A Cross Sectional Assessment of Knowledge, Attitude and Practice towards Leptospirosis among Rural and Urban Population of a South Indian District

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ABSTRACT

Background & Objective: Leptospirosis is one of the common zoonotic diseases, endemic among farmers in tropical countries. It has an epidemic potential during monsoon and flooding, several countries have witnessed such epidemic outbreaks. However, globally awareness of risk factors is reported to be very low. This study aims to quantitatively analyze the knowledge and attitude related to leptospirosis in Madurai district and to identify misconceptions that result in poor practice.

Material & Methods: A cross-sectional population-based survey on rural and urban population using a structured, validated questionnaire to assess Knowledge, Attitude and Practice on Leptospirosis.

Results: 902 participants from rural and 1074 participants from urban population were enrolled. More than 98% knew seasonal fever to be common during rainy season, of them only 2.8% and 4.3% for urban population mentioned microbes as a cause. They had multiple risk factors and majority (98%) was not aware of risks. Only 13% and 5% of rural and urban residents agreed that they knew fever was transmitted by rat. However, they knew only of plague, none of them have ever heard the term, leptospirosis. Overall, awareness on mosquitoes and Dengue were much better than leptospirosis.

Conclusion: Vulnerable and rural populations were found to be less knowledgeable on risk factors and they had poor practice patterns. Education had significant impact on knowledge and attitude of urban population, however surprisingly their practice did not improve with education. Frequent and systematic public education on causes and risk factors of this endemic disease is mandatory.

Introduction

Leptospirosis is a waterborne zoonotic disease commonly known as rice field fever, mud fever or cane cutter fever [1,2]. It is a common infection in farmers in tropical countries [1]. A major leptospiral outbreak was reported from a South Indian district, Madurai following a heavy rain fall in 1993 [3]. Subsequently the disease was found to be endemic in our farmers and certain risk groups. Although tropical climate supported the leptospiral proliferation, there was abundance of other factors in the environment responsible for spread of infection. For example, manual agricultural practices and unprotected contact with livestock were major risk factors in rural population while poor sanitation, inappropriate waste disposal and rat infestation were responsible in urban infections [4]. In spite of high prevalence, globally awareness of the disease is not satisfactory [5-13]. In this paper we have analyzed the knowledge and understanding of this endemic infectious disease among rural and urban population of Madurai district. Their attitude and practice towards the cause, transmission and seriousness of infection are discussed. The study aims to reveal misconceptions that result in wrong practice.
Material and Methods

The areas of present study were selected on the basis of addresses of leptospirosis patients who attended the hospital during and after epidemic outbreak. Study area included three rural areas in Madurai district (Usilampatti, Vadipatti and Melur) and three urban wards of Madurai Corporation, Sellur (ward no.37) Jaihindpuram (ward no. 89) and Karumbalai a slum area, in Tallakulam (ward no.43) between March 2017 and March 2018 (Figure 1). Respondents were randomly selected from a complete sampling frame.

Figure 1: Map showing location of three rural and urban study areas of Madurai district.

Study Instrument

Two focus group discussions were conducted on volunteers from Madurai. The primary version of the questionnaire was developed on results of focal group discussion and through literature review. These participants were aware of seasonal fever in rainy season but they were not aware of any specific cause. Hence the questions addressed initially the awareness of waterborne disease and risk factors. Later the term leptospirosis was introduced. This improved questionnaire was piloted on a sample of 100 outpatients who attended for glass prescription to assess its legibility and comprehensibility. The questions that were consistently misunderstood were corrected. Corrected questionnaire was pretested again in a second sample of 100 patients to assess for the clarity, reliability and validity. Internal consistency was assessed by using Cronbach’s alpha (α = 0.7) and was found to be in acceptable ranges. Face content and convergent validity of the questionnaire was performed by experts in the discipline of Social science and biostatistics. The final questionnaire included 43 questions in four sections. 12 questions focused on demographic data and general information. Further, it had 13 questions to assess the knowledge and 5 questions to explore attitude.

