*Advances in Health Sciences Research, volume 24*
**5th Universitas Ahmad Dahlan Public Health Conference (UPHEC 2019)**

# Improving Primary Health Care Workers' Knowledge to Strengthen Leptospirosis Surveillance in Demak District, Indonesia

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***Abstract*—Leptospirosis has become an important public health problem in Demak District, Central Java, Indonesia. Early diagnosis and appropriate treatments have been carried out to prevent an increase of leptospirosis cases in this region. However, these efforts are still hampered due to the lack of knowledge of leptospirosis, especially in the primary health care level. It is necessary to take effective clinical Leptospirosis training approaches to improve primary health care workers' competency on leptospirosis surveillance. The aim of this study was to strengthen the capacity of the primary health care workers to improve their knowledge on clinical leptospirosis. The quasi-experimental study (one group pre-post test without control) was conducted among 34 participants from all sub-district health offices in Demak District, Central Java. The training was administered for one day with assessment at the baseline and the post-training. The four training outcomes were score changes in workers' knowledge of the clinical manifestations of leptospirosis suspected cases, probable cases; the appropriate time of using Rapid diagnostic tests for diagnosing leptospirosis suspects; and the implementation of active and passive case detection. The result showed a statistically significant difference in knowledge achievement between pre-training (66.46±2.16) and post-training (80.78±1.82). The percentage of the total knowledge between the baseline and the post-training increased significantly by 22.39%. These findings are expected to give a contribution to workers' knowledge to improve the competency of public health care workers on clinical leptospirosis and recommended to be disseminated in similar settings to strengthen leptospirosis surveillance.**

***Keywords: improve, knowledge, primary health care worker, leptospirosis, Demak***

## I. INTRODUCTION

Leptospirosis is one of the zoonotic diseases that occurs as both an emerging and re-emerging disease in Indonesia [1]. Leptospirosis is caused by pathogenic Leptospira bacteria that enter human bodies through mucosa, digestive tracts, or skin wounds [2]. Leptospirosis is spread through the media of water, soil, and food contaminated by leptospira bacteria from the urine of sick animals. The main leptospirosis reservoir is rats, but other mammals that are also reported to

 

contribute to leptospirosis transmissions are dogs, cats, cows, and goats [3].

A leptospira infection in humans can be without symptoms or with mild symptoms or severe complications. WHO divided the criteria for leptospirosis cases into 3 groups, including suspect, probable, and confirmed [4]. The early symptoms of suspected leptospirosis are the appearance of high fever, headache, feeling of weakness, and accompanied by conjunctiva suffusion. The similarity of early symptoms between suspected leptospirosis and general viral infections symptoms becomes one of the difficulties in diagnosing leptospirosis. Leptospirosis is often diagnosed as another infectious disease (underdiagnosed). The lack of specific clinical diagnosis and the high cost of laboratory examinations also make many cases of leptospirosis are under-reported [5,6].

The criteria for diagnosing WHO SEARO 2009 leptospirosis turned out to be used to diagnose cases of an acute undifferentiated fever. This is evident that all suspected leptospirosis cases fell into the diagnosis of mild leptospirosis [4]. This means that by using WHO criteria, medical staff can determine the acute febrile patient as a suspected case of leptospirosis and proves that it is in accordance to the laboratory results as a confirmed case of leptospirosis. This result is in line with the study conducted in Semarang that leptospirosis is one of the causes of acute undifferentiated fever [7].

Demak District of Central Java Province is one of the leptospirosis endemic areas in Indonesia. Leptospirosis has become an important public health problem in Demak District. The number of cases and deaths from leptospirosis in Demak district in the period of 2015-2017 increased. In 2015, the number of leptospirosis cases was 11 people, without death. Meanwhile, in 2016, there were 11 cases with 5 deaths and in 2017 there were 34 cases with 6 deaths. There was 85% PHCs in Demak that reported leptospirosis cases during 2015-2017. The majority of reported cases came from hospital reports with quite a serious patient's condition [8,9]. The detection of leptospirosis cases in early symptoms can reduce the rate of fatality. The Primary Health Care (PHC) is the first level health care facility provided by the Indonesian government in each sub-district. One of the tasks of the PHC is to improve public health through promotive, preventive, curative, and rehabilitative efforts [10]. The PHCs are expected to be the first facility that can be used to find and treat suspected leptospirosis cases in their early stages so that complications and fatality of leptospirosis can be avoided.

