Level of Awareness, Attitude, and Practice towards Leptospirosis (*Leptospira spirochetes*) among the Riverside Residents in Laguna

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ABSTRACT

Leptospirosis spreads throughout contact of humans to contaminated areas with bacterial infection caused by pathogenic genus Leptospira that comes from wild and domesticated species. Studies showed that Philippines have high risks of acquiring bacterial infection as the country is considered one of the tropical countries that experience heavy rain falls and floods. This study aims to determine the level of awareness, attitudes, and practices of the residents in Laguna towards leptospirosis. Determining the level of awareness, attitudes, and practices along with its relationship with one another were based on a standardized questionnaire given to the respondents. Statistical analysis of the study includes frequency distribution, weighted mean, and Spearman-rho correlation. The results indicate the respondents' awareness towards the infection, attitude of everyone, and with how practices were being conducted by the group. It also determines the significance in correlating awareness and attitudes, awareness and practices, and attitudes and practices. There is a satisfactory level of awareness coming from the respondents, pleasant views and opinions from the situational attitude, and majority of practiced preventive measures done. For the correlation analysis, awareness and attitudes were insignificant, awareness and practices were insignificant, and attitudes and practices were positively significant. It is recommended that occupational health entities in the working sector should be strengthened by incorporating measures to monitor leptospirosis and other zoonotic diseases, providing health and safety training programs and encouraging collaboration between health policy makers, local government, relevant organizations, and cooperatives.

Keywords: *Leptospirosis, awareness, attitude, practices*

INTRODUCTION

Leptospirosis is a bacterial disease caused by genus Leptospira spirochetes or leptospirosis, which is an infectious bacterium from animals. It is said to be a zoonosis infection as the cause of direct and indirect transmission of animals to humans is happening. The said disease is distributed endemically in countries or such places where humid subtropical and tropical conditions along with high rainfalls are occurring (WHO, 2011).

Humans acquire leptospirosis through direct contact with urine-contaminated environment or the urine of the infected animals itself. The bacteria are often acquired by humans through the association of rodent urine. However, domestic animals such as cattle, horses, pigs, dogs, and other wild animals are also contributor of the contagious disease (DOH, 2015). Human-to-human transmission is said to be rarely taking place and most cases of leptospirosis are often observed through contact with contaminated surroundings. It is often developed through cuts or wounds in the skin where infection will be entering or through mucous membrane of nose, eyes, and mouth and swallowing contaminated water and food directly with detected bacteria.

Leptospirosis takes place in situations where subtropical and tropical weathers are occurring. Risk factors for acquiring the infection also arise in locations with inadequate sewage disposal or those with improper waste management system. Occupational hazard also takes place where people who are mostly providing needs for their living have contact with animals with outdoor works and recreational activities that conduct mechanisms in relation with water-related doings in vegetation or damp soil are done (WHO,

2019). Typically, with seasonal climate change, natural occurring disasters like flooding and other extreme weather patterns present a hazardous risk in spreading infection of leptospirosis in humans.

Philippines, an example of tropical country, are where naturally occurring disasters takes place during rainfall season. Along with animals like rodents and dogs are seen in places like public markets and streets. The Department of Health have recorded in January 2019 up until August 2019 that there are also 981 cases of Leptospirosis with 113 deaths due to severe illness, Likely through the exposure of floods and heavy rain falls in contamination with leptospirosis have gained large number of cases of leptospirosis. (DOH, 2019)

Early signs and symptoms arise with several changes in the condition and health of a person. These include high fever along with severe headache and chills, muscle pain, redness of the eyes, abdominal pain, hemorrhages in the skin and mucous membrane also rashes, vomiting, diarrhea, and jaundice where liver gets affected (WHO, 2010).

Signs and symptoms of severe leptospirosis will appear a few days once mild leptospirosis symptoms have gone. Symptoms are based on which vital organs are involved. For mild cases, the doctor may prescribe antibiotics, such as doxycycline or penicillin. However, patients with severe leptospirosis will require spending time in the hospital. They will take antibiotics intravenously depending on which organ leptospirosis effects. Hospital stays may range from a few weeks to several months. This mostly depends on how the patient reacts to antibiotic treatment, and how severely the infection damages their organs. Additionally, during pregnancy, leptospirosis can affect the fetus. Anyone who has the infection during pregnancy will need to spend time in the hospital for monitoring (Brazier, 2018).