13 questions addressed practices on activities that could pose a risk for leptospirosis infection. The questions which were not relevant to urban population were used only in rural population. (Example: Will you use slippers while walking in the paddy field?). Knowledge was assessed by questions focusing on cause, transmission and risk factors. Each response was scored as ‘yes’ or ‘no’. A score of 1 was given to correct answer while 0 was given to incorrect response. Scores for individuals were calculated and summed up to give the total knowledge score. Good and poor knowledge was decided on mean values of the population. A cut off level of > 6 was considered as adequate knowledge and ≤ 6 was considered as poor. 5 attitude questions were labeled with positive or negative attitude. Its a 5 point likert scale. A score of > 20 considered as positive attitude and <=20 as negative attitude. Each practice question was labeled with good or poor practice. A score of 1 was given to good while 0 was given to bad practice. The training of the field worker lasted for four weeks which included pilot study on hospital based population by administration of standardized, validated questionnaire. Each village / ward was visited for 3–4 days and 13–15 persons were interviewed each day.
Ethics Statement: Institutional review board approved the study protocol and consent forms (IRB no RES2012 2060ETJ). Village administrative officer of each village granted their permission to conduct the study in their villages. Madurai corporation commissioner granted the permission for urban centers. The participants were informed about the aim of the study, methods and details of their voluntary participation. Literate patients signed the consent form. If they were illiterate, verbal consent was obtained, the field worker read out the question to document their response.

Sample Size and Sampling Strategy: From the pilot study, the percentage of awareness of leptospirosis in Madurai population was found to be very low (0.2%). In order to estimate with the precision of 1% and Confidence interval of 95%, the sample size needed was 1676 (Unadjusted Size). After incorporation of a dropout rate of 5% and a design effect of 1.5 for the use of clusters, the adjusted sample size needed was 1764, to select in 118 clusters. (*Cluster size (m) =15). According to the latest census, the total number of person in 3 selected urban areas of Madurai district is 39258 and total number of person in three selected villages is 275620. The present study interviewed 1074 person from urban areas and 902 from rural side.

Statistical Methods

Descriptive statistics were given for the socio demographic details on age, gender, occupation and education for urban and rural population. Categorical variables were measured as percentages while continuous variables were expressed as mean ± standard deviation. Knowledge and practice scores were categorized as good and poor knowledge/Practice respectively. The response variables were coded as 1 (Yes) vs 0 (No). Explanatory variables tested for association were

  a. Age
  b. Gender
  c. Education
  d. Place of residence (Rural/Urban) and
  e. Knowledge of risk factors for leptospirosis transmission.

Attitude was categorized into positive and negative attitude. Chi-square/Fisher’s exact test was used to find the association between categorical variables. In the contingency table statistically significant factors (i.e. P-value <0.05) were taken for the univariate analysis. Subsequently the significant variables (P-value < 0.05) from the univariate analysis were taken for the multivariate analysis and logistic regression was used to find out the association between the dependent variable and independent variables using STATA 14.0 (Texas, USA). Results from the final models were expressed in terms of odds ratios with associated 95% confidence intervals. The practice patterns of the people were given in the Venn diagrams.

Results

Demographic details, educational status, occupation, source of health-related information and environmental risk factors are given in Table 1. Of 2000 distributed questionnaires, 1976 responses were received with a response rate of 98.8%. The overall gender distribution was equal with 49.3% of males (976/1976). Age ranged from 18 to 87 years with a mean of 42 years. Majority of rural population (83.5%) were agricultural employees while other employments were common in urban population. Illiterates were more common in rural (25.6%) than urban population (8.9%). For both the population, source of health-related education was the media (television 81% and 98%). (Table 1). The response of the participants towards knowledge, attitude and practices towards leptospirosis are shown in Tables 2-4 and in Figure 2. In the present study, single risky practice was sparse and seen only in 0.8% of rural and 3.7% of urban population. All four were seen in 70.2% of rural population while maximum of three were seen in 44% in urban population (Figure 3A & 3B). This was followed by logistic regression modeling to assess the knowledge and attitude associated with the practices. Illiterates were found to be less knowledgeable and had unfavorable attitude and poor practice. Significant differences based on education were seen in knowledge and attitude of urban population however their practice did not improve with education (Tables 5-7).

Table 1: Socio-demographic characteristics of the study respondents.

| Variables                     | Rural (n=902) n (%) | Urban (n= 1074) n (%) |
|-------------------------------|--------------------|-----------------------|
| **Age in years**              |                    |                       |
| 1. < 30                       | 118/902 (13.1)     | 283/1074 (26.4)       |
| 2. 30 – 60                    | 686/902 (76.0)     | 723/1074 (67.3)       |
| 3. > 60                       | 98/902 (10.9)      | 68/1074 (6.3)         |
| **Gender**                    |                    |                       |
| 1. Male                       | 494/902 (54.8)     | 482/1074 (44.9)       |
| 2. Female                     | 408/902 (45.2)     | 592/1074 (55.1)       |
| **Educational level**         |                    |                       |
| 1. Illiterate                 | 231/902 (25.6)     | 96/1074 (8.9)         |
| 2. Primary school             | 359/902 (39.8)     | 338/1074 (31.5)       |
| 3. Secondary school           | 231/902 (25.6)     | 530/1074 (49.4)       |
| 4. College                    | 67/902 (7.4)       | 110/1074 (10.2)       |
**Occupation**

| Occupation* | N/Total (%) |
|-------------|-------------|
| 1. Home maker/Student/retired/unemployed | 65/899 (7.2) | 434/1074 (40.4) |
| 2. Farmer/Coolie/Risk group | 751/899 (83.5) | 253/1074 (23.6) |
| 3. Others | 83/899 (9.2) | 387/1074 (36.0) |

