panama) with confirmed mandatory notification for the disease. In the Caribbean, only 8 out of the 25 countries/territories (32.0%) reported data on leptospirosis (Anguilla, Barbados, Cuba, Dominican Republic, Guadeloupe, Martinique, St. Lucia, and St. Vincent and the Grenadines). Of those eight countries/territories, all but Barbados had confirmed mandatory notification policies, but only Anguilla, Cuba, Guadeloupe, and Martinique reported leptospirosis cases for the entire study period (1996–2005). Mexico was the only country in North America that reported data during the study period (providing information for the years 2000–2005) and the only one in the sub-region with mandatory notification for the disease.

The total median number of leptospirosis cases reported annually by MoHs in the Americas during the study period was 4 713.5. South America reported an annual median of 3 680 cases (78.1% of the total number of cases for the region), followed by the Caribbean, which reported 705 cases (14.9% of the regional total). In Central America, an annual median of 263 cases was reported. The North American countries (among which Mexico was the only one reporting cases) reported 65.5 cases (1.4% of the regional total). Reporting varied widely between countries/territories within sub-regions. For example, Brazil reported 3 165.5 cases or 86% of all cases reported for South America (a total of 3 680). In Central America, Costa Rica was responsible for 196 out of 263 cases or 74.5% of all notifications for the sub-region. Cuba reported 558.5 out of 705 cases or 79.2% of all cases reported by the Caribbean sub-region.

Information from the national MoHs was compared with data from the international institutions and the morbidity databases (Table 2). OIE reported lepto-

TABLE 2. Median annual number of confirmed leptospirosis cases, notification source, number of years with available data, and data source, by country/territory, Americas region, 1996–2005

| Region and country/territory | Median annual no. of cases (range) | Notification source | No. of years with available data | Data source (references) |
|--------------------------------|------------------------------------|---------------------|----------------------------------|--------------------------|
| Caribbean | | | | |
| Anguilla | 0.0 | MoH ^a | 10 | (14) |
| | 0.0 | CAREC ^b | 1 | (72) |
| Antigua and Barbuda | 0.0 | OIE ^c | 3 | (73) |
| Aruba | ... ^d | — ^e | — | — |
| Bahamas | 0.0 (0–4) | OIE | 5 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| Barbados | 19.0 (10–31) | MoH | 6 | (15, 16) |
| | 28.0 (23–28) | OIE | 3 | (73) |
| | 31.0 (31) | PAHO ^f | 1 | (74) |
| | 0.0 | CAREC | 1 | (72) |
| Bermuda | 0.0 | OIE | 2 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| British Virgin Islands | 0.5 (0–1) | OIE | 2 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| Cayman Islands | 0.0 | CAREC | 1 | (72) |
| Cuba | 558.5 (305–1 449) | MoH | 10 | (17) |
| | 553.0 (281–1 442) | OIE | 9 | (73) |
| Dominica | 0.0 | OIE | 2 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| Dominican Republic | 18.5 (18–19) | MoH | 2 | (18, 19) |
| | 239.0 (239) | PAHO | 1 | (75) |
| | 37.0 (10–114) | OIE | 9 | (73) |
| Grenada | 8.0 (8) | OIE | 1 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| Guadeloupe | 50.0 (10–140) | MoH | 10 | (21–30) |
| | 68.5 (0–141) | OIE | 8 | (73) |
| Haiti | 0.0 | OIE | 1 | (73) |
| Jamaica | 404.5 (124–693) | OIE | 4 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| Martinique | 54.5 (34–78) | MoH | 10 | (21–30) |
| | 0.0 | OIE | 1 | (73) |
| Montserrat | 0.0 | CAREC | 1 | (72) |
| Netherlands Antilles | 0.0 | OIE | 1 | (73) |
| Puerto Rico | ... | — | — | — |
| St. Kitts and Nevis | 0.0 | OIE | 4 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| St. Lucia | 0.0 (0–2) | MoH | 8 | (73) |
| | 1.0 (1) | CAREC | 1 | (72) |
| St. Vincent and the Grenadines | 4.5 (3–6) | MoH | 2 | (32) |
| | 10.0 (2–11) | OIE | 3 | (73) |
| Trinidad and Tobago | 35.0 (0–156) | OIE | 3 | (73) |
| Turks and Caicos Islands | ... | — | — | — |
| U.S. Virgin Islands | ... | — | — | — |
| Central America | | | | |
| Belize | 0.3 (0–1) | OIE | 7 | (73) |
| | 0.0 | CAREC | 1 | (72) |
| Costa Rica | 196.0 (8–300) | MoH | 9 | (33) |
| | 197.0 (0–270) | OIE | 5 | (73) |
| El Salvador | 40.0 (6–85) | MoH | 4 | (35) |
| | 20.0 (0–240) | OIE | 6 | (73) |
| Guatemala | 13.0 (5–41) | MoH | 3 | (37–39;76) |
| | 2.5 (0–14) | OIE | 4 | (73) |
| Honduras | 22.0 (17–39) | OIE | 3 | (73) |
| Nicaragua | 14.0 (0–73) | MoH | 8 | (40) |
| | 32.0 (0–67) | OIE | 4 | (73) |
| Panama | 0.0 (0–1) | MoH | 3 | (41–43) |
| | 0.0 (0–4) | OIE | 8 | (73) |
| | 1.0 (0–6) | LepN ^g | 8 | (77) |
| North America | | | | |
| Canada | 0.0 | OIE | 1 | (73) |
| | 0.0 (0–3) | LepN | 3 | (77) |