The risk of getting leptospirosis can be significantly reduced and prevented by avoiding contact with animal urine or body fluids, especially if there are cuts or scrapes in the skin. Wearing protective clothing or footwear near soil or water that may be contaminated with animal urine especially those people who are exposed to contaminated water or soil because of their job or recreational activities. Avoiding swimming in muddy or walking in water that might also be contaminated with animal urine or eliminating contact with potentially infected animals specifically those located near farms or stagnant water. Lastly, control rats and mice around the home on a regular basis. If this is left untreated, leptospirosis may cause kidney failure, brain damage, massive internal bleeding, and death (WHO, 2010).

Review of Literature

Awareness on Leptospirosis

Leptospirosis comes with the highest burden among tropical and subtropical places along with low-income population in the rural and urban environment. The illness is considered as an “acute fever of unknown” by the early symptoms and signs acquired by an individual since clinical awareness and presentation are nonspecific and variable. Pathogenic leptospirosis significantly contributes to exposing threats to humans from the renal tubules of such animals most especially rodents that are considered as the most popular contributor of contaminations. Transmission of bacteria to the environment, it can survive for weeks or months to a warm and humid temperature. From the clinical presentation and data, 5% up until 30% is the case fatality rate for the population however, leptospirosis possesses higher number of threats to people living in a tropical surrounding (Goarant, 2016).

Studies have shown that 90% of the infected people with leptospirosis adapted mild disease while 10% of the population with the infectious illness acquired severe and fatal diseases that may develop complication with the internal organs (Tacio, 2018). Severe effects towards a person include kidney failure, bloody cough, and jaundice from the inflammation of kidneys, liver, and lungs. Against leptospirosis, Immunochromatographic Leptocheck Test which is commercially available is conducted to detect antibodies against leptospirosis that was used by several studies the accuracy and reliability (Wochenschr, 2015). It introduces the first step in diagnosing whether a person or a group of people transmitted bacteria from fresh waters and floods.

Most leptospirosis cases are mild and resolved spontaneously. Early initiation of antimicrobial therapy may prevent some patients from progressing to more severe disease. Identification of leptospirosis in its early stages is largely a clinical diagnosis and relies on a high index of suspicion based on the patient's risk factors, exposure history, and presenting signs and symptoms. Rapid diagnostic tests for leptospirosis are improving, but a negative result should not be relied on to rule out early infection. For these reasons, empirical therapy should be initiated as soon as the diagnosis of leptospirosis is suspected as released (Haake, 2015)

Leptospirosis remains a significant public health problem mainly affecting the population of productive age group. High proportion of cases indirectly reflects the endemic nature of the disease in the study setting. The clinical presentation of the leptospirosis is highly protean and may vary from a mild illness to life-threatening complications as evident from the current study. As the disease is endemic and can have a fatal outcome, it should raise a high index of suspicion among the clinical fraternity when they come across a patient with fever and jaundice. A well planned multi-centric study done at different geographical locations could bring out better insight to the epidemiology of leptospirosis. (Holla, 2018)
Leptospirosis has low case fatality rate. However, it increases with advancing age and may reach 20% or more in patients with jaundice and kidney damage (Weil's disease) who have not been treated with renal dialysis. Incubation period of the disease is 7-10 days. Most of the cases were from the following regions: Region II & VI (14.8%), NCR (14.3%), Region X (11.4%) and Region II (8.1%) (DOH, 2016).