**Learn health related information by**

| Source | N/Total (%) |
|--------|-------------|
| 1. TV | 731/902 (81.0) | 1056/1074 (98.3) |
| 2. Health care personnel | 163/902 (18.1) | 12/1074 (1.1) |
| 3. Radio | 78/902 (8.6) | 3/1074 (0.3) |
| 4. Friends/Relatives | 75/902 (8.3) | 20/1074 (1.9) |
| 5. Notice | 27/902 (3.0) | 6/1074 (0.6) |
| 6. Other sources | 27/902 (3.0) | 32/1074 (3.0) |

**Environmental risk factors**

| Risk factor | N/Total (%) |
|-------------|-------------|
| 1. Presence of rat at home | 425/901 (47.2) | 571/1074 (53.2) |
| 2. Presence of rat at field | 818/900 (90.9) | Not Applicable |
| 3. Presence of cattle at home | 543/901 (60.3) | 41/1074 (3.8) |
| 4. Presence of cattle at streets | 837/901 (92.9) | 983/1074 (91.5) |

Note: * Rural: Unskilled (436), Semi-skilled and Skilled(250), Professional (2), own business(30) and Home maker, unemployed/Retired (184)
Urban: Unskilled (326), Semi-skilled and Skilled(152), Professional (7), own business(99) and Home maker, unemployed/Retired (490)

**Figure 2:**

a. Bare footed farmer from rural area working in close association with cattle at warm and wet paddy field.
b. Animals living in close association with people of urban slum
c. Sewage workers working with bare foot and ungloved hands - Risk group
d. Bare footed milk man working in close association with cattle - Risk group.


**Table 2:** Good Knowledge regarding Leptospirosis among Rural and Urban population.

| General questions                                                                 | Rural n (%) (Yes) | Urban n (%) (Yes) |
|----------------------------------------------------------------------------------|-------------------|-------------------|
| Fever spreads more during rainy season                                           | 887/902 (98.3)    | 1073/1074 (99.9)  |
| Contaminated water can cause disease                                             | 864/901 (95.9)    | 1072/1074 (99.8)  |

**On Causes**

|                                                                                   | Rural n (%) (Yes) | Urban n (%) (Yes) |
|-----------------------------------------------------------------------------------|-------------------|-------------------|
| Microbes are the cause for the seasonal fever                                     | 25/902 (2.8)      | 46/1073 (4.3)     |
| Mosquitoes are the cause for the seasonal fever                                   | 654/902 (72.5)    | 722/1074 (67.3)   |
| Rainy fever caused by microbes can cause death in humans                          | 767/902 (85.0)    | 624/1074 (58.1)   |
| Has heard about leptospirosis or rat fever                                       | 116/902 (12.9)    | 54/1073 (5.0)     |
| Rainy season diseases affect cattle                                               | 806/901 (89.5)    | 704/1074 (65.5)   |
| Microbes are the cause for the cattle fever                                       | 48/899 (5.3)      | 194/1074 (18.1)   |

**On Transmission**

|                                                                                   | Rural n (%) (Yes) | Urban n (%) (Yes) |
|-----------------------------------------------------------------------------------|-------------------|-------------------|
| Animals excreta can cause disease in human on exposure                            | 141/900 (15.7)    | 1040/1074 (96.8)  |
| Diseases spread to human by diseased animals                                     | 295/902 (32.7)    | 823/1074 (76.6)   |
| Water used by cattle can spread disease                                          | 340/902 (37.7)    | 798/1074 (74.3)   |
| Cattle abortion waste can spread disease                                         | 373/902 (41.3)    | 520/1028 (50.6)   |
| Rat can cause disease to cattle                                                  | 197/901 (21.9)    | NA                |