(continued)

TABLE 2. Continued

| Region and country/territory | Median annual no. of cases (range) | Notification source | No. of years with available data | Data source (references) |
|------------------------------|------------------------------------|---------------------|----------------------------------|--------------------------|
| Mexico | 65.5 (40–145) | MoH | 6 | (44–49) |
| | 40.0 (0–76) | OIE | 7 | (73) |
| | 269.0 (264–789) | LepN | 3 | (77) |
| United States | 13.0 (0–58) | OIE | 9 | (73) |
| | 48.0 (45–58) | LepN | 3 | (77) |
| South America | | | | |
| Argentina | 177.0 (30–377) | MoH | 10 | (50–53) |
| | 142.5 (7–376) | OIE | 5 | (73) |
| Bolivia | 0.0 | OIE | 3 | (73) |
| Brazil | 3 038.5 (2 433–3 638) | MoH | 8 | (56) |
| | 2 218.0 (2 042–2 394) | OIE | 2 | (73) |
| Chile | 840.0 (694–882) | LepN | 3 | (73) |
| | 24.5 (18–33) | MoH | 4 | (77) |
| | 24.0 (18–33) | OIE | 7 | (58) |
| Colombia | 5.0 (5–6) | LepN | 8 | (73) |
| | 30.5 (15–43) | MoH | 4 | (61) |
| Ecuador | 43.5 (12–162) | OIE | 5 | (73) |
| | 61.0 (1–398) | MoH | 10 | (62) |
| French Guiana | 29.0 (0–328) | OIE | 7 | (73) |
| | 11.0 (6–18) | MoH | 8 | (73) |
| Guyana | 0.0 | OIE | 4 | (21–28) |
| | 15.0 (15) | MoH | 1 | (78) |
| Paraguay | 73.0 (73) | OIE | 1 | (73) |
| | 48.0 (0–96) | CAREC | 1 | (72) |
| | 5.5 (4–6) | MoH | 4 | (64) |
| Peru | 5.0 (3–12) | OIE | 5 | (73) |
| | 102.0 (77–390) | MoH | 7 | (65) |
| Suriname | 18.0 (0–54) | OIE | 4 | (73) |
| | 159.0 (159) | OIE | 1 | (73) |
| Uruguay | 8.0 (8) | CAREC | 1 | (79, 80) |
| | 53.5 (8–184) | MoH | 6 | (66–68) |
| | 135.5 (45–233) | OIE | 4 | (73) |
| Venezuela | 24.0 (21–51) | LepN | 3 | (77) |
| | 96.0 (16–239) | MoH | 5 | (69–71) |
| | 97.0 (27–214) | OIE | 6 | (73) |

^a MoH: Ministry of Health.

^b CAREC: Caribbean Epidemiology Centre.

^c OIE: World Organisation for Animal Health (<http://web.oie.int/hs2/report.asp?lang=en>).

^d Data not available.

^e Not applicable.

^f PAHO: Pan American Health Organization.

