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Epidemiological Assessment of Lymphatic Filariasis in Pekalongan City, Central Java, Indonesia

Penilaian Epidemiologi Filariasis Limfatik di Kota Pekalongan, Jawa Tengah, Indonesia

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ABSTRACT
Lymphatic filariasis is an infectious disease caused by filarial worms and transmitted by mosquitoes. Pekalongan City is the highest filariasis endemic area caused by *Wuchereria bancrofti* in Central Java. This is indicated by the microfilaria rate of 2.8% in 2016. To reduce the number of filariasis cases, mass drug administration has been carried out since 2011. The aim of the study was to describe the epidemiology of the distribution of filariasis endemic areas, microfilaria rate, treatment coverage. mass and the correlation of sociodemographic factors with the incidence of filariasis. The research variables used secondary data in the form of filariasis cases, education, population density, gender and land use. Data analysis used Spearman's correlation. The results showed that cases of filariasis were spread across all districts with an increasing number of endemic areas during 2011-2016. Efforts to mass treatment have not been successful (mf rate > 1% and treatment coverage < 65%) and must be repeated in 2017-2019. Sociodemographic factors were not related to the incidence of clinical or chronic cases of filariasis. To accelerate the achievement of filariasis elimination, it is necessary to add vector control efforts in integrated filariasis management.

Keywords: lymphatic filariasis, sociodemography, descriptive epidemiology

ABSTRAK
Filariasis limfatik adalah penyakit menular yang disebabkan oleh cacing filaria dan ditularkan oleh nyamuk. Kota Pekalongan merupakan daerah endemis filariasis yang disebabkan oleh Wuchereria bancrofti *tertinggi di Jawa Tengah. hal itu ditunjukkan dengan angka mikrofilaria sebesar 2,8% pada tahun 2016. Untuk menekan jumlah kasus filariasis, telah dilakukan upaya pengobatan massal (Mass Drug Administrasi) sejak tahun 2011. Tujuan penelitian adalah mendeskripsikan epidemiologi sebaran daerah endemik filariasis, mikrofilaria rate, cakupan pengobatan massal dan korelasi faktor sosiodemografi dengan kejadian filariasis. Variabel penelitian menggunakan data sekunder berupa kasus filariasis, pendidikan, kepadatan penduduk, jenis kelamin dan penggunaan lahan. Analisis data menggunakan korelasi Spearman. Hasil penelitian menunjukkan bahwa kasus filariasis tersebar di seluruh kecamatan dengan jumlah daerah endemik selama tahun 2011-2016 semakin meningkat. Upaya pengobatan massal belum berhasil (mf rate > 1% dan cakupan pengobatan < 65%) dan harus diulang kembali pada tahun 2017-2019. Faktor sosiodemografi tidak berhubungan dengan kejadian kasus klinis atau kronis filariasis. Untuk mempercepat pencapaian eliminasi filariasis perlu ditambahkan upaya pengendalian vektor dalam pengendalian filariasis terpadu.*

***Kata kunci**: filariasis limfatik, sosiodemografi, epidemiologi deskriptif*

INTRODUCTION

Lymphatic filariasis is a contagious infectious disease caused by filaria worms and transmitted by mosquitoes as a vector. In 2020, 863 million people in 50 countries were lived in areas that require preventive chemotherapy to stop the spread of infection.[1] Filariasis is chronic diseases and rarely causes death in sufferers. However, if the patient does not get treatment, this disease can cause permanent disability in the swollen parts such as legs,

arms, and genitals. Central Java is one of the endemic filariasis province in Indonesia. Prevalence of filariasis in Central Java ranked second in Indonesia after Jakarta Province. The number of filariasis case in Central Java from 2019 to 2020 tend to decrease (from 27 to 26 cases).[2]

Pekalongan City was the most endemic filariasis in Central Java, In 2019 the City of Pekalongan has not succeeded in reducing the mean number of microfilariae < 1%, so the City of Pekalongan must add the implementation of MDA Filariasis for 2 years.[3] Cases of filariasis in Pekalongan City had begun to be discovered in 2002, and in 2004 a Finger Blood Survey was conducted as a first step in the effort to eliminate filariasis in Pekalongan City.[4] Until 2016 the number of cases of filariasis reached 414 cases with 40 chronic cases.[5] The case was spread in 12 endemic villages in Pekalongan City. The confirmed lymphatic filariasis vector in Pekalongan City is *Culex quinquefasciatus* with *Wuchereria bancrofti* filaria species.[6,7] *Wuchereria bancrofti* behavior is nocturnal, that is, microfilariae are in the peripheral blood only at night. This behavior is in line with the peak density of *Cx quinquefasciatus,* that also at night.[8]

Pekalongan City agreed to conduct a Filariasis Elimination Program which was carried out in stages starting in 2005. The elimination program was mainly carried out with mass treatment in endemic areas with a Mf rate > 1% in the long term. WHO recommended a combination of DEC / Diethiyl Carbamazine citrate (6 mg/kg BW) and albendazole (400 mg) once a year for 5 years.

