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Temporal & Spatial Trends of Leptospirosis Cases in Sri Lanka

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Abstract:

Leptospirosis is most common in tropical and subtropical areas and becoming an emerging infectious disease in Sri Lanka too. Leptospirosis is a bacterial disease which is caused by bacteria of the genus Leptospira. Leptospirosis is intensified by high humidity and heavy rainfall because of widespread contamination by rodent urine in flood water. Currently flood events are being reported frequently and it is timely important to study trends of Leptospirosis cases in Sri Lanka to be considered for planning prevention and control activities.

This study aims to identify temporal and spatial trends of Leptospirosis distribution in Sri Lanka. ArcGIS 10.3 is used to map the spatial distribution of leptospirosis cases in Sri Lanka and basic statistical analysis is further applied to derive spatial and temporal trends and patterns of leptospirosis.

Accordingly leptospirosis is widely recorded in wet zonal districts including Colombo, Kalurata, Ratnapura, Kegalle, Gampaha, Matara and Galle with highlighted exception in Kurunegala and Anuradhapura despite of wet zonal districts. This study further identifies that the dry zonal districts including Moneragala, Hambanthoota and Polonnaruwa are also under the emerging threat of leptospirosis depicting further micro-geographic variation of leptospirosis other than Kurunegala and Anuradhapura. Hence these areas can also be prioritize when planning local level leptospirosis control and prevention strategies.

Keywords: Leptospirosis, GIS, temporal, spatial, trends

1. Introduction

Leptospirosis is a bacterial disease generally known as “Rat Fever” which is caused by bacteria of the genus *Leptospira* (Epidemiology unit, 2016). This bacteria is retained in the kidneys of the animals like rodents, livestock, canines and wild mammals and transmitted to humans and animals directly and indirectly in different ways (Leptospirosis fact sheet). Leptospirosis is intensified by high humidity and heavy rainfall because of widespread contamination by rodent urine in flood water. This is a widely spread zoonotic disease in the world and it is estimated that about 1.03 million annual cases and 58,999 deaths (Naotunna, C, Agampodi SB, Agampodi, TC, 2016). Leptospirosis is most common in tropical and subtropical areas and becoming an emerging infectious disease in Sri Lanka too.

Sri Lanka is considered as leptospirosis high endemic country and Agampodi, S. (2012) identifies that Leptospirosis is emerging as a major public health threat in Sri Lanka. According to the Epidemiology unit of Sri Lanka approximately 3,000-5,000 suspected cases reported each year and a Case Fatality Rate (CFR) of 1-2% in the recent past. The largest outbreak of leptospirosis in Sri Lanka is recorded in 2008 with 7423 suspected case notifications and 204 deaths. Colombo, Gampaha, Matale, Kurunegala and Kalutara districts were mainly affected by this outbreak. Most of the researches had identified that wet zone is leptospirosis endemic and annual rainfall is exceeding 2000 mm. Agampodi SB, Dahanayaka NJ, Bandaranayaka AK, Perera M, Priyankara S, et al. (2014) study on a leptospirosis outbreak in Anuradhapura which is not a leptospirosis endemic wet zonal district. They concluded that this outbreak occurred after floods in this non-endemic dry zone depicts a possible micro-geographic variation of leptospirosis.