**Knowledge about Disease Transmission on Exposure to following Vector/Animal**

|                                                                                   | Rural n (%) (Yes) | Urban n (%) (Yes) |
|-----------------------------------------------------------------------------------|-------------------|-------------------|
| 1. Mosquito                                                                       |                   |                   |
| a. Dengue                                                                         | 693/902 (76.8)    | 1041/1074 (96.9)  |
| b. Malaria                                                                        | 69/902 (7.6)      | 5/1074 (0.5)      |
| 2. Rat                                                                            |                   |                   |
| a. Plague                                                                         | 44/902 (4.9)      | 76/1074 (7.1)     |
| b. Leptospirosis                                                                  | 1/902 (0.1)       | -                 |
| c. Rat fever/Rat flu                                                              | -                 | 9/1074 (0.8)      |
| d. Jaundice                                                                       | -                 | 1/1074 (0.1)      |

**Table 3:** Positive attitude towards Leptospirosis among Rural and Urban population.

| Variable                                                                 | Rural n (%) (Yes) | Urban n (%) (Yes) |
|-------------------------------------------------------------------------|-------------------|-------------------|
| Drinking pond water can cause disease                                   | 662/902 (73.4)    | 1036/1074 (96.5)  |
| Bathing in pond water can cause disease                                 | 344/902 (38.1)    | 783/1074 (72.9)   |
| During raining season fever caused by microbes                           | 565/902 (62.6)    | 942/1074 (87.7)   |
| Rats can spread disease                                                | 440/902 (48.9)    | 796/1074 (74.1)   |
| Diseased cattle should not be eaten                                     | 832/898 (92.7)    | 1062/1074 (98.9)  |
Table 4: Good practice towards Leptospirosis among Rural and Urban population.

| Variables                                      | Rural (Yes)n (%) | Urban (Yes)n (%) |
|------------------------------------------------|------------------|------------------|
| **Water Source**                               |                  |                  |
| Un boiled Tap water for drinking               | 563/902 (62.4)   | 1054/1074 (98.1) |
| Un boiled pond/river water for drinking        | 154/902 (17)     | nil              |
| Habit of drinking boiled water                 | 4/902 (0.4)      | 5/1074 (0.5)     |
| Open water reservoir for bathing               | 222/901 (24.6)   | 6/1074 (0.6)     |
| **Personal Preventive Measures**               |                  |                  |
| Will you wear slippers while walking in the field | 124/899 (13.8) | NA               |
| Will you wear slippers while walking in the street | 272/899 (30.3) | 976/1074 (90.9) |
| Wearing gloves while cleaning the animal waste with an injured hand | 6/901 (0.7) | 7/95 (7.4) |
| After cleaning animal dung will you clean hand with Dettol/soap | 176/902 (19.6) | 78/95 (82.1) |
| Cleaning hands with disinfectant after handling an abortion of animal fetus | 587/902 (65.1) | NA               |
| Will you wear gloves while cleaning wastes     | NA               | 15/95 (15.8)    |
| **Animal Care and Environmental Care (Rural population)** |      |                  |
| Consulting veterinary doctor for diseased cattle | 824/898 (91.8) | NA               |
| Dispose the abortion waste/dead animal by burying* | 772/902 (85.6) | NA               |
| After delivery of animals, clean that place with disinfectant | 117/902 (13.0) | NA               |

Note: *Although 86% buried the dead animal/abortion waste, none of them followed the published standard norms. NA Not Applicable

Figure 3A: Venn diagram showing the percentages of rural population (n=902) with combinations of multiple risky practices.
Figure 3B: Venn diagram showing the percentages of Urban population (n=1074) with combinations of multiple risky practices. Note: Single risky practice seen only in 3.7%. 2 practices in 43.5%, 3 in 47.7% and all four were seen in 5.2% of urban population.

Table 5: Contingency table showing frequency distribution of all variables.