Early diagnosis and appropriate treatment have been carried out to prevent an increase of leptospirosis cases in Demak District. However, these efforts are still hampered due to the lack of knowledge about leptospirosis, especially at the primary health care level. Medical staff at PHC needs good knowledge to recognize the early symptoms of suspected leptospirosis in order to reduce the misdiagnosis for the detection of leptospirosis cases. Demak District Health Office cooperates with IVRCRD to conduct training for PHC medical staff primarily to improve skills in recognizing early symptoms of leptospirosis. It is necessary to take effective clinical leptospirosis training approaches to improve primary health care workers' competency on Leptospirosis surveillance. The aim of this study was to strengthen the capacity of primary health care workers in improving their knowledge about clinical leptospirosis. The results of the study are expected to improve leptospirosis control program as an effort to reduce morbidity and mortality in Demak District.

## II. METHOD

### *A. Ethical Approval*

The ethical clearance was obtained from the Ethics Commission Board of National Institute of Health Research and Development, Ministry of Health Indonesia No.LB.02.01/2/KE.082/2018. The informed consent was obtained from each participant during the study.

### *B. Participants and Trainers*

All PHCs (27 health centers) in Demak District were involved in the study. Each health center was requested to send two medical service personnel to attend the training activities. The Medical service staffs were chosen as samples because they became the first gate for the discovery of suspected leptospirosis cases in the PHC through clinical symptom recognition. A total of 34 participants participated in the research activities consisting of 32 medical personnel (16 doctors and 16 nurses) and 2 non-medical personnel (1 sanitarian and 1 surveillance staff). The trainers came from the Demak District health office as leptospirosis expert team (medical and surveillance experts), and the researchers from the Institute for Vector and Reservoir Control, Research and Development (IVRCRD), NIHRD-MoH.

### *C. Interventions*

The intervention used in this study was a quasi-experimental study design (one group pre-post test without control). The training was administered for one day on April 30$^{th}$, 2018 in Sunan Kalijaga Hospital, Demak District. There were 9 topics of training based on the discussion results between the research team of IVRCRD, senior clinicians, and tropical diseases consultant from the central public hospital who had experiences in leptospirosis diagnosis. The topics were identification of causative agent, risk factors, routes of transmission, reservoirs of leptospirosis, identification of clinical symptoms of suspect leptospirosis, identification of clinical symptoms of probable leptospirosis, general laboratory test for leptospirosis diagnosis, Rapid diagnostic tests for diagnosis of suspect leptospirosis, and leptospirosis surveillance methods (active and passive). The topics were presented to the participants by using PowerPoint presentations, visual images, and leptospirosis case studies. For the clinical symptom recognition topics, particularly in distinguishing between suspected and probable cases, the trainers emphasized on clinical signs in patients, symptoms of complaints experienced by patients, and laboratory results. All participants were actively encouraged to discuss and share their experiences during the training.

### *D. Data Collections and Analysis*

The training evaluation was carried out by using a questionnaire filled out by the participants. The questionnaire consisted of 2 question groups, including socio-demographic information and the participant's knowledge of leptospirosis diagnosis and surveillance. The social demographic data collected were gender, age,

education background, and profession. The knowledge questions consisted of causal questions, risk factors, modes of transmission, clinical symptoms, supporting laboratory examinations, the appropriate time for using RDT and surveillance of leptospirosis. Each correct answer was scored 10 points. The knowledge of the participants was evaluated before (as a baseline) and after the training for 15 – 20 minutes.

