Original Research Paper

Volume - 13 | Issue - 03 | March - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Public Health

SHIFT OF THE HUMAN LEPTOSPIROSIS RISK FACTORS IN SOUTH ANDAMAN ISLAND, INDIA

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ABSTRACT **Introduction:** Leptospirosis is a zoonosis, endemic in south Andaman with 12.9% prevalence rate for rural population. Objective: identify the changes in environmental and behavioral risk factors associated with leptospirosis, which will help in the prevention and control strategies design. **Methods:** Cross-sectional study design with a universal sampling of laboratory-positive cases of 385 and 360 controls. **Results:** Multilogistic regression analysis with 21 significant variables revealed, that leptospirosis positivity is significantly associated with the presence of cats (OR 3.774, P < 0.05, CI 316, 6.151), rodents (OR 2.041, P < 0.05, CI 1.270, 3.282) and cattle's (OR 6.350 P < 0.05, CI 3.789, 10.640) and animal handling, bathing in the pond and working in the field and open defecation (OR 4.128, P < 0.05, CI 2.270, 7.508). **Conclusion:** Our results emphasize the importance of creating awareness about leptospirosis, many identified risk factors can be easily controlled by proper sanitation, proper drainage system and easy access to personal protective equipment.

KEYWORDS : Leptospirosis, Endemic setting, Risk factors, proper drainage system

INTRODUCTION:

Leptospirosis is zoonosis [1]. It has global prevalence, endemic in tropical nations and some regions of India. [1][2], Globally, an estimated 1.03 million cases and 58,900 deaths occur each year. These estimates place leptospirosis as a leading zoonotic cause of morbidity and mortality [3]. In the Andaman Islands, the prior seroprevalence rate was 52.7%[4]. Due to prevention and control programmes, especially among health care professionals, early reporting, diagnosis and testing, prevalence has come down to 12.9% for rural and 7% for the urban population, constituting overall seroprevalence of 10.9%[5]. Different risk factors were identified to be connected with leptospiral seroprevalence in rural and urban locations, suggesting transmission process may be different. Prevention and control strategies must be custom designed for rural and urban communities. Hence, we aimed to identify the environmental and behavioral risk factors associated with leptospirosis in the south Andaman Islands, which will help in the strategies design and identify changes in risk factors. The study's findings will help policymakers in effective policy designing by providing recent information about risk factors of the disease and gaps in implementation.

METHODS:

Study area: The South Andaman district of the Andaman and Nicobar Islands is a group of more than 500 islands and islets that stretches over 700 km from north to south in the Bay of Bengal (92° to 94° East and 6° to 14° North).

The study's design is cross-sectional, as sufficient information about standard deviation and expected mean difference between case and control for risk factors was absent in the literature, so a cross-sectional study is planned. We have assumed a prevalence of 50% [4][6].

The sample size 385, which is calculated by Cochran formula with 50% prevalence rate is and 360 laboratory leptospirosis confirmed negative subjects with same age group, gender, occupation and similar house and surrounding conditions were also included as a control, total 745 subjects participated in the study.

We had Listed down confirmed patients with IgM ELISA, RTPCR and MAT titer of 1≥400 in a single, fourfold rise in titer or seroconversion in paired sera [7] from available RMRC record year (2010-2020) and contacted the cases from the contact address provided by them by personal visit to their home and asked subjects to gather the cases in a community hall or hospital conference room for their consent, data and sample collection. Approximately 2ml of blood was collected in a gold cap vacutainer (BD), a cold chain was maintained during transport to the institute, serum was separated, and Microscopic Agglutination Test (MAT) was carried out as per standard protocol. Cases with a MAT titre of ≥1: 100 indicating prior exposure were classified as seropositive [8], and others were considered negative.

Inclusion criteria: Reported and laboratory-confirmed cases with leptospirosis.

Exclusion criteria: Not applicable.

Dependent variable: Laboratory Confirmed cases with Leptospirosis.

Independent variable: Mentioned in TABLE 1 as risk factor.

Information about potential risk factors was obtained by interviewing the subjects using a structured pre-validated questionnaire, which was designed by considering risk factors mentioned in previous studies as well [5].

RESULTS: The mean age of the population is 41.50 years with a standard deviation of 14.11 years, age of the participants ranges from 18-85 years. The relationship between sociodemographic and behavioral risk factors is given in TABLE 1.

TABLE 1: Relationship between sociodemographic and behavioral risk factors.