Attitude on Leptospirosis

Some of the limitations of this study include further exploration of reasons behind the involvement and non-involvement of the public in a particular prevention practice. Further investigation of this could be done qualitatively through open-ended questionnaires that would give respondents a freedom to express their opinions in detail. Additionally, social desirability bias could occur, for instance while determining the attitudes of the respondents regarding leptospirosis prevention. Respondents might give a response that they thought would be more acceptable to the interviewer rather than revealing their actual opinion. This could have been overcome by using self-administered or audio-assisted interview questionnaires for data collection. The positive attitude among the communities in the study area might be since sufficient knowledge on the routes of transmission of the disease encouraged the communities to have a positive preventive attitude. Knowing the symptoms of leptospirosis also made it easier for respondents to know when they must see a doctor because they are aware of the severity of the disease. It also shows that the health sector is doing a good job in reaching out to the communities to spread the information on diseases such as leptospirosis (Pathman et al., 2018).

The only variable that was significant for positive attitude and positive belief was education level. Although the knowledge of the respondents is not significantly related to the education level, we can see that the attitude and belief of an individual need to be cultivated from when that person is young, and this is where education level plays a big role. When they have higher education levels, this means that individuals have been attending school for a longer time and that the proper attitudes and beliefs about certain diseases, especially infectious diseases, have been instilled in them. People with lower education levels might have sufficient knowledge, but this does not mean that they have the proper understanding to translate it into proper attitudes. In addition, cultural norms also play an important role in the attitude of an individual (Abdullah et al., 2019).

Another aspect is that people with high levels of education might think that they know a lot and that they do not need to see a doctor if they become sick. Moreover, having a good education does not mean that an individual has a good income. Some practice habits require a certain amount of money to be spent on personal protective equipment, such as goggles and boots, which means, although having sufficient attitudes and beliefs, individuals cannot translate these into practice due to financial constraints. In contrast, a study in Thailand showed that educational status did play a significant role in the outcome of practice. The reason for this might be that the respondents did not have sufficient knowledge to put into practice, despite having sufficient financial support (Pathman et al., 2018).

Practices towards Leptospirosis

A recent study on the preventive measures of leptospirosis in a Malaysian urban community found out that improper waste management has been a major exposure and contact towards human beings that usually affects all living things including the ecosystem. As the improper management of the environment increases, animal carriers of such bacteria like rodents also increase (Abdullah et al., 2019).

Information dissemination through mass media, mainly using television, is the number one preventive and control strategy to avoid leptospirosis and this could be one of the information that they could share to members of the family and friends. The common prevention and control strategies practiced by the three groups of respondents were to maintain cleanliness on the surrounding and to keep good hygiene (Quina et al., 2014).

They found out that community-based health education and promotion activities are needed to increase knowledge about leptospirosis, and subsequently improve prevention practices. Potential delivery strategies could include using broadcast media to disseminate well defined, behaviorally focused disease prevention messages, and improving the capacity of local government health units to conduct health promotion activities (Arbiol et al., 2016).

Education level became the sole predictor to influence the good practice of respondents in this study. Similarly, the study in Philippines discovered high education level was associated with higher preventive practice among agricultural workers as compared to non-agricultural workers. Meanwhile, in a recent study in Madurai district of India, education level proved to have significant impact on knowledge and attitude of urban residents, but their practice still did not improve with education and workers while job category was associated with preventive practice of the respondents. The prediction supported the general idea that education level plays a crucial role in manifestation of good practice among the public (Pathman et al., 2018).

Conceptual Framework

The conceptual framework includes the correlation of the variables Awareness, Attitude, and Practices to each other. The framework shows how all the factors develop a connection to one another. The variables presented a formation of linkage between them and the categories of acquired perception from the respondents through engaging their awareness level, perception based on attitude, and the application of practices towards the case, leptospirosis.

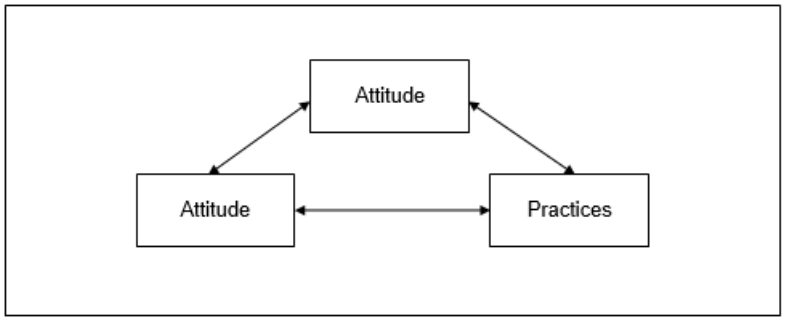

Figure 1. Conceptual Framework of the Study

Objectives of the Study

This research aims to know the level of awareness, attitude, and practices towards leptospirosis among selected residents in Laguna. Specifically, it describes the demographic profile of the respondents in terms of age, sex, educational attainment, and occupation; assess the awareness, attitude, practices towards leptospirosis; and determine significant relationships among the variables.