The socio-demographic data were analyzed descriptively in percentage. In addition, the data of participant's knowledge were presented as mean and standard deviations. Overall knowledge scores were compared between baseline and post-training obtained from the total score and the individual topic score. An independent t-test analysis was used to measure the difference in mean scores for baseline and post-test between groups of doctors and nurses. Meanwhile, a comparison between the baseline and post-training of participants' knowledge scores was analyzed by using a paired t-test.

## III. RESULTS

Table I shows socio-demographic data from the participants in Demak District in 2018. The majority of 34 respondents were female (70.6%). The age of participants was dominated by the group labeled 38 - 45 years. Most participants had Medical Degree backgrounds, in which the doctor and nurse were the most groups who attended the training.

TABLE I. SOCIO-DEMOGRAPHIC INFORMATION OF THE PARTICIPANTS IN DEMAK IN 2018

| Socio-demographic Information | | n (N=34) | Percentage (%) |
|---|---|---|---|
| Sex | Male | 10 | 29.4 |
| | Female | 24 | 70.6 |
| Age (year) | 26-37 | 5 | 14.7 |
| | 38-45 | 22 | 64.7 |
| | 46-53 | 7 | 20.6 |
| Education background | Nursing-diploma | 12 | 35.3 |
| | Medical degree | 16 | 47.1 |
| | Nursing degree | 6 | 17.6 |
| Profession | Doctor | 16 | 47.1 |
| | Nurse | 16 | 47.1 |
| | Sanitarian officer | 1 | 2.9 |
| | Surveillance officer | 1 | 2.9 |

This study was aimed to measure the clinical knowledge of medical personnel who directly conducted examinations on patients at PHC. Therefore, a knowledge analysis for participants who worked as sanitation and surveillance officers was not conducted. Based on the independent t-test results, there were no significant differences between groups of doctors and nurses for both baseline and post-training tests (Table II). Pre and post-training evaluations indicated that the participant's knowledge about leptospirosis showed significant improvement in which a better progress was observed among nurse (23.57%) than medical doctors (21.29%).

TABLE II. BASELINE AND POST-TRAINING SCORE OF THE PARTICIPANTS IN DEMAK IN 2018 BASED ON THE INDEPENDENT T-TEST

| | Mean score ±SD | Min | Max | Percentage change (%) [a] | p-value |
|---|---|---|---|---|---|
| **Baseline** | | | | | |
| Doctors | 67.81 ± 12.31 | 45.0 | 96.0 | | 0.41 |
| Nurse | 64.18 ± 12.30 | 30.0 | 86.0 | | |
| **Post-training** | | | | | |
| Doctors | 82.25 ± 11.01 | 64.0 | 98.0 | 21.29 | 0.43 |
| Nurse | 79.31 ± 9.70 | 64.0 | 95.0 | 23.57 | |

a. Percentage change: (Post-training score - baseline score/baseline score*100)

TABLE III. SOCIO-DEMOGRAPHIC INFORMATION OF THE PARTICIPANTS IN DEMAK IN 2018

| Questions | Mean ± SD of baseline score | Mean ± SD of Post-training score | Percentage change (%)[a] | p-value |
|---|---|---|---|---|
| Cause of leptospirosis | 9.06±2.97 | 9.38±2.46 | 3.53 | 0.32 |
| Risk factors of leptospirosis | 5.69±2.39 | 5.31± 2.41 | -6.68 | 0.37 |
| Routes of transmission to human | 9.84±0.88 | 10.00±0.00 | 1.63 | 0.33 |
| Reservoir of leptospirosis | 10.00±0.00 | 10.00±0.00 | 0[b] | NA[b,c] |
| Clinical signs of suspect leptospirosis | 2.81±4.57 | 3.90±3.96 | 38,79 | 0.00* |
| Clinical signs of probable leptospirosis | 8.75±3.11 | 10.00±0.00 | 14.29 | 0.03* |
| General laboratory test for the diagnosis of leptospirosis | 9.22±2.24 | 10.00±0.00 | 8.58 | 0.05 |
| The appropriate time of using RDTs for diagnosing leptospirosis suspects | 2.18±4.20 | 4.68±5.07 | 114.68 | 0.01* |
| The difference between active and passive surveillance | 3.90±4.87 | 9.37±2.46 | 140.26 | 0.00* |
| Total | 66.00±2.16 | 80.78±1.82 | 22.39 | 0.00* |

a. Percentage change: (Post-training score - baseline score/baseline score*100)
b. Paired t-test can be analyzed because there was no difference between baseline and post-training scores
c. NA=not analyzed