| Variables | Knowledge | Attitude | Practice |
|-----------|-----------|----------|----------|
|           | Good n (%) | Poor n (%) | P-value | Positive n (%) | Negative n (%) | P-value | Good n (%) | Poor n (%) | P-value |
| Age (in years) |          |          |          |          |          |          |          |          |          |
| <30       | 61 (51.7) | 57 (48.3) |          | 69 (58.5) | 49 (41.5) |          | 48 (40.7) | 70 (59.3) |          |
|           | 276 (40.2) | 410 (59.8) |          | 275 (40.1) | 411 (59.9) | <0.001 | 237 (34.5) | 449 (65.5) |          |
| >60       | 24 (24.5) | 74 (75.5) | <0.001 | 19 (19.4) | 79 (80.6) |          | 33 (33.7) | 65 (66.3) | 0.411 |
| Gender    |          |          |          |          |          |          |          |          |          |
| Male      | 223 (45.1) | 271 (54.9) | 0.001 | 199 (40.3) | 295 (59.7) |          | 186 (37.7) | 308 (62.4) |          |
| Female    | 138 (33.8) | 270 (66.2) |          | 164 (40.2) | 244 (59.8) | 0.979 | 132 (32.3) | 276 (67.7) | 0.097 |
| Occupation|          |          |          |          |          |          |          |          |          |
| Home maker# | 30 (46.2) | 35 (53.8) |          | 38 (58.5) | 27 (41.5) |          | 35 (53.9) | 30 (46.2) |          |
| Farmer/Coolie | 280 (37.3) | 471 (62.7) |          | 280 (37.3) | 471 (62.7) | <0.001 | 244 (32.5) | 507 (67.5) |          |
| Others    | 49 (59.0) | 34 (41.0) | <0.001 | 44 (53.0) | 39 (47.0) |          | 38 (45.8) | 45 (54.2) | <0.001 |
| Education       | Rural (n = 902) | Urban (n = 1074) |
|-----------------|-----------------|------------------|
| Illiterate      | 64 (27.7)       | 132 (36.8)       |
| Primary         | 167 (72.3)      | 227 (63.2)       |
| Secondary       | 123 (47.8)      | 128 (52.2)       |
| Graduate        | 117 (51.8)      | 48 (71.6)        |

| Age (in years)  | Rural (n = 902) | Urban (n = 1074) |
|-----------------|-----------------|------------------|
| <30             | 136 (48.1)      | 260 (42.8)       |
| 30 – 60         | 482 (59.2)      | 47 (69.1)        |
| >60             | 50 (73.5)       | 21 (30.9)        |

| Gender          | Rural (n = 902) | Urban (n = 1074) |
|-----------------|-----------------|------------------|
| Male            | 264 (54.8)      | 216 (44.8)       |
| Female          | 350 (59.1)      | 186 (31.4)       |

| Occupation      | Rural (n = 902) | Urban (n = 1074) |
|-----------------|-----------------|------------------|
| Home maker      | 173 (39.9)      | 130 (30.0)       |
| Coolie/Risk     | 261 (60.1)      | 87 (34.4)        |
| Others          | 157 (62.1)      | 185 (47.8)       |

| Education       | Rural (n = 902) | Urban (n = 1074) |
|-----------------|-----------------|------------------|
| Illiterate      | 69 (71.9)       | 105 (31.1)       |
| Primary         | 207 (61.2)      | 221 (41.7)       |
| Secondary       | 285 (53.8)      | 53 (48.2)        |
| Graduate        | 53 (51.8)       | 53 (51.8)        |

Note: #Home maker/Student/retired/unemployed. a – Chi square test; b – Fisher’s exact test