METHODOLOGY

This study is a descriptive correlational study designed to examine the relationship between the awareness, attitude, and practices of riverside settlers towards leptospirosis. The chosen locale is a barangay in Laguna who complied with the criteria of selection which were the frequency of floods, nearness to riversides, convenience to the respondents, and the abundance of the respondents to the community. A simple random sampling was applied to select the respondents due to cost-effectiveness and availability. The researchers used G*Power software to determine the sample size of 42 with effect size of 0.5, and power of 0.95.

A questionnaire was administered as a standardized survey instrument, which was adapted following the recommendations for Knowledge, Attitude, and Practices (KAP) studies. These questionnaires have been used widely in public health studies as a tool to gather information on knowledge and attitude on certain subjects and to assess the practice on the matter among those at risk. The 36 questions in the questionnaire fell into the following categories: demographic and socioeconomic characteristics; awareness on leptospirosis, attitudes towards leptospirosis, and individual and household practices related to environmental risk factors for leptospirosis. A 4-point Likert Scale was used as the range of the questionnaire. The researchers conducted a methodological gathering procedure for ethical considerations. Preparation of letters for permission, consents, and documentation of such was done for the survey to be conducted. The respondents have the ethical right to accept or reject answering the survey questionnaire after they are oriented with the study and its purpose. Statistical analysis included weighted mean, Spearman-rho correlation, and Chi square analysis using the software Statistical Package for the Social Sciences (SPSS).

RESULTS AND DISCUSSIONS

Table 1 shows the demographic profile of the respondents. It shows that the highest age of the respondent interviewed is 67 and the lowest will be 26. Computed with the weighted mean, it resulted to have an average of 40.19. Majority of the respondents are female with the.52% of the population, while male has lower population of 40.48%. Majority of the respondents has secondary level of education with 69.04%. College had 12 respondents with 28.57% and Vocational with a frequency of 1 resulting to have 2.38%. Employees in a private sector have the highest present respondents with 20 participants resulting in a percentage of 47.62%. Lastly, the employed in public sectors garnered 21.43% from the 9 respondents.

Table 1. Demographic profile of respondents

Profile	Min	Max	Mean	SD
Age	26	67	40.19	10
		Frequency		Percent
Sex				
Male		17		40.48
Female		25		59.52
Educational Attainment				
Elementary		0		0
Secondary		29		69.04
College		12		28.57
Vocational		1		2.38
Occupation				
Unemployed		13		30.95
Employed (Private)		20		47.62
Employed (Public)		9		21.43

Table 2 shows the respondents' level of awareness on leptospirosis. The respondents were strongly aware regarding the preventive measures along with the idea that leptospirosis can be treatable and may cause death. The respondents answered moderately aware to most questions and slightly aware to situational examples. Among all questions on the awareness attribute, the maintenance of household compound cleanliness obtained the highest weighted mean. House cleanliness has been people's predictor for physical health than neighborhood walkability thinking that those who kept their homes clean will be healthier and be more active than those who do not (Ryback, 2016). With this, individuals will more likely clean their houses whatever disease they will be exposed. Identifying the level of awareness on Leptospirosis was interpreted from the different basic information about the disease. Assessing the level of awareness regarding Leptospirosis is through how the disease could be diagnosed, transmitted, manifested in an individual and preventive measures such as maintaining cleanliness and avoiding contact with flood (Nozmi etc., 2018).

