



## Potential Sources of Transmission and Distribution of Lymphatic Filariasis in Semarang City, Central Java, Indonesia

Nurjazuli Nurjazuli<sup>1✉</sup>, Aris Santjaka<sup>2</sup>

<sup>1</sup>Departemen of Environmental Health, Faculty of Public Health Diponegoro University, Semarang

<sup>2</sup>Departemen of Environmental Health, Health Polytechnic, Semarang

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### Abstract

*Lymphatic Filariasis (LF) is a neglected tropical disease caused by filarial worms. Semarang City has an increasing number of LF. The aim of this study was to investigate potential sources of transmission and distribution of LF. It was descriptive research using cross-sectional design. The sample were 28 LF cases. The variables studied were level of knowledge, physical and biological environmental factors, and provision of health service. Data were collected with interview and observation. Data were analysed descriptively and spatially. The results showed that LF cases were distributed in centre of Semarang City, especially in the coastal area. Poor drainage and stagnant water around the houses were potential breeding places for mosquitos, which are suspected as a vector of LF transmission. Physical and biological environmental factors around the houses of LF patient may possibly be sources of distribution and transmission of LF. It was indicated with the existence of mosquito larvae in any habitats.*

### Introduction

Lymphatic Filariasis (LF) is one of the neglected tropical diseases (NTDs), likely transmitted by mosquito vectors. This disease has become of global concern and even become a major public health problem in 11 Southeast Asian countries (WHO, 2013). This disease does not only affect large numbers of people, high morbidity, and mortality but also affects productivity and the social life regionally (Narain et al., 2010).

Almost all regions of Indonesia are endemic to LF. The provinces with the highest number of clinical cases are Aceh, East Nusa Tenggara, Papua, Riau and East Kalimantan (East Borneo).

The endemic level in Indonesia varies from 0% to 40%. Central Java is one of the LF endemic areas in Indonesia, with an mf rate of 0.8% (Wahyono, 2010). Semarang City is not thought of as an endemic area for LF, but based on registered data up until 2016, there have been 27 cases of LF (Health Office of Semarang, 2016). Some of them were new cases reported in 2014–2015, and case reports have increased year to year recently.

Community behavior and environmental conditions in terms of disease prevention have been relatively poor, especially in coastal areas. Poor knowledge about LF may be pre-disposing factor for LF transmission. Many habitats like

✉ Correspondence Address:

Environmental Health Department, Faculty of Public Health,  
Diponegoro University, Semarang 50271

E-mail: nurjzl\_fkmundip@yahoo.co.id, Phone: +62-24-7460044

Table 1. The distribution of LF based on district area in Semarang City 2016

No	Sub-District	Frequency	Percentage (%)
1	Semarang Selatan	1	3.70
2	Semarang Barat	9	33.3
3	Semarang Timur	1	3.70
4	Semarang Utara	3	11,1
5	Ngaliyan	2	7.40
6	Tembalang	2	7,40
7	Candi Sari	1	3.70
8	Pedurungan	6	22.2
9	Semarang Tengah	2	7.40

drainage with standing water, pool, river provide good sites for mosquito breeding. These factors may be related to the occurrence of LF in Semarang City. Therefore, the objective of this study was to analyze the potential sources of transmission and distribution of LF in Semarang City.

**METHOD**

It was a descriptive research with cross-sectional design. The research was conducted in Semarang City, Central Java on July till August 2016. The study population was all lymphatic filariasis cases in Semarang City up to 2016. The number of lymphatic filariasis cases were limited,

so a total number of 28 cases had been selected to be sample included in this research. Data source of lymphatic filariasis cases was taken from registry on the District Health Office of Semarang City. The variables studied were level of knowledge, physical and biological environmental factors, and provision of health service related to health promotion and prevention efforts regarding LF. A questionnaire and checklist were used as research instrument for data collecting. Data collection was done by interviewing respondents and observing the physical and biological environment variables. Data processing was done using computer aid. And data analysis was presented

Figure 1. Spatial distribution of LF cases in Semarang City 2016.