Risk Factor	Negative	Positive	χ2 values	P values
Place of residence				
1- Urban	21 (21.4%)	77 (78.6%)	32.364	0.000
2- Rural	338 (52.2%)	309 (47.8%)		
House Surroundings				
1- Wet	267 (44.6%)	331 (55.4%)	15.204	0.000
2- Dry	92 (62.6%)	55 (37.4%)		
House location				
1- Low	243 (42.6%)	327 (57.4%)	30.006	0.000
2- High	116 (66.3%)	59 (33.7%)		
Type of roof				
1- Pucca	192 (66.0%)	99 (34.0%)	60.541	0.000
2-Thatch	167 (36.8%)	287 (63.2%)		
Type of wall				
1- Brick	251 (44.1%)	318 (55.9%)	16.023	0.000
2-Mud	99 (61.9%)	61 (38.1%)		
Presence of water bodies	109 (38.5%)	174 (61.4%)	17.099	0.000
Owns house	257 (62.9%)	151 (37.0%)	79.154	0.000
Presence of ponds in compound	77 (24.2%)	241 (75.8%)	127.723	0.000
Owns land	268 (44.1%)	340 (55.9%)	22.358	0.000
Rat infestation	197 (37.9%)	323 (62.1%)	73.208	0.000

Attached latrine	159 (65.7%)	83 (34.3%)	44.039	0.000
Presence of rivers/streams nearby	92 (27.5%)	243 (72.5%)	104.724	0.000
Presence of cattle	55 (32.0%)	117 (68.0%)	23.539	0.000
Presence of cat	54 (29.2%)	131 (70.8%)	35.581	0.000
Presence of pigs	11 (84.6%)	2 (15.4%)	7.032	0.010
Presence of goats	50 (54.9%)	41 (45.1%)	1.896	0.180
Presence of dogs	93 (52.2%)	85 (47.8%)	1.544	0.229
Presence of chicken	122 (53.3%)	107 (46.7%)	3.427	0.068
Presence of ducks	17 (56.7%)	13 (43.3%)	.900	0.358
Wears chappals	318 (64.8%)	173 (35.2%)	158.523	0.000
Handles animals	148 (61.4%)	93 (38.6%)	24.947	0.000
Recent travel history	21 (38.2%)	34 (61.8%)	2.381	0.160
Baths in ponds	70 (21.1%)	262 (78.9%)	176.209	0.000
Works in field	89 (24.2%)	279 (75.8%)	167.815	0.000
Went for swimming	56 (62.2%)	34 (37.8%)	8.076a	0.005
Open defecation	30 (24.8%)	91 (75.2%)	31.668	0.000
*Row percentage of the respective variable is provided in the bracket.				

The rural place of residence suggests a more significant association with disease positivity. The result is statistically significant, where positive cases residing in rural areas were 338 (52.2%), and control was 309 (47.8%) ($\chi2$= 32.364, P < 0.05). Wet surroundings and stagnant water bodies, rivers, and steam have a statistically significant relationship with leptospirosis. The presence of rats is one of the critical risk factors where cases have 323 (62.1%) and 197 (37.9%) control has rat infestation in their houses. The relationship is statistically significant ($\chi2$= 73.208, P < 0.05). Another important statistically significant association with leptospirosis is the presence of cats in 131 (70.8%) cases ($\chi2$= 35.58, P < 0.05) and 117 (68.0%) subjects had cattle in their house's backyard ($\chi2$= 23.539, P < 0.05). Out of 26 risk factors, 21 were statistically significant; hence with 21 risk factors, multi-logistic regression was carried out. In Multilogistic regression analysis, eight risk factors were highly significant, which are given in TABLE 2. leptospirosis positivity is significantly associated with the presence of cats (OR 3.774, P < 0.05, CI 316, 6.151), rodents (OR 2.041, P < 0.05, CI 1.270, 3.282) and cattle's (OR 6.350 P < 0.05, CI 3.789, 10.640) and other significant risk factors are animal handling, bathing in the pond and working in the field and open defecation.

TABLE 2: Multiple logistic regression model of risk factors of Leptospira positivity.

Variable	B	Significance	OR	95% Confidence Interval for OR Lower	Upper
Presence of water bodies	0.458	0.093	1.582	0.927	2.699
Owns House	-0.241	0.477	0.786	0.405	1.527
Wet surroundings	0.491	0.110	1.633	0.895	2.981
Presence of river/stream	0.212	0.471	1.236	0.695	2.198
House in a low-lying area	0.059	0.806	1.061	0.661	1.704
Ponds In Compound	-0.195	0.511	0.823	0.461	1.471
Owns Land	0.547	0.111	1.728	0.881	3.390
Rat Infestation	0.714	0.003	2.041	1.270	3.282
Attached Latrine	-0.063	0.814	0.939	0.554	1.592
Type of roof - Pucca	-0.488	0.115	0.614	0.334	1.127
Type of Wall - Brick	-0.220	0.618	0.803	0.339	1.901
Type of Floor - Cement	0.597	0.184	1.816	0.752	4.384
Presence of Cattle	1.848	0.000	6.350	3.789	10.640
Wears Chappals	-0.579	0.087	0.560	0.289	1.088
Handles Animals	-0.882	0.000	0.414	0.253	0.677
Baths in Ponds	0.976	0.001	2.654	1.511	4.662
Works In Field	0.950	0.000	2.587	1.607	4.163
Went For Swimming	-0.046	0.878	0.955	0.529	1.725
Rural residence	1.519	0.000	4.569	2.372	8.801
Presence of cat	1.328	0.000	3.774	2.316	6.151
Open defecation	1.418	0.000	4.128	2.270	7.508
Constant	-2.624	0.000			
	a. The reference category is negative., *Bold numbers are showing statically significance at P < 0.05				