Table 2. Level of awareness on leptospirosis of the respondents

	Weighted Mean	Verbal Interpretation
Leptospirosis is a disease caused by microorganism.	3.47	Moderately Aware
Leptospirosis is a zoonotic disease.	3.28	Moderately Aware
Leptospirosis can enter our body through cuts.	3.38	Moderately Aware
Infected person with Leptospirosis may have jaundice.	2.95	Moderately Aware
Leptospirosis can cause death.	3.67	Strongly Aware
Leptospirosis can cause kidney failure.	3.31	Moderately Aware
Eating while working is risk to get leptospirosis.	2.45	Slightly Aware
Drinking while working is a risk to get leptospirosis.	2.31	Slightly Aware
Town service workers is considered as risk for leptospirosis.	3.00	Moderately Aware
Leptospirosis is treatable.	3.57	Strongly Aware
Leptospirosis can be prevented by maintaining house compound cleanliness.	3.86	Strongly Aware
Leptospirosis can be prevented by avoiding walking through flood.	3.81	Strongly Aware
Composite Mean	3.26	Moderately Aware

Legend: 1.00-1.49 Not aware; 1.50-2.49 Slightly aware; 2.50-3.49 Moderately Aware; 3.50-4.00 Strongly Aware

Table 3 reflects the level of attitudes towards Leptospirosis, and the interpretation for each weighted mean. Assessing the respondents' attitudes towards Leptospirosis depict the acceptable and unacceptable view and behavior towards the infection. The results show the agreement of the respondents towards the matter of behavior in preventing and transmitting Leptospirosis. Results that imply a highly positive attitude can be a source of enhancing the interest to attain the awareness and the result in adapting such practices in preventing the disease (Arbiol etc., 2016). Results also showed that the respondents generally think that they should know more about leptospirosis. Knowledge is a justified true belief, more than a true opinion. This makes individuals be curious to know more about the subject as they wanted explanations for relation and reasons why they are doing the usual things (Lickerman, 2010).

Table 3. Level of attitude on leptospirosis of the respondents

	Weighted Mean	Verbal Interpretation
Drinking while working is not a problem.	2.86	Agree
I need a "safe work practice" course in order to prevent from getting the disease.	3.60	Strongly Agree
Rubber gloves is important equipment during working.	3.62	Strongly Agree
Wearing gloves during working is troublesome.	2.69	Agree
Wearing gloves during working make our work slower.	2.45	Disagree
Wearing gloves during working make me feel discomfort.	2.52	Agree
Wearing boots make our work slower.	2.40	Disagree
I must know about leptospirosis.	3.83	Strongly Agree
I do not mind to wear any type of shoe.	2.40	
I should make sure that my house is free from rats.	2.54	Strongly Agree
I mind if the dustbin in my house had no cover.	2.02	Disagree
I do not feel worry walking through flood.	1.81	Disagree
Composite Mean	2.81	Agree

Legend: 1.00-1.49 Strongly Disagree; 1.50-2.49 Disagree; 2.50-3.49 Agree; 3.50-4.00 Strongly Agree

Results on Table 4 has been on the positive end as low weighted mean scores has been obtained on consuming anything while working having 2.57, 2.50, and 1.55, respectively and walking through flood having 1.79 indicating seldom practice. It was observed that the respondents are often cautious on the risks they are exposed to obtain such disease with most having above 3.00 above scores. Prevention is always done if practices are always conducted. With factors associated, it is hypothesized that prevention practice of the illness can be significantly associated with one's socioeconomic and demographic profile, along with a person's awareness level and behavior (Arbiol et. al., 2016).

Table 4. Level of practices on leptospirosis of the respondents

	Weighted Mean	Verbal Interpretation
Eating while working.	2.57	Often
Drinking while working.	2.50	Often
Smoking while working.	1.55	Seldom
I remind my colleagues to follow the working procedure.	3.38	Often
I wear rubber gloves during working.	3.24	Often
I wear boots during working.	3.12	Often
I wearmask during working.	3.40	Often
I make sure the glove is in good condition before using it.	3.69	Always
I make sure my house is free from rats.	3.69	Always
I walk through flood.	1.79	Seldom
I cover the food.	3.83	Always
I stay cautious of things that may cause wounds.	3.40	Often
Composite Mean	3.01	Often