The result of the baseline and the post-training scores of the participants in Demak in 2018 can be seen in Table III. Among questions proposed to participants, the question on reservoirs of leptospirosis was not included in the analysis because the mean score of baseline and post-training was equal. In baseline result, the highest score was found in the knowledge of reservoir of leptospirosis. However, the

lowest score was gained from the knowledge of using RDTs for the diagnosis of a suspect of leptospirosis (2.18±4.20). For the post-training result, there was three topics which were understood well by the participants (score 10.00±0.00) i.e. routes of transmission to human, general laboratory test for the diagnosis of leptospirosis and clinical signs of probable leptospirosis.

Knowledge scores that showed a significant increase between baseline and post-training were on questions about the clinical signs of leptospirosis, clinical signs of probable leptospirosis, the difference between active and passive surveillance, the appropriate time for using RDT for diagnosing of suspect leptospirosis, and the difference between active and passive surveillance. The percentage change of total knowledge in baseline and post-training scores was 22.39%. The results of statistical analysis showed that there were significant differences between the scores of the baseline and post-training (p-value <0.00).

## IV. DISCUSSION

This study showed four variables of knowledge increased significantly i.e. identification of clinical signs of suspect leptospirosis, identification of clinical signs of probable leptospirosis, the appropriate time of using of RDT for diagnosing leptospirosis suspect and the difference between active and passive surveillance. Independent t-test result showed that there was no significant difference between doctors and nurse for both baseline and post-training test, which means that the results of the training were well-understood by the two groups of participants. These results are in line with other studies which mention the success of increasing the knowledge of participants from different medical education backgrounds [11–13].

During the baseline and post-training tests, doctor's knowledge score was higher than nurse's score, but nurses had a higher difference in knowledge improvement compared to the doctor's. This result has similarity with the result from a study of various medical staffs training in Lebanon which showed that nurses had the highest improvement knowledge scores than medical doctors [13]. Providing training materials can increase participants' knowledge, especially in recognizing the symptoms of leptospirosis at an early stage. Medical staff at PHCs has understood the early symptoms of leptospirosis so that they are expected to provide treatment earlier.

This study was mainly attempted to describe the knowledge of participants on clinical sign of leptospirosis. The clinical symptoms of leptospirosis that are similar to other viral infections, often make medical personnel difficult to diagnose. The wide spectrum of symptoms makes leptospirosis misdiagnosed or underdiagnosed. The clinical manifestations of leptospirosis are highly varied from nonspecific symptoms such as flu like illness, nausea, vomiting, appetite loss, to more serious stages such as the appearance of hematological, gastrointestinal, cardiac manifestation and renal failure [14,15].

After receiving the training, the medical staff's knowledge score on clinical signs of suspected leptospirosis increased significantly. Medical staff at PHCs has understood the early symptoms of leptospirosis so that they are expected to provide a treatment earlier. An early treatment of leptospirosis is important to prevent disease complications. Patients who do not get the treatment will continue to suffer a more serious and potentially fatal condition of leptospirosis. A treatment with new antibiotics can be given if the patient has leptospira infection [16]. The discovery of the case of leptospirosis in its early stage determines the treatment given. The earlier antibiotics are given to patients, the rate of complications and mortality can be reduced [17]. According to the MoH, PHCs plays a role in community-based leptospirosis surveillance by active and passive case detection. The task of the PHC is to screen suspected cases and confirmation of leptospirosis cases that come to health care facilities or cases that have been diagnosed with leptospirosis by a doctor [18].