Table 6: Univariate analysis.
| Variables         | Rural (n = 902)                                      | Urban (n = 1074)                                      |
|-------------------|------------------------------------------------------|------------------------------------------------------|
|                   | Good Knowledge                                      | Attitude                                            | Practice                                           |
|                   | Odds ratio (95 % CI)                                 | P-value                                              | Odds ratio (95 % CI)                              | P-value                                              | Odds ratio (95 % CI)                              | P-value                                              |
|                   |                                                    |                                                      |                                                    |                                                      |                                                      |                                                      |
| Gender            |                                                     |                                                      |                                                    |                                                      |                                                      |                                                      |
| Female*           | 1.00                                                | NS                                                   | NS                                                 | NS                                                   | NS                                                   | NS                                                   |
| Male              | 1.61 (1.23 – 2.11)                                  | 0.001                                               | NS                                                 | NS                                                   | NS                                                   | NS                                                   |
| Occupation        |                                                     |                                                      |                                                    |                                                      |                                                      |                                                      |
| Home maker*#      | 1.00                                                | 1.00                                                | 1.00                                               |                                                      |                                                      |                                                      |
| Farmer/Coolie     | 0.69 (0.42 – 1.15)                                  | 0.159                                               | 0.42 (0.25 – 0.71)                                 | 0.001                                               | 0.41 (0.25 – 0.69)                                   | 0.001                                               |
| Others            | 1.68 (0.87 – 3.24)                                  | 0.120                                               | 0.80 (0.42 – 1.54)                                 | 0.508                                               | 0.72 (0.38 – 1.39)                                   | 0.331                                               |
| Education         |                                                     |                                                      |                                                    |                                                      |                                                      |                                                      |
| Illiterate*       | 1.00                                                | 1.00                                                | 1.00                                               |                                                      |                                                      |                                                      |
| Primary           | 1.52 (1.06 – 2.17)                                  | 0.023                                               | 1.82 (1.26 – 2.63)                                 | 0.001                                               | 1.67 (1.15 – 2.42)                                   | 0.007                                               |
| Secondary         | 2.39 (1.63 – 3.49)                                  | <0.001                                             | 3.08 (2.08 – 4.55)                                 | <0.001                                             | 2.05 (1.38 – 3.04)                                   | <0.001                                              |
| Graduate          | 6.59 (3.60 – 12.06)                                 | <0.001                                             | 8.31 (4.48 – 15.41)                                | <0.001                                             | 4.63 (2.61 – 8.21)                                   | <0.001                                              |
| Age (in years)    |                                                     |                                                      |                                                    |                                                      |                                                      |                                                      |
| <30*              | 1.00                                                | 0.001                                               | NS                                                 | NS                                                   | NS                                                   | NS                                                   |
| 30 – 60           | 0.64 (0.48 – 0.84)                                  | 0.001                                               | NS                                                 | NS                                                   | NS                                                   | NS                                                   |
| >60               | 0.33 (0.18 – 0.60)                                  | <0.001                                             | <0.001                                             |                                                      |                                                      |                                                      |
| Gender            |                                                     |                                                      |                                                    |                                                      |                                                      |                                                      |
| Female*           | NS                                                  | NS                                                  | 1.00                                               | <0.001                                             | <.0001                                              | <.0001                                              |
| Male              |                                                     |                                                      | 1.77 (1.38 – 2.27)                                 | <0.001                                             |                                                      |                                                      |
| Occupation        |                                                     |                                                      |                                                    |                                                      |                                                      |                                                      |
| Home maker*#      | 1.00                                                | 1.00                                                | 1.00                                               |                                                      |                                                      |                                                      |
| Coolie/Risk       | 0.92 (0.67 – 1.27)                                  | 0.620                                               | 1.23 (0.88 – 1.71)                                 | 0.228                                               |                                                      |                                                      |
| Others            | 1.47 (1.11 – 1.94)                                  | 0.006                                               | 2.14 (1.61 – 2.85)                                 | <0.001                                             |                                                      |                                                      |
| Education         |                                                     |                                                      |                                                    |                                                      |                                                      |                                                      |
| Illiterate*       | 1.00                                                | 1.00                                                | 1.00                                               |                                                      |                                                      |                                                      |
| Primary           | 1.62 (0.99 – 2.66)                                  | 0.057                                               | 1.93 (1.05 – 3.17)                                 | 0.033                                               | NS                                                   | NS                                                   |
| Secondary         | 2.20 (1.36 – 3.54)                                  | 0.001                                               | 2.90 (1.70 – 4.93)                                 | <0.001                                             | <0.001                                              | <.0001                                              |
| Graduate          | 2.75 (1.54 – 4.91)                                  | 0.001                                               | 4.36 (2.33 – 8.15)                                 | <0.001                                             |                                                      |                                                      |

Note: *Reference category; NS – Statistically not significant. # Home maker/Student/retired/unemployed.

**Table 7:** Multivariate analysis.
### Discussion

Leptospirosis is a zoonotic disease caused by the spirochetes, leptospires. Risk factors for infection have been studied extensively [14-22]. Animal species including rats, dogs, cattle, goats, horses and buffaloes serve as maintenance hosts [1,2]. They shed millions of leptospires in their urine contaminating the soil and open water reservoirs. The human infections depend on the chance of direct or indirect contact with the urine of these infected animals. Leptospires can gain entry into humans through abraded skin and through intact mucous membranes resulting in mild fever to multi organ ailments [1]. This tropical disease is reported from all over India including Tamil Nadu in South, West Bengal and Assam in the East, Bihar, Uttar Pradesh and Delhi in North, Maharashtra and Gujarat in West and also at Andaman Islands [2-5,12,20,21,23]. Madurai city is a known endemic area for leptospirosis for several decades [3,4,23]. Infection is more common in specific group of population such as farmers, slaughter and sewer workers because of their frequent direct exposure to animal excreta or to the contaminated environment. In spite of high prevalence, globally awareness of the disease is not satisfactory [5-13]. This study aims to quantitatively collect the baseline data on understanding of risk factors for leptospirosis among rural and urban population of Madurai district and to reveal misconceptions that result in wrong practice.

