

## Epidemiological Profile of Human Leptospirosis in an Urban South Indian City

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### Abstract:

**Background:** Leptospirosis is under diagnosed and under reported in India. The clinical features of leptospirosis are non-specific. Combining clinical expertise and awareness with rapid tests for diagnosis will increase the recognition of patients with leptospirosis. **Aim :**To evaluate the epidemiological risk factors for leptospirosis. **Methods:**Patients with fever admitted in a government facility hospital, North Chennai, South India, who were tested positive for leptospirosis utilizing Macroscopic Slide Agglutination Test (MSAT) titers of 2+ and above [confirmed by Microscopic Agglutination Test (MAT)] with Modified Faine's score of > 25 [Clinical (A) + Environmental (B) + Laboratory (C)] were taken up for study. These patients were evaluated for epidemiological risk factors in addition to the clinical profile. Other causes of fever were excluded with relevant investigations. This cross sectional study was undertaken from February 2006 to May 2007. **Results:** 90 patients were analyzed. There were 56 (62.2%); Males and 34(37.7%)Females. Mean Age was 37.5 years. All cases came from North Chennai. There were 86.6% outdoor manual workers, 7.7% housewives & 5.5% were students. 51 % patients came between September to December months. The important epidemiological risk factor in our study was the contact with contaminated environment. (Poor sanitation: 95.5%; walking barefoot: 85.5%; poor drainage facilities: 78.8% and contact with rodents in 33.3% cases).Fever, headache, myalgia were the common presenting features in our study. **Conclusion:** This study revealed that poor sanitation, walking bare foot, inadequate drainage facilities were the important epidemiological risk factors due to contaminated environment in acquiring leptospirosis in North Chennai. Rodents were the main animal source of contact. Rainfall was another important epidemiological risk factor.

**Key words:** leptospirosis,contaminated environment,poor sanitation,rainfall

### Introduction

Infectious disease is an important cause of morbidity and mortality in India. Leptospirosis is one of

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most widespread zoonotic infection in world today and it has long been considered a rare zoonotic disease in India with only sporadic cases being reported<sup>[1, 2]</sup>. Now, the disease has been reported from various states of India during the monsoon months in mini epidemic proportions.

Domestic animals such as cattle, dogs, pigs may act as carriers for several months (temporary carriers), while rodents usually remain as carriers throughout their life (permanent carriers) and are considered the major reservoir of infections. Leptospire are excreted in the urine of the animals and they affect human beings when they come into contact with the urine of infected animals, directly or indirectly, when

exposed to an environment contaminated by the urine of the infected animals. Therefore, the illness occurs commonly during the monsoon months. Leptospire enter the host through abrasions of the skin of the feet or intact mucous membranes of eye, throat and gut<sup>[3]</sup>.Leptospirosis can occur in both urban and rural areas. In urban areas of developing countries, contaminated environment due to various factors such as overcrowded slums, inadequate drainage and sanitation facilities for both man and animals, presence of straydogs, cattle, pigs, domestic rats, bandicoots, poor condition of slaughter houses and people walking bare foot contribute to the spread of the illness<sup>[4,5]</sup>.

In rural areas, high-risk groups are workers in rice fields, cane fields and other agricultural crops and animal husbandry staff. Workers in sewers, mines and military personnel are also at risk. Any person can be infected due to contact with the contaminated environment<sup>[4,5]</sup>.Therefore, the more important epidemiological factors are rainfall, contact with contaminated environment and animal's contact. The number of cases in a region often fluctuates from year to year due to various factors such as rainfall, flooding and animal infections. This study has been undertaken to study the epidemiological risk factors for acquiring leptospirosis in North Chennai, a large city in South India.