The purposes of the program are to reduce the MF rate < 1% in each district/city, to prevent and to limit disability due to filariasis. Various efforts have been made to control filariasis cases in Pekalongan City, but new cases are still found each year. The efforts that have been made include Finger Blood Survey, management of patients with filariasis and Mass Drug Administration (MDA). Filariasis MDA is to provide DEC combined with albendazole once every 5 years in a row. Filariasis MDA activities have been carried out since 2005-2010 with the target of endemic filariasis village (mf rate> 1%). Since 2011-2015,MDA had been covered all population in Pekalongan City.[9]

The results of MDA coverage per Public Health Centre in Pekalongan City in 2018 averaged > 88% with a target number of 257,632 residents out of 290,347 residents. However, in its implementation, some residents were delayed taking medicine by 25,595 residents and residents who did not take medicine for 10,978 residents.[10] Evaluation of MDA activities in Pekalongan City is carried out every year, until the 5th year the microfilariae rate is still above 1%. These results indicate that filariasis transmission is still occurring in Pekalongan City. The success of mass treatment is very closely related to the level of community adherence to treatment. This condition causes MDA activities in Pekalongan City to be repeated for 3 years (2017-2019).

Risk factors for high transmission of filariasis in Pekalongan City include environmental factors that support filariasis transmission, lack of local knowledge about filariasis, habits, beliefs, traditions, and behaviors that support filariasis transmission such as the habit of going out at night and sleeping habits using bednet, increasing the density of filariasis vectors, as well as the presence of filariasis vector resistance to the insecticide.

The objectives of the study were to describe the epidemiology of the distribution of endemic areas, filariasis cases, mass treatment and correlation of several sociodemographic factors with filariasis occurrence.

METHOD

This research method is a descriptive epidemiological analysis,[11] The data used is secondary data. The source of data in this epidemiological analysis is filariasis case data for 2011-2016, effort to control lymphatic filariasis which is derived from the health profile report of the Pekalongan City Health Office. Sociodemographic data are from the

Central Statistics Agency (BPS). Other information was obtained from various sources, such as books, journals, web pages and research reports. Epidemiological analysis is presented in the form of mapping the distribution of filariasis endemicity, clinical cases and MDA results of filariasis as well as the correlation of the incidence of filariasis cases with sociodemographic factors (education, density, population, sex ratio and land use). Data analysis used the Spearman Rank Correlation test.

RESULTS

Pekalongan City is located in the lowlands of the North Coast of Java Island, located at 6°50'42"- 6°55'44" South Latitude and 109°37'55"- 109°42'19". East Longitude with a height about 1-2 meters from sea level. Administratively, it has a northern boundary with the Java Sea, in the east bordering with Batang Regency, in the West bordering with Pekalongan Regency and in the South bordering with Pekalongan Regency and Batang.[10] Pekalongan City is divided into four subdistricts, 46 Villages with an area of 4,525 ha or around 0.14% of the area of Central Java Province. Land use in Pekalongan City consisted of 32.52% of paddy land and 67.48% of dry land (Figure 1).

Figure 1 Map of Village in Pekalongan City[12]

West Pekalongan District consists of 7 (seven) villages, namely Medono, Podosugih, Sapuro Kebulen, Bendan Kergon, Pasirkratonkramat, Tirto and Pringrejo. East Pekalongan Subdistrict consists of 7 (seven) villages, namely Noyontaansari, Kauman, Poncol, Klego, Gamer, Setono and Baros River. South Pekalongan District consists of 6 (six) villages, namely Banyurip, Buaran Kradenan, Jenggot, Kertoharjo Curriculum, Yosorejo and Sokoduwet. North Pekalongan District consists of 7 (seven) Villages, namely Krapyak, Kandang Panjang, Panjang Wetan, Padukuhan Kraton, Degayu, Bandengan and Baru Baru. North Pekalongan is the widest district in Pekalongan City, which is 14.88 Km^2 or 33% of the total area of Pekalongan City.[13,14,15,16]

Pekalongan City in general has almost the same geographical conditions but with a different number of residents. The number of residents in a house can affect the water used for daily needs. In this regard, the more residents in a house or the more residents in a place, the more waste is generated. Pekalongan City has a problem in domestic water disposal. Water in the waterways is stagnant and does not flow due to the height of the region which is almost the same as the sea surface.