DISCUSSION:

In our study, the rural population is more susceptible to leptospirosis infection than the urban population, as mentioned in TABLE 1, and the findings ($\chi2$ = 32.364, P < 0.05) are as per the previous study ($\chi2$ = 9.57, p = 0.00198) from the same location.[6], the presence of stagnant water bodies and rivers or streams imposes a high risk for the occurrence of disease, as mentioned by the study from Thailand, which suggests living nearby and bathing in natural bodies of water (adjusted OR 10.45, 95% CI 1.17–93.35) were both significantly associated with an increased risk of severe leptospirosis.[7], Risk factors for leptospirosis in France were investigated to improve the vaccination program for this disease. Data from 90 hospitalized case patients and 169 matched control subjects were analyzed in a case-control study. Skin lesions, canoeing, contact with wild rodents, and country residence were independently associated with leptospirosis, emphasizing that leisure activity is a risk factor for this illness[8][9]. Findings from the virgin islands, United States, suggest binary logistic regression included contact with cows (OR: 39.5; 95% CI: 9.0–172.7), seeing rodents/rodent evidence or contact with rodents (OR: 2.6; 95% CI: 1.1–5.9)[10] in our study, multi-logistic regression has shown a significant association with eight risk factors, out of which 50% is related to the presence of animals or handling animals which include rat infestation, the presence of cattle, and cats, handling of the animal, the findings suggest improper animal handling and maintenance. It also puts farm animals such as cattle at significant risk of leptospirosis infection, which can be minimized by proper waste disposal and keeping the backyard animals at a distance from the house. Also, training on effective rodent control methods may be given to the rural and urban residents as the presence of rodents is a significant risk factor that can be controlled with proper strategy, planning and implementation. Pet, such as the presence of a cat, is another potential risk factor that also requires personal hygiene and discipline to keep pets and family healthy.

Apart from the presence of rodents, the occurrence of the disease in dogs and cats can generate a higher risk of infection for humans. Infections may also be acquired during various agricultural work and recreational activities, such as swimming.[11] but in contrast to general findings, No studies in Indonesia showed a significant association between exposure to domestic animals, swimming in a river, fishing in ponds or irrigation waterways, and leptospirosis infection in humans, but had a significant association with disease positivity with skin lesions and presence of rodents.[12]

In our study presence of a dog is not a potential risk factor as dogs are generally kept outside the house or on the veranda (a small open space in front of the house), but another study from Bhutan suggests dogs could be a source of infection for humans[13] Another 50% of statistically significant multi-logistic regression risk factors are related to the place of residence, bathing in a pond, working in the field and open defecation (OR 4.128, P < 0.05, CI 2.270, 7.508). It also suggests

that the rural population often needs access to good sanitation toilets and proper drainage systems; hence, sometimes, the population is forced to open defecation because of a lack of facilities. Systematic planning and providing basic facilities such as toilets could help reduce disease prevalence. The primary source of livelihood in the islands is agriculture or related occupation and fishing [5], which also exposes the residents to the risk of leptospirosis. This potential risk factor can also be controlled by using personal protective devices, especially during working hours. One study on gap maps of risk factors from India recommended the use of Checklist for One Health Epidemiological Reporting of Evidence (COHERE) for relevant reporting[14]

CONCLUSION: Over the past few years, leptospirosis has been increasingly recognized, as the need for multidisciplinary approaches in a One-Health perspective has been acknowledged, raising hope to tackle the challenges of this zoonosis successfully. [15]. The need to develop a deeper understanding of the epidemiology of Leptospira spp.[16]. Our results emphasizes the importance of creating awareness about leptospirosis transmission and control, as many locals were unaware that cats and cattle also transmit the disease. Many identified risk factors can be easily controlled by proper sanitation, drainage and easy access to personal protective equipment.

The gap between published journal articles and local knowledge needs to be improved. This connection must be improved, especially for endemic diseases with public health importance. Personal attitude towards disease is also crucial. Any change can only be enforced successfully by a positive difference in habits and attitudes.

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