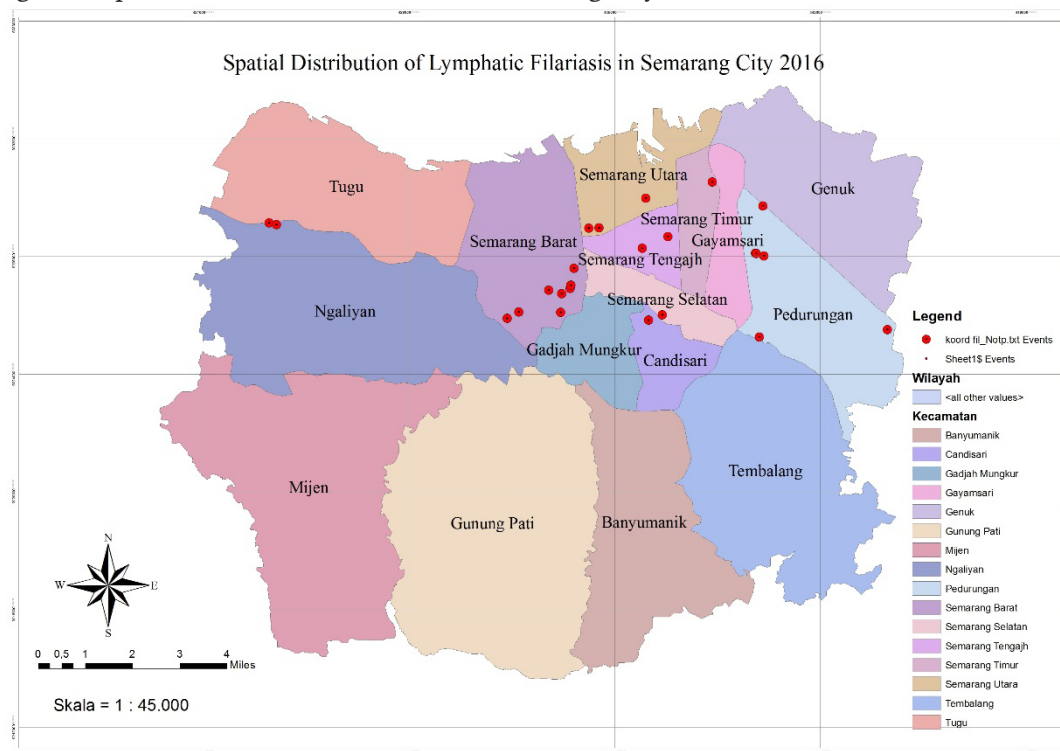


Table 2. Knowledge related to lymphatic filariasis in Semarang City

Knowledge of respondents	f	Percentage (%)
1. Ever hear filariasis disease :		
- Yes	16	61.5
- No	11	38.5
2. Sources of information regarding to filariasis:		
- Public Health Centre	12	44.5
- Electronic media	7	25.9
- Others	8	29.6
3. Knowing about filariasis symptoms:		
- Legs enlargement	22	81.5
- Hands enlargement	1	3.7
- Others	4	14.8
4. Understand the cause of filariasis:		
- Worm/parasite	11	40.7
- Virus	1	3.7
- Others	15	55.6
5. Knowing that filariasis can be transmitted to other:		
- Yes	10	37.0
- No	17	63.0
6. Knowing the source of transmission:		
- Someone who suffer of filariasis	4	14.8
- Others	23	85.2
7. Knowing when filariasis was being transmitted:		
- At noon	3	11.1
- At night	9	33.3
- At noon and night	6	22.3
- Stating do not have any idea of it	9	33.3
8. Knowing what filariasis was transmitted by:		
- Mosquito	17	63.0
- Others	6	22.2
- Stating do not have any idea of it	4	14.8
9. Knowing whoever can be transmitted:		
- Adult people	2	7.4
- Everyone	21	77.8
- Stating do not have any idea of it	4	14.8
10. Knowing that filariasis can be prevented:		
- Yes	19	70.4
- No	5	18.5
- Stating do not have any idea of it	3	11.1
11. Knowing social impact of suffering filariasis;		
- No	4	14.8
- Yes : Not being able to work properly, being ostracized by family and neighbor, feeling alienated from society, keep themselves from other	23	85.2
12. Knowing consequences of suffering filariasis:		
- Permanent disability	12	44.4
- Decreasing of productivity	9	33.3
- Others	4	14.8
- Stating do not have any idea of it	2	7.4

descriptively.

## RESULTS AND DISCUSSION

As of October 2016, 28 LF cases had been identified in Semarang City. One individual had died. LF cases were spread in 9 sub-districts and 20 villages. The distribution of those cases was shown in Table 1.

Four cases were reported in Bongsari Vil-

lage (14.8%), the most in any sub-district. The sub-district that had the most cases was West Semarang with nine cases (33.3%); the second-most was Pedurungan sub-district with six cases (22.2%) (Table 1). Most LF cases were suffered by women (70.4%). The average age of LF cases was 51.67 years (range: 21–85). LF patients generally have been living in their houses for an average of 30.17 years (range: 1.5–85).