Distribution of Endemic Filariasis in Pekalongan City

The Pekalongan City Health Office report for 2005-2015 there were seven Public Health Center with positive microfilaria, i.e: Jenggot, Hamlet, South Pekalongan, Tirto, Kramatsari, Klego, and Sokorejo Puskesmas. Filariasis Cases in Jenggot Public Health Center is the highest (25% filariasia cases in Pekalongan City are in area of the Jenggot Health Center). In 2015 filariasis CDR (Chronic Disease Rate) was 0.003% cover 12 Public Health Center in Pekalongan City.[10]

Distribution of filariasis endemic areas is determined based on the results of a finger blood survey on microfilaria in each village. Microfilaria rate (mf rate) illustrates the prevalence of people who have a finger blood test containing microfilaria compared to the number of people examined. A map of endemicity per village is shown in Figure 2.

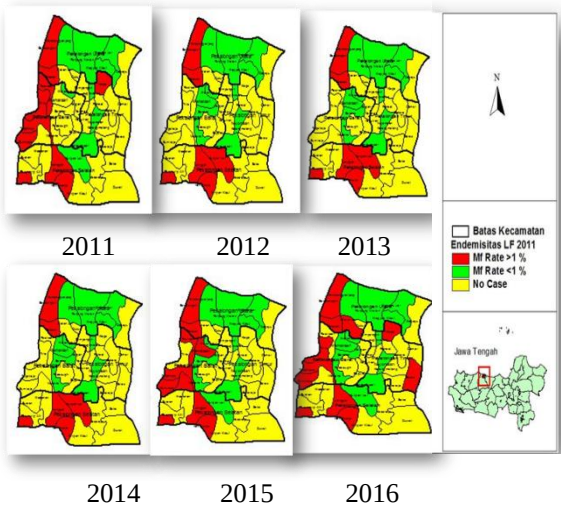

Figure 2. Map of Lymphatic Filariasis Endemicity in Pekalongan City at 2011-2016

The endemic area of filariasis in Pekalongan City is more dominant in the Districts of West and South Pekalongan. This area is direct border to Pekalongan Regency which is indeed endemic lymphatic filariasis. Since 2014 lymphatic filariasis cases have begun to shift towards North Pekalongan and East Pekalongan. In 2016 the number of lymphatic filariasis endemic areas was 11 villages spread in four subdistric.

In 2016 there were 20 villages with filariasis problems and 11 of them were endemic with an mf rate of > 1%, i.e: Pabean and Bandengan (North Pekalongan Sub-District), Pasirsari, Kramatsari, Pringlangu, Tegalrejo and Bumirejo (West Pekalongan Sub-District), Jenggot, Banyuurip Ageng and Kertoharjo (South Pekalongan Sub-District) and Brengo (East Pekalongan Sub-District). Data of lymphatic filariasis got from Public Health Center and hospital in Pekalongan City. Most cases found in 2011 as much 110 clinic cases and 7 chronic cases. While in 2015 there were 3 clinic cases.

Distribution and coverage of Filariasis Mass Drug Administration in Pekalongan City

Activity of filariasis MDA in Pekalongan City had been done from 2005-2010 focused in endemic filariasis villages with *mf rate* > 1 % covered Pasirsari, Bandengan, Bumirejo, Tegalrejo, Pabean and Kertoharjo Village.[4]

Department of Parasitology, Faculty of Medicine, University of Indonesia conduct finger blood survey in several villages at 2010. Finger blood survey results obtained 213 blood samples with 8 positive microfilariae (mf rate 4%). These results are still above the WHO provisions for elimination of variations with a target mf rate of < 1%.[1] Based on these results, starting from 2011 the overall MDA began to be implemented in Pekalongan City.

Achievement of MDA in the first year at 2011 as much 87.44% increase in 2012 and the peak in 2013. In the year of 2014 and 2015 coverage of MDA tend to decreases. Number of Public Health Center that doing MDA as long 2011-2015 as much 14 (all Public Health Center), however Medona and Buaran Public Health Center just do MDA at 2014-2015. The highest of MDA coverage was in Sokorejo Public Health Center reach 100% in 2015.