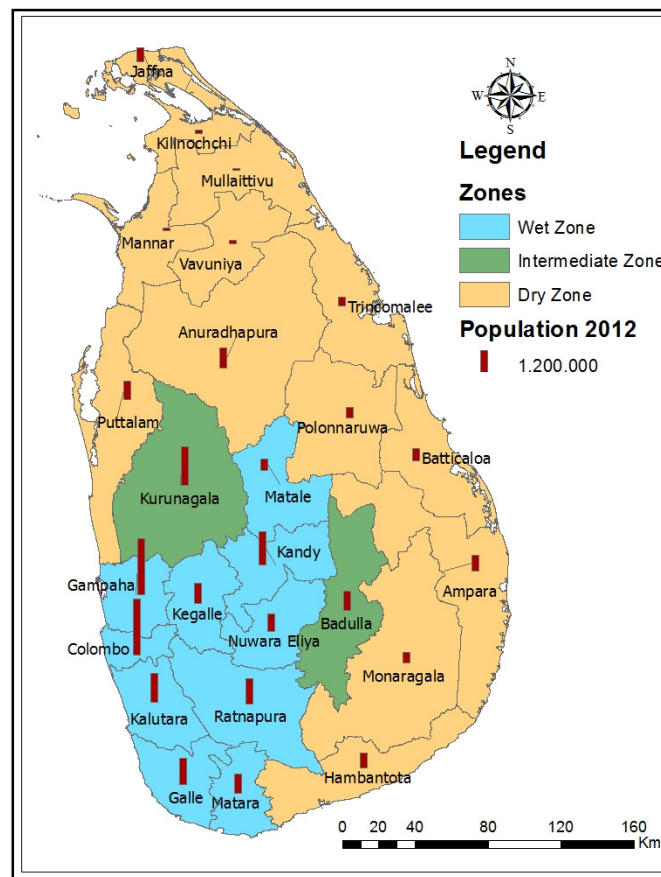


Figure 1: Study Area with Population

Knowledge gaps on disease agent, hosts and environment enabling the disease transmission in local settings are identified as limitations in Control and prevention of leptospirosis (Naotunna. C, Agampodi. SB, Agampodi. TC, 2016). WHO also identifies the necessity of analyzing leptospirosis data for deriving information in order to facilitate in control and preventive actions. Not only that currently flood events are being reported frequently which can accelerate the leptospirosis cases in the country. Hence it is timely important to study trends of Leptospirosis cases in Sri Lanka to be considered for planning prevention and control activities.

2. Objectives

Main objective is to assess spatial and temporal trends of Leptospirosis distribution in Sri Lanka. Specific objectives are,

1. Mapping spatial distribution of Leptospirosis distribution in Sri Lanka
2. Examining the temporal trends of Leptospirosis distribution in Sri Lanka

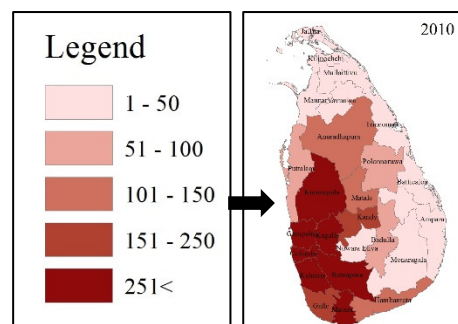


Figure 2: Sample of classification used for mapping

3. Methodology

Sri Lanka is located in the Indian Ocean between the latitudes of $5^{\circ} 55' N$ and $9^{\circ} 51' N$ and the longitudes of $79^{\circ} 41' E$ and $81^{\circ} 53' E$. Sri Lanka possesses an area of $65,610 \text{ km}^2$ (Department of Survey, 2007) which accommodated for 20.4 million people by 2012 census year. Twenty five districts are there in Sri Lanka and all 25 districts are used for this study (Figure 1).

This research is entirely based on the secondary data sources. Accordingly monthly leptospirosis incidents by districts from 2010 to 2016 was collected from the Epidemiology Unit of the Ministry of Health in Sri Lanka. Data can be retrieved from their official site, <http://www.epid.gov.lk/web/>.

ArcGIS 10.3 was used to map the spatial distribution of leptospirosis incidents in Sri Lanka. Accordingly total incidents of each year in each district was considered in mapping and number of incidents were classified manually considering the class limits as indicated in figure 2 and graduated colors were assigned. Symbology tool in ArcGIS 10.3 was used in this classification. Spatial trends were identified by visual interpretation. Furthermore Excel based basic statistics were also used in analyzing the trends of leptospirosis incidents.