Table 3. Environmental conditions surround the house

Aspect	f	Percentage (%)
1. The existence of standing water puddle surround the house:		
- Yes	8	29,63
- No	19	70,37
2. The existence of mosquito larvae in standing water puddle:		
- Yes	5	62,50
- No	3	37,50
3. The existence of wastewater drainage surround the house:		
- Yes	17	62,96
- No	10	37,04
4. The existence of larvae in water drainage:		
- Yes	5	29,41
- No	12	70,59
5. The existence of cattle pen:		
- Yes	3	11,11
- No	24	88,89
6. The existence of mosquito at cattle pen:		
- Yes	3	100,00
- No	0	0,00
7. The existence of hanged cloths:		
- Yes	16	59,26
- No	11	40,74
8. The existence of mosquito on hanged cloths.		
- Yes	13	81,25
- No	3	18,75
9. The existence of house screen on ventilation:		
- Yes	5	18,52
- No	22	81,48

Figure 1 shows that the LF cases were not spread evenly across the city of Semarang. LF cases seemed concentrated in low-lying areas at the center of the city of Semarang, which include the districts of Semarang Barat, Semarang Utara, Semarang Tengah, Semarang Timur and Semarang Selatan. These areas were relatively close to the beach and were in the coastal flood region and/or flooded during the rainy season.

Table 2 showed that knowledge about LF was relatively low. Only 61.54% of subjects had heard about LF. Most of them (44.5%) received information about LF from a public health center. Understanding of the symptoms of LF was good. A total of 81.5% subjects knew that enlargement of the feet was a symptom of the LF. On the other hand, knowledge of LF's causes was relatively low. Only 40.7% subjects understood that the cause of LF is filarial worms. The subjects also did not understand LF transmission. A total of 37.0% subjects mentioned that LF can be transmitted to others. But only 14.8% subjects knew that the source of transmission was a person suffering from LF. In fact, other sources like

animal reservoirs such as bats and monkeys can also play a role in the spread of LF. However, 63.0% subjects knew that mosquitoes play a role in the transmission and spread of LF. Although most subjects (77.8%) in the study stated that LF can be transmitted to everyone, but only 70.4% of them stated that LF can be prevented.

The social aspect was also a concern in this study. A person who suffers from LF may be impacted both physically and socially. A total of 85.2% subjects said that suffering from LF may have social impacts such as not being able to work freely, being ostracized by family and neighbors, and feeling alienated from society. LF also caused handicap condition of physical effects. A total of 44.4% subjects in this study stated that LF caused disability in their lifetime.

The success of LF elimination was affected by the public health services provided by the chief stakeholders (health sector and related institutions). Health services in the prevention of LF aimed to cure patients and prevent further transmission. As additional information, the results of this study indicated that 44.5% subjects

had received information regarding LF from Public Health Center. The rest received it from mass media (electronic).

Treatment aspects are important in eliminating the source of transmission of LF. Of the 27 subjects, only 25.9% of them said that they ever received the treatment given by Public Health Center. Another health service is a blood test. A total of 51.8% subjects said that they had blood tests to diagnose LF. In addition, 7.4% subjects were aware there was a mosquito-catching survey in their area but did not know the purpose of the survey.

Table 3 indicated that environmental factors play an important role in the control of LF. Environmental conditions, both inside and outside the home were suspected to be mosquito habitats for vectors of LF. Suitable environmental conditions for mosquito development have the potential to support the transmission and spread of LF. Environmental aspects of the data collection were done by direct observation in and around the homes of LF cases.

Observations indicated that as many as 29.65% of respondents had standing water puddles around their home. Of these, 62.50% found mosquito larvae in the puddles. Other habitats of mosquitoes are drainage ways. The results of observation found that there were drains around the house LF cases (62.96%). But in these aqueducts, only 29.41% of the channels had mosquito larvae in them. The low findings of larvae in these channels are likely because the water in the channel in a state of flow, so that it did not become a good habitat for mosquitoes.

Mosquitoes are a zoophilic (i.e., blood-sucking) insect. The existence of animal pens around the house can thus help complete the life cycle of mosquitoes. In this study, only three cattle sheds were found at the homes of LF patients. Mosquitoes were found in one of the three enclosures. In addition to the pens, observations were made in the rooms of the house. The results of this study found that as many as 59.26% of LF patients (including their families) had a habit of hanging clothing to dry. Observations on hanging clothes showed that as many as 81.25% harbored resting mosquitoes that land on clothing. Ventilation is another way for mosquitoes to enter the house. The observations noted that only 18.52% of respondents attached screens over their vents (ventilation nets).

This study found that cases of LF were most suffered by women (70.4%). It was more than men (29.6%). This finding was contrary to

a study conducted by Ekamen in Nigeria, which indicated a higher prevalence rate was recorded in this study among male participants (57.89%) than females (42.11%) (Ekanem et al., 2011). Figure 1 shows that the LF cases were not spread evenly across the city of Semarang. LF cases seemed concentrated in low-lying areas toward the center of the city of Semarang. These areas were relatively close to the beach, which were prone to flooding during the rainy season and/or coastal floods. The environmental conditions in the region thus had a high potential for the development of mosquito vectors of LF. Moreover, the type of houses in the coastal area were generally not healthy houses, in terms of mosquito prevention. The present study indicates that the prevalence of LF was significantly affected by the house type in both the Upland and Coastal rainforest communities (Emmanuel & Uttah, 2013).