The Number of Clinic and Chronic Lymphatic Filariasis and Correlation with Sosiodemography Factor

The number of clinic and chronic filariasis could be had correlation with demography factor. Statistical analysis by using correlation analysis could be prove correlation between demography factors with clinic filariasis cases in each Sub district. Correlation relationship intermediate or strong if rho > 0.4 or rho > 0.6.[11] Result of statistics analysis there were no variable that had correlation with clinic filariasis, all variable had p > 0.05.

Table 1. Correlation Clinic and Chronic Lymphatic Filariasis with Sosiodemography Factor

		Total population	Growth rate	YHS	SHS	Population density	Land area	sex rasio (M/F)
Clinic cases	Correlation Coefficient (Spearman's rho)	-.400	1.000**	-.200	.400	-.600	.800	.400
	Sig. (2-tailed)	.300	.	.400	.300	.200	.100	.300
	N	4	4	4	4	4	4	4
Chronic cases	Correlation Coefficient (Spearman's rho)	-.316	.316	.316	-.632	-.949*	.632	.316
	Sig. (2-tailed)	.342	.342	.342	.184	.126	.184	.342
	N	4	4	4	4	4	4	4

Information: YHS = Yunior High School, SHS=Senior High School, M=Male, F=Female

Efforts to Control Lymphatic Filariasis

To control lymphatic filariasis transmission, Pekalongan City Health Office conducts three activities, namely finger blood survey, management of patients with filariasis and MDA evaluation.[4] Filariasis in Pekalongan City found the first time at 2002 in Panjang Wetan, Kandang Panjang, Sugihwaras and Tegalrejo Villages. Sufferer filariasis was found to be in a condition of swelling in the legs (Limfadema).

Positive sufferers of microfilaria are given counseling about filariasis and treatment procedures. Patients were given DEC treatment for 10 days at a dose of 3x1 tab. Day 11 patients were given albendazole with a single dose. Lymphadema patients are given treatment and medication according to the program. Evaluation of MDA activities starts in the third year. MDA evaluation at 2013 was carried out by the Banjarnegara Health Research and Development Animal Disease Control. Location of MDA evaluation is in Pabean Village which is endemic lymphatic filariasis. In 2013 patients with positive filaria were still found (Mf = 1.4%).[17] In 2014 the number of microfilaria was higher, until 2015 the mf rate was > 1%. The results of evaluations of medication adherence were highest in the fifth year (74.7%), while evaluations in the first to third years were below WHO standards (< 65%).[18]

Tabel 2. MDA Evaluation from Third Until Fiveth Years in Pekalongan City

Year's of MDA	Village	Number of sample	Mf rate (%)	Medication adherence(%)
First (2011)				63.01
Second (2012)				60.89
Third (2013)	Pabean	519	1.4	55.88
Fourth (2014)	Kertoharjo			74.70
	- Community	381	9.71	
	- MIS	235	2.97	
	- Public Elementary School 1	119	0.84	
	- Public Elementary School 2	95	9.47	
	Jenggot	50	20.0	
Fiveth (2015)	Poncol	300	0	
	Jenggot	300	1	
	Pabean	316	0	
	Kertoharjo	210	1.90	

DISCUSSION

The endemic area of filariasis in Pekalongan City from 2011-2016 was increasing. The increase in filariasis endemic areas cannot be separated from the increasing surveillance of cases conducted by the Pekalongan City Health Office. This is also supported by research conducted by other agencies, both from universities and the Health Research Agency.[10]

The limit for determining endemic filariasis areas is the range of MF rate> 1%. The presence of microfilaria in the blood of SDJ results is an indication that the transmission of filariasis is still ongoing. The presence of host factors, filaria worms, *Cx. quinquefasciatus* as its vector and the environment which is a risk factor for filariasis is in Pekalongan City. Efforts to eliminate filariasis in Pekalongan City are aimed at these four factors. However, modification and managing the environment is very difficult to do, considering that most of the endemic areas of filariasis are in low-lying areas.[19] Reported that Customs Village is the lowest area in Pekalongan City, which is 1 meter to 0 meters above sea level. This condition makes the Pabean Village become a basin in the Pekalongan City area. This environmental condition causes tidal water that enters the Pabean Village to be flooded and does not return to the sea. Therefore, intervention on host factors, parasites, and vectors is preferred.