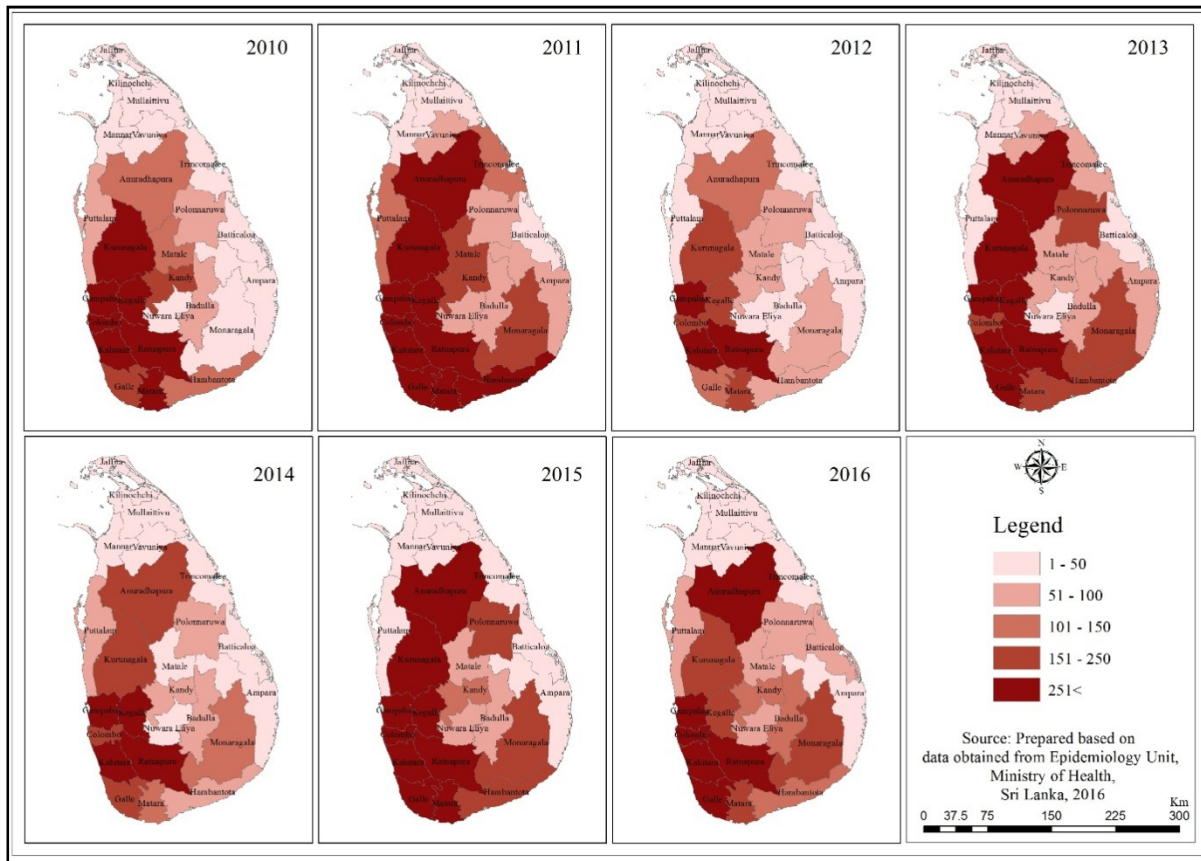


Figure 3: Spatial distribution of total leptospirosis cases recorded from 2010 to 2016

4. Results and Discussion

Total number of leptospirosis incidents in each district from 2010 to 2016 is mapped in figure 3. In 2010 wet zonal districts including Gampaha, Colombo, Kalutara, Ratnapura and Kegalle records higher number of victims whereas Kurunegala also ranking higher though it belongs to Intermediate zone. Normally leptospirosis is endemic within wet zonal districts since most favorable conditions for transmission of leptospirosis like paddy farming activities, high rainfall, and moist soil, year-round water retention in paddy fields, the use of buffalo in agriculture and peri-domestic animal farming in rural areas can be seen in common in these regions (Agampodi, SB, Dahanayaka. NJ, Bandaranayaka. AK, Perera. M, Priyankara. S, et al, 2014) But in most of the recent years it's clearly evident that the Kurunegala (Intermediate zone) and Anuradhapura (Dry Zone) highlights with higher number of leptospirosis incidents. Especially outbreaks of leptospirosis can be seen in the years including 2011, 2013, 2015 where Anuradhapura and Kurunegala also included other than the leptospirosis endemic districts. Even in 2016 though Kurunegala doesn't include in the highest range of the leptospirosis victims, Anuradhapura had recorded a higher number of victims. Considerable impact of leptospirosis can be seen in the other dry zonal districts including Moneragala and Hambantota which are located in the southern part of the country. As a whole lesser influence from leptospirosis is apparent throughout this period in dry zonal districts including Jaffna, Killinochchi, Vauniya, Mannar, Trincomalee, Batticaloa, Ampara, Putlam and Badulla. On the other hand Nuwara Eliya, Kandy and Matale records comparatively lesser number of leptospirosis incidents though they are wet zonal districts. It may be because these areas are rarely undergone flood conditions due to the inherent topographical setting of these districts.

Furthermore top ten districts affected each year by leptospirosis was identified as indicated in table 1. Accordingly other than the leptospirosis endemic districts, dry zonal districts including Anuradhapura, Moneragala and Hambantota seems emerging with higher number of leptospirosis cases (number of cases > 100).