**Materials and Methods**

Patients, age more than 12 years admitted with fever of more than 5 days due to infectious disease who were tested positive for leptospirosis were taken up for study. These patients were evaluated for relevant epidemiological risk factors for acquiring leptospirosis. The period of study was from February 2006 to May 2007.Malaria, urinary tract infection, tuberculosis, enteric fever, viral hepatitis and other causes of fever were excluded from the study. Demographic data, occupation and address were collected. Epidemiological profile like rainfall, contact with contaminated environment and history of animal contact were collected. Contaminated environment was defined as presence of one or more of the following: drainage facilities in the house, stagnation of contaminated water around the house, contact with cattle,

Pigs, bathing in water bodies (ponds, lakes) where domestic animals are bathed, walking barefoot and inefficient garbage disposal. Clinical features like fever, headache, myalgia, jaundice, oliguria, vomiting, loose stools, altered sensorium and other relevant features were recorded.

A simple and sensitive MSAT (Macroscopic Slide Agglutination Test) titers  $\geq 2+$  was used for early detection of leptospirosis. Modified Faine's score of  $> 25$  (Clinical (A) + Environmental (B) + Laboratory (C))<sup>[5,6,7]</sup> was used in the diagnosis. All patients tested positive by MSAT were further confirmed by MAT (Microscopic Agglutination Test) with titers of  $\geq 1:80$ . MSAT is a simple screening test. This genus specific test is considered significant when the titer is 2+ and above. The sensitivity of the test was enhanced by adding locally prevalent serovars<sup>[8]</sup>. The genus specific tests are the tests of choice for the diagnosis of current infection. These tests are simple, more sensitive and become positive earlier than MAT<sup>[9,10]</sup>.Antibodies to the leptospira are detected by serological tests<sup>[3,11,12]</sup>.

**Results**

**Table 1: Age and Sex Distribution of the study population**

Age	Male	Female	Total (%)
12 – 20	12	8	20(22.2)
21 – 30	6	8	14(15.5)
31 – 40	13	9	22(24.4)
41 – 50	9	2	11(12.2)
51 – 60	9	4	13(14.4)
61 – 70	4	2	6(6.6)
71 – 80	3	1	4(4.4)
Total	56	34	90(100)

**Table 2: Occupation of the Study Population**

Occupation	Cases (%)
Labourers	71(78.8)
Farmers	7(7.7)
Housewives	7(7.7)
Students	5(5.5)

A total of 90 patients diagnosed to have leptospirosis were analyzed. There were 56 males & 34 females with mean age of 37.45 years. Age/sex group distribution data showed that maximum number of

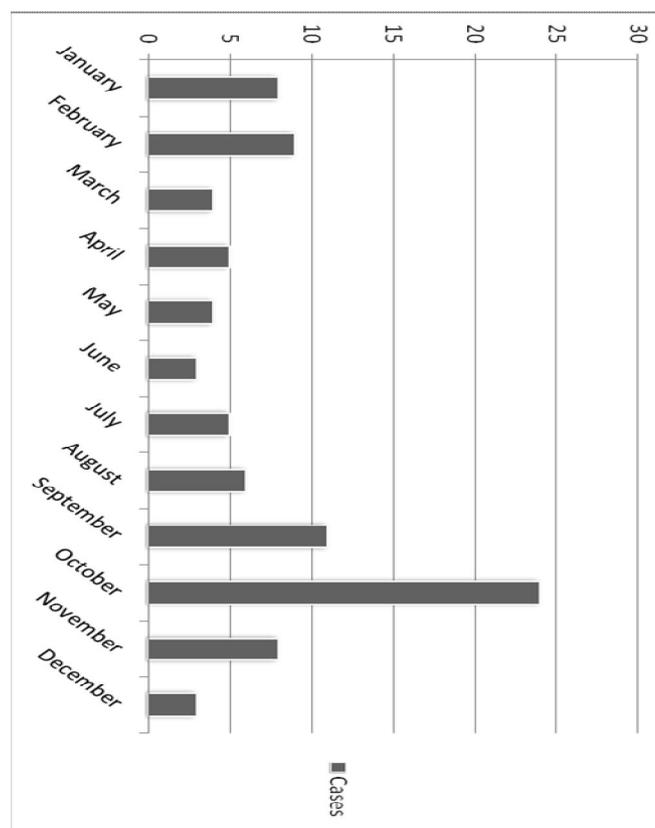
patients was seen in age group between 31 to 40 years. Among them lowest age was 13 and highest age was 74 years. As age advances, the leptospirosis incidence decreased in our study group(Table1). The maximum percentage of cases occurred in laborers (78.8%). The other patient groups were farmers (7.7%) who were outdoor manual workers, housewives (7.7%) and students (5.5%)(Table 2). In our study group, the patients came predominantly from North Chennai (South India), the area surrounding the hospital.