In this study, although participants had already known about general laboratory test for the diagnosis of leptospirosis, the results of Rapid Diagnostic Test (RDT) examination confused doctors to determine leptospirosis cases. Determination of leptospirosis cases in PHCs based on clinical symptoms and RDT (Rapid Diagnostic Test) results refers to the guidelines for controlling leptospirosis by MoH [18]. The patient was categorized as a probable case if the result of RDT was positive. Otherwise, if the RDT result was negative, it was not included as a case of leptospirosis. However, leptospirosis RDTs have a weakness that is a low level of sensitivity for the first week of illness [19,20]. Laboratory testing using serological test showed that the potential for diagnosing leptospirosis was effective after 6 days' post onset of symptoms [21].

Knowledge of RDTs scores of participants also had the biggest differences between before and after training. These results indicate that medical staffs at PHC have understood the limitations of the use of RDTs. Patients with an acute fever who clinically had early symptoms as suspected leptospirosis were rejected as probable cases because RDT examinations performed in a week of the beginning of the fever did not appear (false negative). An increased surveillance and the use of accurate diagnostic tools were needed to further increase the incidence and improve the diagnosis of leptospirosis [22]. The training suggested doctors to use general laboratory tests available at PHCs to support the diagnosis of leptospirosis if the RDT examination from the patient showed a negative result. Doctors also advised patients to seek treatment back to PHC within 3-7 days so that doctors could monitor the patient's condition and confirmed the results of the RDT.

The percentage of the total knowledge between the baseline and the post training increased significantly. This shows that the training activities were able to increase participants' knowledge of leptospirosis surveillance activities. The existence of routine surveillance, especially in PHCs, is the main point for controlling risk factors and the spread of bacteria to the environment. The implementation of leptospirosis surveillance in PHCs begins with the discovery of suspected leptospirosis cases by medical personnel and is followed by investigating the risk factors of the suspected. Epidemiological investigation data include the search for social demographic conditions and suspected environment useful for preventing the spread of leptospirosis in the patient's living environment.

Participants received material explanations from the trainer presentations with additional visual images. The use of image visualization for health education in adult groups could trigger participants to play an active role in discussions and submit topics to ask further questions to the trainers [23]. One of the methods in training was an interactive discussion using case studies. In the case study, participants presented examples of leptospirosis in suspected, probable, and confirmed criteria from both clinical symptoms and laboratory examination. The advantage of case studies is to observe and study a topic from two similar conditions more intensively [24]. The method was expected to help medical staffs to compare their experiences in diagnosing patients at the health center so far with the material obtained during training. According to Rocque et al, using a multidisciplinary approach for medical staffs training increased participants knowledge significantly [13]. Training in Demak also presented trainers from a senior doctor, who was expected to provide medical insights on the diagnosis of leptospirosis especially in young doctors at the PHC level. Studies in Queensland show that the knowledge gap between junior and senior doctors is one of the obstacles in managing patients. Junior doctors need to learn experiences from senior doctors so they can add to their skills at work [25].

The limitation of this study is the evaluation on the level of knowledge measured only once after the training. Further studies after training need to be done to see knowledge retention in participants. The study of attitudes and practices level of medical personnel needs to be carried out to describe the medical staff's behavior for leptospirosis case detection at PHCs.

## V. CONCLUSION

In general, the level of participant's knowledge increased significantly. The percentage of the total knowledge between the baseline and the post training increased significantly by 22.39%. This shows that the training activities were able to increase participants' knowledge of leptospirosis surveillance activities. These findings will contribute knowledge to improve the competency of public health care workers on clinical leptospirosis and is recommended to be disseminated in similar settings to strengthen leptospirosis surveillance.

## ACKNOWLEDGMENT

Our gratefulness goes to the Head of IVRCRD for the support given, the Head of Demak District Health Office and PHCs, along with their staff, Mr. M. Hussein Gasem, Sp.PD-KPTI,PhD,FINASIM, Mr.April Hari Wardhana SKH., MSi., PhD, and data collection team who had helped and participated in the implementation of this research.

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