The risk environment is in the form of standing water around the settlement.[20] Reported that in the Jenggot Community Health Center area, from 9 houses there were 66.7% puddles with *Cx quinquefasciatus* larvae. These puddles are slow to seep into the ground due to low percolation levels, especially during the rainy season. MDA Filariasis aims to eliminate filariasis by eliminating the incidence of transmission from patients to prospective patients with filariasis. The transmission will decrease or not even occur if the number of microfilariae circulating in the community is very low too. That even though, there are mosquitoes as vectors but the bite will not be

able to transmit filariasis due to the low number of microfilariae in the patient's blood.[21]

Providing drugs for patients with positive microfilaria, if used correctly will be able to reduce the MF rate. But because the treatment must be done for a long time, the level of compliance is very low so the elimination program is not successful. A long period of therapy, with side effects that occur causes patients to drop out, and the program also fails. Side effects that occur due to the body's reaction to dead microfilariae, or in other words, the momentary suffering replaces the prolonged suffering from the disease.

The target of the filariasis program based on WHO 2000 is that the minimum POMP coverage that must be achieved to break the chain of transmission is 85%. The achievement of POMP per Public Health Center during five years has fluctuated but the average is above 80%. Many factors affect the success of treatment, including cadre competence, the participation of community leaders, the character of the local community as well as from health worker factors.[10]

Obstacles encountered during the implementation of filariasis MDA activities include residents who are hesitant to take medicine, refusal of citizens to be recorded or when taking medication, change of cadres during implementation, some residents have not been recorded, drugs are not taken in front of the Elimination Implementation Workers (EIW) and MDA result data collection from EIW is quite long.

The success of the mass treatment is very closely related to the level of community adherence to treatment. The expected level of mass medical adherence to the community is 85%. In the 5 years of implementing Filariasis MDA (2011-2015), endemic areas in Pekalongan City have not reached the target level of treatment compliance, which is still below 65%.

Factors that influence treatment non-compliance include public perceptions about side effects and treatment benefits, not receiving drugs and families not taking drugs.[22]

The level of adherence to taking drugs in mass medicine is very important in the elimination of filariasis. The level of adherence to taking medication for the population in MDA in 2011-2013 tends to decrease and is still below 65% (Table 2).

According to the implementation of mass treatment, activities are carried out by inviting the public to come to the prescribed treatment post and the community taking medicine in front of the officers.[24] But in practice, the cadres distributed the drug to the houses and not all residents took medicine in front of the officers. This is likely to be the cause of the decrease in MDA coverage.

Compliance with decreasing medication has led to the elimination of filariasis in 2020 in Pekalongan City which is still far from expectations. The target scope for the MDA of filariasis depends on the practice of taking medication directly. However, medication adherence behavior is also closely related to the support of Human Resources (HR) both health workers, cadres, cross-sectoral and health promotion.[23]

Mass treatment campaigns have the possibility of failing to maintain appropriate treatment coverage to eliminate filariasis. To ensure the success of the global filariasis elimination program, additional measures are needed to reduce disease transmission. Vector control can be successful in filariasis elimination programs when applied single or combined with mass treatment.[20]

Political commitment, sustainable financing, surveillance and monitoring are important elements to support the global lymphatic filariasis elimination program. This disease can reemerge caused by a small population that still carries microfilaria. Mass treatment is not the only effort to eradicate filariasis, considering that filariasis is a zoonotic disease that is transmitted through mosquito bites. In addition to mass treatment, other efforts need to be made to break the chain of transmission of filariasis, one of them is by avoiding/reducing contact with mosquitoes as a vector of filariasis. Efforts can be made to

improve risky behavior to be not at risk, such as using mosquito nets and using anti-mosquito repellent.

CONCLUSIONS

Over the past five years (2012-2016), the number of filariasis endemic areas in Pekalongan City has increased. Filariasis transmission in Pekalongan City is still ongoing. This is proven by the presence of microfilaria in the blood, increasing endemic filariasis areas, and mf rate > 1%. Mass Drugs Administration in Pekalongan City for the first five years is declared a failure and must be repeated until 2019. Sociodemographic factors (growth rate, land area, junior high school education, senior high school education, sex ratio, population size) do not correlate with clinical or chronic filariasis cases.

RECOMENDATION

There needs to be an integrated effort in controlling filariasis, which involves cross-sectoral and programmatic. Develop integrated planning for filariasis risk factors (community, environment and vector behavior) and become the responsibility of local government organizations. In addition, MDA activities must also be supported by vector control followed by molecular examination (xenomonitoring) on vector mosquitoes.

AUTHOR CONTRIBUTION

TI, TR, APK, BI contributed equally as the main contributor of this paper. All authors read and approved the final paper

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