**Table 3: Epidemiological Risk factors in cases detected with Leptospirosis**

Epidemiology	Cases	Percentage (%)
I. Rainfall	52	57.7
II. Contact with contaminated environment	86	95.5
i) Poor sanitation (eg. inefficient garbage disposal)	86	95.5
ii) Walking barefoot	77	85.5
iii) Poor drainage facilities (eg. stagnant water)	71	78.8
iv) Recreational activities involving the contact with contaminated water	13	14.4
v) Bathing in ponds, lakes and wells	14	15.5
III. Animal contact	44	48.8
i) Rodents	30	33.3
ii) <u>Domestic animals</u>		
a. Cattle	10	11.1
b. Dogs and Cats	14	15.5
c. Pigs	10	11.1

Contact with contaminated environment occurred in 95.5% patients. History of recent rainfall within the last month of onset of fever was present in 57.7% patients, animal contact in 48.8% patients. 95.5% patients who had contact with contaminated environment came from an area where poor

**Figure1: Month wise distribution of leptospirosis**



**Figure-2: Contact with contaminated environment**



sanitation existed in the form of inefficient garbage disposal. Out of 48.8% patients who had contact with animals, 33.3% patients had history of contact with rodents and 15.5% patients had history of contact with dogs and cats (Table 3).September to November months recorded the highest number of patients(47.78%)(Figure:1). All patients had fever. Headache occurred in 94.4%, myalgia in 56.6%, jaundice in 23.3% and oliguria in 16.6% patients.

**Figure: 3 Shows interaction between epidemiological risk factors**

Epidemiology
<b>Environment</b>
(Favourable factors)
Suitable animal host
Optimum Temperature 28° – 32° C
Water – unpolluted
Non-saline
Alkaline pH
<b>Occupations at risk</b>
Agriculture, Livestock handling, Mining, Abattoirs, Poultry, fishing, conservancy workers
Laboratory/Veterinary/Military personnels
<b>Environmental pollution</b>
(contaminated water)
inadequate drainage facilities
inefficient garbage disposal
stray dogs, cattle, pigs and rodents
barefoot walking
<b>Home and leisure activities</b>
Home – family pets
leisure – swimming
hunting
boating

**Discussion**

Leptospirosis has been under diagnosed and under reported from India due to a lack of awareness of the disease and lack of appropriate laboratory diagnostic facilities in most parts of the country [1,2]. Since 1980's the disease has been reported from various states during monsoon months in mini epidemic proportions. The disease is endemic in Kerala, Tamilnadu, Gujarat, Andamans, Karnataka, Maharashtra. It has also been reported from Andhra Pradesh, Orissa, West Bengal, Uttar Pradesh, Delhi & Puducherry [13,14].

In our study middle and young age groups were commonly affected with leptospirosis than the age group >60 years (Table-1) and males predominated in our study group which was consistent with the study of C.O.R. Everard, S. Bennett et al [15]. The age group between 20 to 50 years is the economically productive period and during which period they have high chance of occurring contact with contaminated environment. This may be related to the "way of life" as well as to specific occupations [9]. Majority of patients in our study group belonged to the lower

socio economic status. Contaminated environment, poor sanitation facilities and stagnant contaminated water were prevalent in their areas. In the 90 patients of our study group, fever (100%), headache (94.4%), myalgia (56.6%) were the common clinical features noted.

Contaminated environment is due to poor environmental hygiene, which is contributed by rainfall, poor sanitation (inadequate garbage disposal which can attract rodents), poor drainage facilities (e.g. stagnant water). These factors can attract cattle, pigs, rodents and stray dogs which are potential source for infection. With all the above factors, walking in barefoot, recreational activities involving the contact with contaminated water and bathing in ponds, lakes and wells poses a potential risk, when coming in contact with stagnant water or infected soil (Figure-2). Contact with contaminated environment is most important epidemiological risk factor. In our study contact with contaminated environment occurred in 95.5% patients.