### Knowledge

Knowledge on common diseases of the society improves the attitude and health care practices of the population. Leptospirosis is a major public health problem globally however knowledge, attitude and practice towards the disease are highly variable from country to country. In Sri Lanka, outbreaks had occurred in 2008 and in 2011 [24]. Because of regular public health programs, their knowledge on this infection is very good, 97% of their study participants knew...
about leptospirosis. There was a high level of awareness of health risks associated with flooding as well [24]. Similarly, recent KAP study from Thailand revealed a good awareness (97.1%) which was much better than a previous study done in the same country a decade before [6,25]. 83% of slaughterhouse workers in Jamaica had fair knowledge on zoonotic disease and 78% had heard about leptospirosis [14]. Canoeists and dairy farmers from England had adequate knowledge on sources of leptospirosis (> 90%) [26,27].

Likewise, majority of respondents from Argentina had heard about this disease although their knowledge on the severity was limited [28]. Poor knowledge results in poor practice and disease transmission. Poor knowledge was common in several countries including India, Thailand, Malaysia, Peru and United Sates [5,7,29,30]. Leptospirosis was often misdiagnosed as Dengue in Trinidad because of poor awareness [31]. A study was conducted among municipal workers (garbage collector, drainage cleaner and septic tank cleaners) in Tamil Nadu [5]. In spite of very high-risk exposure, they never had any health education on risk and preventive measures. 87.2% had never heard the term leptospirosis. In our district as well as globally, leptospirosis outbreaks are common during rainy season [1-3,14,16]. In our study, although very high percentage of our participants knew that fever is common in rainy season (98-100%) and that contaminated water can cause fever (96-100%), it was very surprising that both the groups did not feel it could be due to microbial illness (2.8-3.6%) rather they attributed the fever to mosquitoes (70-73%).

Although 116 (13%) of rural and 42 (4.5%) of urban participants reported having previously heard of fever spread by rats, the term leptospirosis was known only to a single person (who studied for a government exam) (Table 2). 44 participants (4.9%) of urban and 76 (7.1%) of rural population recollected plague spread by rats but not about leptospirosis. As in other countries, the most commonly perceived disease in rural population was Dengue [31]. Notably they did not recollect any other microbial cause that can cause fever in human. Similarly, they knew that cattle also get fever (98-100%) and that contaminated water can cause fever (96-100%), it was very surprising that both the groups did not feel it could be due to microbial illness (2.8-3.6%) rather they attributed the fever to mosquitoes (70-73%).

Attitude

A previous study at Trinidad population revealed a positive attitude towards general health and good sanitary practices in spite of their poor knowledge on leptospirosis. Author recommended education of the population to improve their knowledge and practice on proper waste disposal and rodent control [31]. In spite of very good knowledge (97%) in Jamaica 44.7% of rural and 41.2% of urban participants failed to see open garbage dumping as a contributing factor to the presence of rodents [24]. Similarly, in our population 52% of rural and 25% of urban did not worry about rats in their premises. Significant number of rural population did not believe that using open water reservoir is a risk factor. Nearly 50% did not believe that rats can transmit infectious disease. In our study, although the knowledge of leptospirosis was poor the attitude of urban population was better than rural population (Table 3).

Practice

Knowledge of infection and a positive attitude towards preventive measures alone do not influence the real practice. Improper sewage and garbage disposal facilities, presence of rats and failure to use personal protective measures (PPM) were responsible for the endemicity of the disease in Indonesia [19]. In spite of good training and knowledge, Jamaican workers had several environmental risk factors in their slaughterhouse and had poor protective practice [14]. A cross-sectional study among school children in Sri Lanka showed a ‘good’ level of knowledge, however, this knowledge was not translated into practice of PPM when they helped their parents in agricultural work [32]. In spite of very good knowledge, the study participants at Brazil performed risk activities such as cleaning open sewers without protective boots (33%) or gloves (35%) [33]. In our study the most common failure of PPM was walking barefooted outdoors in rural population and using unboiled water for drinking in urban population (Table 4). In the present study, more than 73% of rural and 95% of urban respondents agreed about the seriousness and possible transmission of the disease on using unprotected water, however 25% used such water for bathing and 20% for drinking (Table 4). Habit of drinking boiled water was as low as less than a percent in both populations. Although the contingency table (Table 5) shows good knowledge and attitude among younger, female and educated population, they were not statistically very different in their practice (Tables 6 & 7). Overall practice of our population irrespective of age, gender, occupation or literacy was poor when compared to the population of Brazil, Sri Lanka, England, Malaysia and Thailand.