^g LepN: LeptoNet (www.leptonet.net).

spirosis cases for 40 countries/territories in the Americas, CAREC reported cases for 15 (only within the Caribbean), LepNet reported cases for 7, and PAHO reported cases for 2. For 23 countries/territories, information was available from both the national MoHs and the OIE. The total median annual number of cases reported for those 23 countries/territories was 4 648.5 and 3 773.6 respectively. The median annual number of cases reported by the MoHs and the OIE showed strong positive correlation ($r = 0.995$). The MoHs and LeptoNet provided information for five countries/territories, and the MoHs and CAREC provided information for four. The MoHs and PAHO provided information for two countries.

Eight countries in the Americas (16.7% of all countries/territories in the region) reported leptospirosis deaths (Table 3). Five of the countries with leptospirosis death surveillance were in South America and two were in Central America. Barbados was the only Caribbean country/territory to report deaths from the disease. The total median number of deaths per year reported for the entire region was 380, but 349 of those (91.8%) were reported by just one country (Brazil). The three international databases used in the study (CAREC, LeptoNet, and OIE) did not report information about leptospirosis deaths. Barbados, Brazil, and Chile reported a high median rate of annual case fatality ($\geq 10.0\%$). Uruguay and Venezuela reported a median rate of annual case fatality of 6.1% and 9.4% respectively. In Argentina, Costa Rica, and Nicaragua, the median annual case fatality was $< 5\%$.

DISCUSSION

Despite the fact that leptospirosis is considered an emerging disease (88), this study found that case surveillance data were only available for 50.0% of the countries/territories in the Americas region; confirmation of mandatory notification policies for leptospirosis was only available from 18 (37.5%) of the countries/territories; and less than 20% of countries/territories in the region reported leptospirosis deaths. Therefore, although a number is given in this report for total median annual cases and deaths due to leptospirosis, it is not representative of the entire region due to the limited num-

TABLE 3. Leptospirosis case fatality (median annual % and number of deaths) reported by Ministry of Health official websites, period of available information, and data source, by country, Americas region, 1996–2005

| Region and country | Median annual % case fatality (range) | Median annual no. of deaths (range) | Period of available information | Data source (references) |
|--------------------|---------------------------------------|-------------------------------------|---------------------------------|--------------------------|
| Caribbean | | | | |
| Barbados | 10.0 (2–50) | 2.0 (0–19) | 1996, 2000–2005 | (15, 16) |
| Central America | | | | |
| Costa Rica | 2.1 (2–5) | 5.0 (4–7) | 2001–2004 | (81) |
| Nicaragua | 0.0 (0–3) | 1.0 (0–4) | 2002–2005 | (82–85) |
| South America | | | | |
| Argentina | 3.6 (2–7) | 4.0 (1–12) | 1996–2005 | (50–53, 86) |
| Brazil | 12.0 (7–13) | 349.0 (280–439) | 1996–2005 | (56) |
| Chile | 12.9 (0–27) | 2.0 (0–6) | 2002–2005 | (58, 87) |
| Uruguay | 6.1 (0–38) | 5.0 (0–8) | 1998–2001, 2003 | (66, 67) |
| Venezuela | 9.4 (2–73) | 12.0 (4–27) | 1996–1998, 2004–2005 | (69–71) |

ber of countries/territories with official reporting data.

Previous estimates and evaluations of leptospirosis incidence and mortality from the global literature have been based on qualitative assessment and expert opinion (5, 10). A previous calculation based on official surveillance data estimated 320 000 annual cases of leptospirosis globally, with the Americas contributing about 10% of the notified cases (~30 000 cases) (5). These estimates included a large number of cases from Brazil (> 28 000) (5), which was not consistent with historical reports from the Brazilian MoH (56). The total median annual number of deaths reported in the Americas region (380) is consistent with the number reported by the World Health Organization in 1999 (261 deaths). Case fatality reported in the region is, in general, in agreement with previous studies (89–94). The low case fatality reported in some countries (e.g., Nicaragua) suggests that there may be under-recognition or sub-notification of leptospirosis deaths.

There was substantial regional variability in reported leptospirosis cases and deaths. Regional variability is expected due to environmental heterogeneity and differences in sanitation and health care infrastructure. However, some of the observed regional variability in case reporting may be attributable to differences in surveillance methodology. The fact that > 80.0% of the cases and > 90.0% of deaths were reported by three countries/territories with a long history of national surveillance supports the hypothesis that the major source of variation was due to surveillance methodology. Substantial effort is needed to increase the geographic coverage of leptospirosis data by national MoHs in the Americas region. A large number of countries/territories, especially in the

Caribbean, report leptospirosis cases only through international organizations (72, 73). International databases such as LeptoNet and those provided by OIE and CAREC receive heterogenic information (including data from leptospirosis reference laboratories) that may only correspond to limited areas in each country/sovereign territory. It is unclear to what extent the regional data contained in these databases are representative of the entire country/territory.