Based on Table 2, knowledge about LF was important in the prevention and control of LF. This research found that patient knowledge was still relatively low regarding the cause, source of transmission, symptoms, prevention, treatment, and impact of LF. Most of them (44.44%) received information about LF from public health centers. This result was in contrary compared to a study conducted in Bengal India, in which 33.3% of the community received information through interpersonal communication, followed by 15% from television. A total of 97% respondents stated that health workers did not talk with them about MDA (Mass Drug Administration), but 76.3% had the disease explained to them and its transmission (Sinha et al., 2012). Other research has found that the level of knowledge, especially about the symptoms, transmission, prevention, and treatment of LF had a significant relationship to the incidence of LF, with a  $p$ -value=0.003 (Sapada et al., 2015). Education about LF also related to compliance with drug treatment as a part of the control of LF transmission. A previous study conducted in Pekalongan, Central Java, showed that respondents who had poor knowledge on LF influence awareness of the disease; it was recommended that District Health Offices (DHO) and public health centers needed to increase community knowledge with adequate information (Ginandjar et al., 2017).

The success of LF eradication is dependent on a control strategy involving health sector and related institutions. Public health centers provide counseling and treatment for LF cases. Only 25.93% of the respondents said that they ever had received the treatment given by Public Health Service. Compliance was also a problem. Gene-

rally, there are many reasons for this low level of compliance. People may not feel the necessity for consumption because they were healthy or did not have any symptoms, forget to consume the medicine, too many tablets to be taken at a time, fear of side effects especially in case of children, poor awareness regarding the benefits of MDA and lack of confidence upon the drug distributors (Sinha et al., 2012). This condition could be a source of LF transmission and influence the success of LF elimination. As the author of the study stated, the success of LF elimination depends on the level of real consumption and medication adherence rather than the coverage of taking the medication (Sinha et al., 2012).

Another health service had been received by the LF patients are blood tests and mosquito surveys, but they did not know the purpose of the survey. These surveys are very important for basic mosquito control in endemic areas and we recommend them. Previous studies conducted in other areas of Central Java indicated that *Culex quinquefasciatus* is the major vector and the only mosquito which positively tested for filarial worm; of 49 mosquitoes dissected, eight were found to positively containing filarial worms (16.33%) (Nurjazuli, 2015). This is similar to a study conducted in Nigeria, which showed the infection rate of 10.1% and *C. quinquefasciatus* as the major vector (56.0%) (Manyi et al., 2014). In another study in Malaysia found 62 mosquitoes were positive and 27 mosquitoes infected with L3 out of 1,599 mosquitoes dissected for the presence of filarial larvae (Muslim et al., 2013).

This research found that many potential breeding places near LP patient homes: standing water puddles, aqueducts, and drainage ways, although they contained mosquito larvae at a low level. The existence of water puddle can be a risk factor for filariasis. Standing water puddles (i.e., swamps or pools) should be avoided or eliminated as potential breeding areas for mosquitoes (breeding places), as should resting places for mosquitoes to minimize vector-borne filariasis. Research conducted by Nurjazuli in Pekalongan City also indicated that there are three type of main water used as mosquito habitats: domestic wastewater, tidal water, and batik industry waste water. Domestic wastewater was most of the mosquito habitat (Nurjazuli et al., 2018).

The results of this study also found that as many as 59.26% of LF cases (including their families) had a habit of hanging clothing to dry (Table 2). Observations on hanging clothes showed that as much as 81.25% found resting mosquitoes landing on clothing. Observations showed that only

18.52% of respondents attached a home screen on the vents (ventilation net). Mosquitoes can enter and go out from the house at any time. At night, doors and windows were usually closed, and thus ventilation is one way for mosquitoes to enter the house, thus increasing the probability of contact between mosquitoes with the occupants of the house. A study conducted by Jontari found that someone who lives in a house without ventilation nets has nine times higher risk of suffering filariasis (Jontari et al., 2014).

## CONCLUSION

In Semarang City, levels of community knowledge about LF were still relatively low. Health services related to educational efforts in controlling for LF transmission still need to be improved. Only a small proportion of LF cases (25.93%) claimed to have received treatment, blood tests and surveys of mosquitoes in the area. Environmental conditions inside and outside the house of LF cases create a very supportive habitat development of mosquito vectors. Lack of knowledge and health services, as well as environmental conditions still seem to be potential factors in the transmission and spread of filariasis in Semarang City.

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