Legend: 1.00-1.49 Never; 1.50-2.49 Seldom; 2.50-3.49 Often; 3.50-4.00 Always

Table 5 shows the relationship of awareness and attitudes, awareness and practices, and attitudes and practices. Rho-value and p-value were computed to show the level of significance from the components of the study. There is no significant relationship between the awareness vs. attitude having a value of 0.358 which is lower than the value 0.05 to present significance in their relationship. Relationship of attitude and practice is not significant because the value computed is 0.380 that fails to reach the significant value. The relationship towards awareness and practice brings significance with a rho-value of 0.540 indicating that there is a direct positive relationship between the variables indicating that greater awareness on leptospirosis means transformation of practices towards better preventive measures.

Table 5. Relationship between awareness, attitude, and practices of respondents

	Rho-value	p-value	Interpretation
Awareness vs Attitude	-0.145	0.358	Not Significant
Awareness vs Practice	0.540	0.000	Significant
Attitude vs Practice	-0.139	0.380	Not Significant

CONCLUSIONS

The study surveyed the awareness, attitudes, and prevention practices of leptospirosis among selected respondents in Laguna living near the bodies of water, specifically riverside. This study has some limitations worth noting. First, the study did not cover the range of reasons for engaging or not engaging in specific prevention practices and individual perceptions in risks. Third, the respondents in this study were adults. While leptospirosis is more common and severe in adults, it is also known to affect children.

In general, all attributes showed satisfactory results but showed great variation on specific question response. Positive attitude towards safe work practices and its importance and positive awareness and practices towards household cleanliness were observed in this study. Apart from the relationship between awareness and prevention practices, no significant relationship was found in the correlation analyses between variables. A moderately positive attitude result was not sufficient to significantly relate with both awareness and practice variables.

Recommendations

Seminars and continuous trainings for the people may develop their awareness on how to avoid and prevent leptospirosis for the residents' benefit. With the given limitations, future studies may address the first limitation using open-ended qualitative questionnaires to explore in detail the reasons for respondents' choices and may examine the knowledge, attitudes, and practices among children.

The occupational health entities in the working sector should be strengthened by incorporating measures to monitor leptospirosis and other zoonotic diseases, providing health and safety training programs and encouraging collaboration between health policy makers, local government, relevant organizations, and cooperatives.

REFERENCES

Abdullah N. (2019) Leptospirosis and its prevention: knowledge, attitude and practice of urban community in Selangor, Malaysia. BMC Public Health. Retrieved September 30, 2019 from bmcpublichealth.biomedcentral.com/articles/10.1186/

Arbiol, J., Orencio, P.R., Romena, N., Nomura, H. Takahashi, Y., & Yabe, M., (2016). Knowledge, attitude and practices towards Leptospirosis among lakeshore communities of Calamba and Los Baños, Laguna, Philippines. Retrieved September 30, 2019 from

kyushuu.pure.elsevier.com/en/publications/knowledge-attitude-and-practices-towards-Leptospirosis-among-lake

Azfar, M., Nazri M., Rusli M., (2018) Knowledge, attitude and practice about leptospirosis prevention among town service workers in northeastern Malaysia. Retrieved November 13, 2019 from ncbi.nlm.nih.gov/pmc/articles/PMC6009071/

Brazier, Y. (2018). Leptospirosis: What you need to know. Retrieved October 13, 2019 from medicalnewstoday.com/articles/246829.php

Davis, C.P. &Stoppler, M.C. (n.d). Leptospirosis. Retrieved September 30, 2019 from www.medicinenet.com/Leptospirosis/article.htm?fbclid=IwAR2V UxVDqt5Fkg0L_0MT_i5QKHUXcJVwckTuZ7xnegXCPnuIo0oUILAers

DOH, (2015). Can Leptospirosis be prevented? Retrieved from (2019) www.doh.gov.ph/node/17371

DOH, (2015). Leptospirosis. Retrieved October 13, 2019 from https://www.doh.gov.ph/Health-Advisory/Leptospirosis

DOH, (2015). The outbreak in olongapo. Retrived from October 13, 2019 from www.doh.gov.ph/Top-Health-Stories/LEPTOSPIROSIS-OUTBREAK-IN-OLONGAPO