Limitations

This review had some limitations that should be considered when interpreting the findings. First, most of the data used in the analysis came from websites and thus may not be replicable in future studies. For example, 16 of the 73 selected reports and bulletins analyzed in August of 2007 (21.9%) were not available online when the authors tried to retrieve them in August 2010. (Copies of all data accessed online in 2007 were stored and are available by request.) Second, variation in clinical case definitions and laboratory confirmation methodology may be potential sources of variability between countries/territories in the Americas region. Third, because laboratory diagnosis of leptospirosis is technically challenging, national systems reporting laboratory-confirmed cases may report fewer cases than those reporting only clinically suspected cases.

Recommended research

Growing trends of rapid urbanization and changing weather patterns, particularly increased heavy rainfall and flooding, are likely to lead to more frequent severe leptospirosis epidemics (88, 95, 96). In addition, increasing globalization and international travel will continue

to increase the risk of imported cases of this difficult-to-diagnose and potentially fatal disease. Therefore, further research is recommended to further characterize leptospirosis. The methodology described in this report may be useful for conducting systematic reviews to help estimate the burden of this important disease.

Conclusions

Although leptospirosis is not included as a notifiable illness in the majority of countries/territories in the Americas, it has an important impact on health in many parts of the region. However, current notification practices for leptospirosis in the region are limited. Therefore, the numbers of cases and deaths reported are not representative for the region. The lack of leptospirosis data for a large proportion of countries/territories in the Americas may reflect weaknesses in certain aspects of national surveillance systems, including mandatory reporting policies, clinical laboratory infrastructure for performing case confirmation, and the capacity to collect reported cases. Improved surveillance in the region is therefore urgently needed to strengthen capacity for early outbreak identification and accurate monitoring of regional patterns, and to estimate the regional burden of disease.

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RESUMEN

Vigilancia de la leptospirosis en la Región de las Américas, de 1996 al 2005: análisis de los datos de los ministerios de salud

Objetivo. Determinar los procedimientos actuales de notificación de la leptospirosis en la Región de las Américas.

Métodos. Se recopiló información de los sitios web oficiales de los ministerios de salud de los países de la Región de las Américas y dos organizaciones internacionales, de comunicaciones personales y de tres bases de datos internacionales de morbilidad. Con la excepción de las bases de datos de morbilidad, el análisis se limitó a los informes oficiales que citaban casos de leptospirosis, clínicamente presuntos o confirmados por el laboratorio o defunciones por esta infección, ocurridos durante el período de 1996 al 2005.

Resultados. Un total de 73 informes de los 1 644 considerados reunían los criterios de selección y se incluyeron en el análisis. Se dispuso de datos publicados sobre leptospirosis de la mitad de los países o territorios soberanos (24 de 48), 18 de los cuales contaban con políticas de notificación obligatoria de la leptospirosis. La suma de las medianas del número de casos de leptospirosis notificados anualmente por los 24 países o territorios fue de 4 713,5, pero tres países en particular (Brasil, Costa Rica y Cuba) representaban 83,1% (3 920 casos) de las notificaciones. Ocho países (16,7%) notificaron defunciones debidas a leptospirosis. La suma de las medianas del número de defunciones notificadas anualmente por los ocho países fue de 380, pero 349 (91,8%) fueron notificadas por Brasil.

Conclusiones. Los procedimientos de notificación de la leptospirosis en la Región de las Américas son limitados. Por consiguiente, los números de casos y muertes notificados no son representativos de la Región. La carencia de datos de leptospirosis de muchos países o territorios puede reflejar los puntos débiles de ciertos aspectos de los sistemas nacionales de vigilancia, incluidas las políticas de notificación obligatoria, la infraestructura de laboratorios clínicos para confirmar los casos y la capacidad para recopilar los casos notificados. Es necesario mejorar la vigilancia de los casos y las defunciones por leptospirosis en la Región de las Américas con objeto de permitir el seguimiento de los perfiles epidemiológicos regionales y calcular la carga de esta importante enfermedad.

Palabras clave

Leptospirosis; vigilancia epidemiológica; notificación de enfermedad; revisión; Américas.