Poor sanitation facilities (eg. inefficient garbage disposal) were the (95.5%) most important epidemiological risk factor found in our study group. This is followed by history of walking barefoot in 85.5% patients, exposure to poor drainage facilities in 78.8% patients, history of bathing in contaminated water sources like in ponds/lakes/wells in 15.5% patients and in 14.4% of patients had history of recreational activities involving the contact with contaminated water (Table.3). History of recent rainfall within the previous one month of the onset of fever was present in 57.7% patients. Out of 48.8% patients who had history of animal contact, 33.3% patients had history of contact with rodents of which one patient gave the history of removal dead rats and the other had the hobby of putting eatables to the rats whose house was heavily infested with rats. Among the patients who had contact with animals, significant number had contact with domestic animals. In our study group all the farmers and some of the labourers had exposure to domestic animals such as cattle, dogs, cats and pigs. This study highlights the importance of contact with contaminated environment being the most important risk factor.

In our study we had leptospirosis patients throughout the year with more number of patients (47.78%) between September to November months during which time the Chennai city gets monsoon rain (Figure-1). In other months, the persistence of contaminated environment was responsible for the transmission of leptospires. This is in contrast with the study done by Muthusethupathi MA, Shivakumar S, et al<sup>[16]</sup> during 1987 – 93 where 90% patients reported during monsoon months.

Occupation plays an important role in the risk of acquiring infection. Leptospirosis is common in high risk groups which include agricultural workers, outdoor manual workers, abattoirs, miners, veterinarians and also any one venturing outside in an environment which has water, infected soil and infected animals<sup>[4]</sup>. In our study group, 78.8% patients were labourers and 7.7% were farmers (Table-2). Thus the outdoor manual workers predominated in our group. These patients had direct contact with the contaminated environment. 7.7% patients were housewives and 5.5% were students who had contact with the contaminated environment while playing in the schools. The inter-relationship between the occupations, contaminated environment and home and leisure activities is shown in Figure-3. This was consistent with the previous Chennai study in which the outdoor manual workers predominated work<sup>[4]</sup>. Outdoor manual workers are more vulnerable while they come in contact with contaminated environment. Leptospirosis is a zoonosis and infected animals (rodents and domestic animals) are an important source of infection. Contaminated environment is due to the urine of these infected animals contaminating the soil and water and contact with this leads to human infection.

Everard JD, Everard CM<sup>[5]</sup> pointed out that where leptospirosis is widespread in the environment and where the disease is endemic, infection will be related to a way of life as well as to specific occupations. Thus when there are large number of rodents, stray dogs and wild animals, where people drink or bathe in untreated water, when sewerage and drainage facilities are inadequate and where open shoes or none at all worn, leptospiral infection can be common. In such places occupational risk factors are

so vertically linked with life style risk factors then investigation of sources of infection in individuals are inappropriate.

This study has revealed the role of contaminated environment in the transmission of leptospirosis. Among the contact with contaminated environment, poor sanitation (inefficient garbage disposal) and walking barefoot are the most important epidemiological risk factors. Recreational activities and bathing in the contaminated water, rainfall and animal contact are the other epidemiological risk factors. Leptospirosis can also occur in non-monsoon months due to the persistence of the contaminated environment. Outdoor manual workers are at risk of acquiring leptospirosis.

Conclusion: Contact with contaminated environment [poor sanitation (e.g. inefficient garbage disposal), poor drainage facilities (e.g. stagnant water)], walking in barefoot, recreational activities involving the contact with contaminated water and bathing in contaminated water sources like in ponds, lakes and wells are important epidemiological risk factors in acquiring leptospirosis. Rodents were the main animal source of contact. Rainfall was another important epidemiological risk factor. High risk occupational groups involving the contact with the above factors are vulnerable.

We recommend that all patients with fever of more than 5 days of duration should be investigated for leptospirosis especially in endemic areas. Preventive measures like anti-rodent measures, isolation of index case domestic animals and control of transmission along with public health measures to improve the contaminated environment will run a long way to decrease not only leptospirosis but also other communicable diseases.

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