Environmental Exposure- Rural

Infected cattle shed millions of leptospires in their urine and they can survive in moist alkaline soil for months. Study in an agricultural population of Thailand identified important risk factors which included farming for more than 6 hours and walking through stagnant water two weeks prior to illness [34]. Combination of tropical climate and need to immerse their bare foot in moisture for hours offer plenty of opportunity to Indian farmers to get infected (Figure 2). Previous study from Madurai on seroprevalence of leptospirosis in animals confirmed field rats to be carriers [4]. 90% of rural population had rats in their field and 54% of urban (Table 1) had rats at home, however most (93%) could not name any specific rodent-borne diseases (Table2). It is noteworthy that similar to population of Peru, our population was...
not aware of rodent-borne diseases. Like them, our population was not worried about the presence of rats which were seen only as nuisance and not as microbial carriers [7]. Surprisingly very few could recollect about the plague but not leptospirosis (Table 2). Rural population had poor knowledge on disease transmission than urban population (Table 2). Use of protective rubber boots or gloves will help in prevention however, agricultural workers were neither aware nor using them. Farmers and milk men buried the dead animal and abortion waste. However, they buried in any place in a shallow pit. As per the Indian national guideline’s burial should be performed in a remote area, located a minimum of 300 feet down gradient from water sources. The bottom of the pit or trench should be minimum 4 to 6 feet above the water table. Bleaching powder (calcium hydroxide) should be layered upon the dead animals to keep out insects and vermin. The study population was not aware of the guidelines [35].

Environmental Exposure- Urban

Environmental sanitation is a cornerstone of infectious disease prevention. Although Madurai city has drainage system in its corporation limit, some slum areas lack proper sanitation services. They have open sewers, posing risk for people who walk barefooted, especially in rainy season. Madurai had suffered from several incidents of sewage contamination of drinking water in rainy season due to failure of drainage infra-structure [36-39]. The microbial levels have been reported high in the tap water in the city. Direct tap water is not potable and cannot be drunk without purification. It is true concern that only a small proportion of the population is aware of this risk. Although it is highly recommended to take boiled water for drinking, 99% of the urban population were using unboiled water for drinking (Table 4).

Special Risk Groups

Slaughterhouse workers need to be very cautious in handling animal tissues, dead animals and animal excreta; study done on those workers in Jamaica had poor prevention practice in spite of very good knowledge on zoonotic disease (83%). Animal blood, gut contents and meat scraps were commonly seen in their open drains and only 12% of them used protective clothing [14]. In our study 85% of slaughter house workers admitted that they never use gloves as they feel it was very uncomfortable. On questioning about their personal hygiene only 23% used disinfectant after handling animal waste. Only 5% of milk man declared that they use disinfectants to clean their hand after coming in close contact with cow while milking because they did not believe that they will get infection from their own cow. Sewage workers, garbage collector and septic tank cleaners were interviewed in a previous study in Tamil Nadu. 57.6% had unsatisfactory practice score and they were very poor in using personal protective measures such as gloves, boots and mask. Though Madurai Corporation had provided gloves and boots to sewage workers. In our study, 79% of them felt it was difficult to use while they clean and 23% of them mentioned that they do not have any gloves as they were temporary workers. Our study identified two potential reasons for poor practice that favor risk exposure. First, appropriate personal protective gloves were not felt comfortable by sewers and they were not aware of the risks of exposure.

Sewage workers who had constant exposure to contaminated water and environment were seen using neither gloves nor proper foot wear (Figure 2D) Venn diagram of the rural and urban populations on both environmental risk factors and poor personal hygiene are given in (Figure 3A & B). This study identified common behavioral risk factors (walking bare-foot, drinking unboiled water) and environmental risk factors (rats and cattle at paddy field and at home) for leptospirosis infection. The probable source of infection was difficult to ascertain because of the multiplicity of risk exposures and the overlapping unsafe activities. Interestingly more than 70% of the rural population had multiple risk factor exposure when compared to urban population. Awareness program on leptospirosis for animal shelter workers at UK was modestly successful in transferring short-term knowledge [30]. Similarly, Sri Lankan public health education programs greatly increased the knowledge of the population [24]. Presently media and public educational programs concentrate on diseases like HIV and Dengue. However, there are several other tropical illnesses like leptospirosis, parasitic diseases and nutritional deficiencies with potential morbidity and mortality which need proper attention.

Conclusion

Leptospiral infection is the result of interface between human, infected animals and the contaminated environment. Close association with animals, tropical climate and lack of awareness of risk factors lead to rural leptospirosis. Population overgrowth and failures of drainage infrastructure and lack of awareness result in urban disease. The study points to inadequate knowledge and poor practices of both rural and urban population. Increasing knowledge about leptospirosis is the key for promoting desired, positive attitude and practice in the community. Health education should reach the general public, in particular high-risk groups.

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