Rank	2010	2011	2012	2013	2014	2015	2016
1	Colombo	Kurunegala	Gampaha	Gampaha	Ratnapura	Gampaha	Ratnapura
2	Gampaha	Ratnapura	Ratnapura	Kalutara	Gampaha	Kalutara	Kalutara
3	Kalutara	Gampaha	Kalutara	Ratnapura	Kalutara	Ratnapura	Galle
4	Ratnapura	Hambantota	Colombo	Kurunegala	Kegalle	A.pura	Gampaha
5	Kegalle	Colombo	Matara	A.pura	Galle	Kurunegala	Colombo
6	Kurunegala	Kalutara	Kegalle	Kegalle	Colombo	Kegalle	A.pura
7	Matara	Matara	Kurunegala	Galle	A.pura	Colombo	Matara
8	Kandy	Kegalle	Galle	Colombo	Kurunegala	Galle	Kegalle
9	Galle	***A.pura	A.pura	Moneragala	Matara	Matara	Moneragala
10	Matale	Galle	Hambantota	Polonnaruwa	Moneragala	Moneragala	Kurunegala

Table 1: Top ten Leptospirosis affected districts from 2010 to 2016
 ** Blue: Wet Zone **Green: Intermediate Zone **Yellow: Dry zone
 ***A.pura: Anuradhapura

Total number of leptospirosis cases in each year is graphed in figure 4 depicting a leptospirosis outbreak in 2011. This is the largest outbreak recorded after 2008. Fifteen districts recorded leptospirosis cases more than 100. Kurunegala was highly affected by this outbreak that 1005 cases were reported within the two months, February and March.

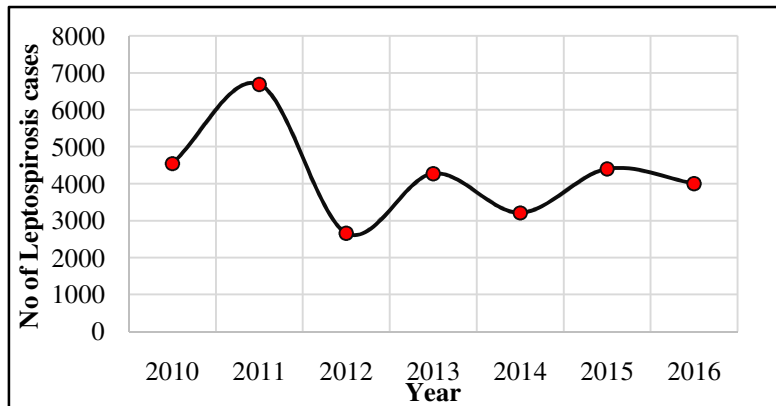


Figure 4: Total number of leptospirosis cases from 2010 to 2016

Year 2015 also considerable since 13 districts recorded leptospirosis cases more than 100 where many dry zonal districts like Anuradhapura, Hambantota and Moneragala was affected adversely. Not only had that Kandy district also recorded 135 cases which was hardly affected in other years.

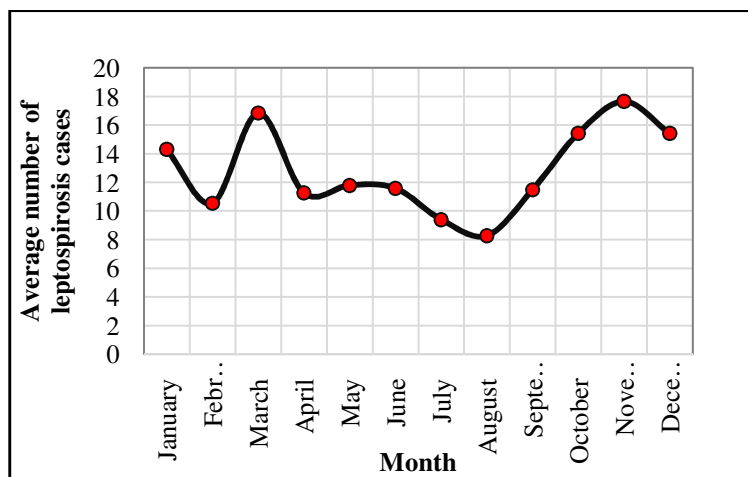


Figure 5: Monthly Average of Leptospirosis cases in Sri Lanka

Monthly average of leptospirosis cases is indicated in figure 5 in order to derive overall seasonal pattern of leptospirosis cases in Sri Lanka. Peak is recorded in March whereas this patterns seems correlated with “Yala and Maha” Seasons followed by North West Monsoon rains and North East Monsoons respectively. Among these higher influence can be seen during Maha season falls from September to March. Hence people should be made aware on these facts so as to prevent and control leptospirosis victims.

5. Conclusion/Recommendation

In conclusion this study identifies that the dry zonal districts including Moneragala, Hambanthoota and Polonnaruwa are also under the emerging threat of leptospirosis depicting further micro-geographic variation of leptospirosis other than Kurunegala and Anuradhapura. Year 2015 is important since even Kandy also affected highly by leptospirosis which is non-endemic in spite of a wet zonal district. Hence local level studies are timely important to identify the reasons for the variations of endemic spatial patterns. Furthermore it is recommended to consider longer period to rectify the seasonal changes of leptospirosis in Sri Lanka.

6. Acknowledgement

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7. References

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