DOH, (2015). The series of downpours may bring Leptospirosis. Retrieved October 13, 2019 from www.doh.gov.ph/node/14641

DOH, (2015). The surge of Leptospirosis. Retrieved October 13, 2019 from www.doh.gov.ph/node/1497

DOH, (2015). Can Leptospirosis be prevented? Retrieved from October 13, 2019 www.doh.gov.ph/node/17371

DOH (2016), Leptospirosis Cases. Retrieved September 30, 2019 from doh.gov.ph/sites/default/files/statistics/LEPTOSPIROSIS%20MW15.pdf

Ganti, A. (2019). Weighted Average. Retrieved 2019 from www.investopedia.com/terms/w/weightedaverage.asp

Goarant, C. (2016). Leptospirosis: Risk Factors and Management Challenges In Developing Countries. Retrieved September 30, 2019 from dovepress.com/Leptospirosis-risk-factors-and-management-challenges-in-developing-cou-peer-reviewed-article-RRTM

Heidel, E. (2016). Demographic variables. Retrieved 2019 from https://www.scalelive.com/demographic-variables.html

Holla R. (2018) Leptospirosis in Coastal South India: A Facility Based Study. Biomed Research International. Retrieved October 1, 2019 from www.hindawi.com/journals/bmri/2018/1759125/abs/

Haake, D.A, &Levett P.N. (2015). Leptospirosis in Humans. Retrieved September 30, 2019 from www.ncbi.nlm.nih.gov/pmc/articles/PMC4442676/

Levett, P. (2010) Leptospirosis. Epidemiology. Retrieved September 30, 2019 from https://cmr.asm.org/content/14/2/296

Lickerman A., (2010) Why we need to know why. Retrieved November 13, 2019 from psychologytoday.com/us/happiness-in-world/2010/why-we-need-know-why

Nozmi, Osman, Daud, et. al. (2018). Low Levels of Knowledge, Attitudes and Preventive Practices on Leptospirosis among a Rural Community in Hulu Langat District, Selangor, Malaysia. Retrieved 2019 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5923735/#__ffn_sectitle

Pathman A. (2018) Knowledge, Attitudes, Practices, and Health Beliefs toward Leptospirosis among Urban and Rural Communities in Northeastern Malaysia. Retrieved September 30, 2019 from ncbi.nlm.nih.gov/pmc/articles/PMC6266327

Quina, C.R., Almazan, J.U., &Tagarino, J.B. (2013). Knowledge, Attitudes, and Practices of Leptospirosis in Catbalogan City, Samar, Philippines. Retrieved September 30, 2019 from pubs.sciepub.com/ajphr/2/3/5/index.html

Ryback R., (2016) The Powerful Psychology Behind Cleanliness. Retrieved November 13, 2019 from www.psychologytoday.com/us/blog/the-truisms-wellness/201607/the-powerful-psychology-behind-cleanliness

Tasio H. (2018) Leptospirosis: The Flood-borne Legacy. Business Mirror. Retrieved September 30, 2019, from hbusinessmirror.com.ph/2018/07/12/Leptospirosis-the-flood-borne-legacy/?fbclid=IwAR1JB_PTrO30q2ZBG4F2Mdk76fGT2e2v2wqt1rQ

USC Libraries (2019). Research Guides. Retrieved 2019 from libguides.usc.edu/writingguide/quantitative

Wochenschr, W.K. (2015). Evaluation of the Immunochromatographic (Leptocheck) Test for Detection of Specific Antibodies Against Leptospires. Retrieved September 30, 2019 from ncbi.nlm.nih.gov/pubmed/26381276

WHO, (2010). Diseases Leptospirosis Burden Epidemiology Reference Group (LERG) Retrieved October 13, 2019 from who.int/zoonoses/diseases/lerg/en/index2.html

WHO, (2011). Leptospirosis –Fact Sheet. Retrieved 2012 from www.paho.org>alias=39726

WHO, (2019) Leptospirosis. Retrieved October 13, 2019 from medicalnewstoday.com/articles/246829.php