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Dengue Hemorrhagic Fever Transmission Risk Level on Three Local Health Center in Three Endemic District in South Sulawesi Province Indonesia

Tingkat Risiko Penularan Demam Berdarah Dengue pada Tiga Puskesmas di Tiga Kabupaten Endemis di Provinsi Sulawesi Selatan, Indonesia

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Abstrak. *Penelitian ini bertujuan untuk menentukan tingkat risiko penularan DBD di wilayah endemis DBD di Kab.Bone, Kota Palopo dan Kota Makassar Provinsi Sulawesi Selatan. Penelitian dilaksanakan Bulan Mei-Juni 2015 pada rumah tangga secara sistematik sampling sebanyak 100 rumah pada setiap wilayah kerja puskesmas endemis DBD tertinggi di Kab. Bone (Watampone), Kota Palopo (Wara) dan Kota Makassar (Mangasa) Provinsi Sulawesi Selatan. Data dianalisis untuk menunjukkan indikator surveilans larva (HI, CI, dan BI) dan density figure. Data disajikan dengan jumlah larva berdasarkan jenis kontainer, persentase dan distribusi kontainer. Nilai ABJ ketiga puskesmas termasuk rendah Watampone: 53%, Wara: 54%, Mangasa: 68%. Persentase CI (angka container) larva tertinggi adalah Puskesmas Watampone (17, 78%), selanjutnya Wara (17,71%) dan Mangasa (15,47%). Berdasarkan perhitungan HI, CI dan BI, density figure dari ketiga kabupaten pada kategori sedang hingga tinggi dan Maya index menunjukkan tingkat risiko penularan DBD sedang. Hasil menunjukkan bahwa Density figure pada kontainer rumah tangga yang diperiksa sedang hingga tinggi. Kampanye pencegahan DBD yang kuat, deteksi kasus dari rumah ke rumah dan upaya persuasif yang mengedukasi mengenai hal ini penting dilakukan untuk meningkatkan kesadaran masyarakat agar ikut berpartisipasi dan lebih waspada terhadap DBD.*

Kata Kunci*: DBD, larva, Aedes aegypti, kontainer, Maya Indeks*

Abstract. The aim of this research is to determine of transmission risk level of Dengue Hemorrhagic Fever (DHF) endemic area in District of Bone, Municipal of Palopo, and Municipal of Makassar, South Sulawesi province. Study held in May-June 2015 to 100 households by systematically sampling method in three highest local healthcare center work area in each endemic in District of Bone (Watampone), Municipal of Palopo (Wara), and Municipal of Makassar (Mangasa), South Sulawesi Province. Data analyzed to show the indicators of DHF surveillance (House Index, Container Index, and Breteau Index) and density figure. Data served with the number of larva in each inspected container, percentage and distribution of containers. Larval free house indices values of three local healthcare center were Watampone: 53%, Wara: 54%, and Mangasa: 68%. The highest container indices values were local healthcare center of Watampone (17.78%), Wara (17.71%) and Mangasa (15.47%) respectively. According to HI, CI and BI, density figure calculation, the study areas were categorized as moderate to high risk to DHF and the Maya index indicate the moderate risk to DHF transmission. Density figure of household water containers were moderate to high. Stronger campaign, door to door case detection and educating persuasive efforts concerning DHF case is important to be done in order to awaken the community awareness including stake holder to contribute to solve on DHF problem.

Keywords: Dengue Hemorrhagic Fever, larva, *Aedes aegypti*, container, Maya index.

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INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is the serious community health problem in Indonesia, because of the huge number of DHF patients, this disease is fast and widely spread, especially in the rainy season. DHF cases have emerged in 411 from 440 districts/municipalities in Indonesia with average incidence rate 93.4 per 100.000 inhabitants for 34 provinces until the end of 2013.[1] This article only discusses study for DHF because majority of Dengue cases in Indonesia was manifested as DHF proportion which the highest one beside dengue fever (DF) and dengue shock syndrome (DSS).[2]

These circumstances exacerbated by inhabitants culture which is fond of long-time intercept and retain water deposit for household need, water consumption, and for self-sanitation. It is giving the opportunity for the mosquitoes to breed inside water container. *Aedes sp*. larva existing on the area is the indicator that the adult *Aedes* mosquitoes exist. The important species in genus *Aedes* that can be DHF vectors are *Aedes aegypti* and *Aedes albopictus*.[3]

The main *Aedes* breeding places are indoor and water container in the environment, usually not more than 500 meters from the house because *Aedes aegypti* does not breed in the puddle water that directly contact with soil.[4] This mosquito often breeds in the clean water container such as large container in the bathroom, drum, large water jar, plant pots, the jumbles, drinking water dispenser, etc. that usually cleaned up rarely.

DHF cases in South Sulawesi showed the fluctuate tendency to increase and decrease due to seasonal variation. By the end of February 2016, in the peak of the rainy season, Provincial Health Department of South Sulawesi reported the number of DHF patients in all district of the province such as District of Bone 220 patients (4 patients died), Municipal of Palopo 194 patients and Municipal of Makassar 16 patients.[5] The government's control efforts had been done for over the years. Routine mosquito breeding places eradication by larva inspector, elucidation, or fogging focus had been done. However, DHF case still remains to become the problem to majority of districts/municipalities in South Sulawesi. The study aimed to depict the *Aedes* larval existence on household of residents and also to performed Maya Index[9] for identifying potential risk level of DHF transmission toward those areas as focal point of the DHF eradication program and provoke the changing of program and behavior to face this problem based on all of the aspects.

MATERIALS AND METHODS

Study held in DHF endemic area in three district/municipalities in South Sulawesi Province in May-June 2015; District of Bone, Municipal of Palopo and Municipal of Makassar as the top three which has the highest DHF case data in previous year.[5,6] This study was part of the multicenter study for resistence status mapping of *Aedes aegypti* to insecticide in Indonesia.[6] Study held in the three highest DHF case in local health center in three endemic district/municipalities in South Sulawesi Province. The local health centers were Wara (Palopo), Watampone (Bone), and Mangasa (Makassar) consecutively. The cross-sectional research used systematic sampling method to yield household sample. Study site population purposively selected by the highest case of DHF in previous year for each district/municipalities. First sample were the neighborhood chief's (*kepala kampung/ketua RT*) house then followed to the nearest house until 100 houses inspected for each district/municipalities.[6]

Each household inspected on their containers to look for *Aedes* larva and counted for every type of container and type of larvae stage (larva and pupae).[6,7,8]

All of the containers in household inspected for *Aedes* larva existence after the respondent informed and agreed to participating in the study by signed the informed consent. Containers distinguished by indoor and outdoor containers the number of each type of container and estimation of quantity of larva for positive container counted.

Larva density data analyzed analytically according to WHO guidance[9] and statistically using Pearson Chi Square to define the difference of both indoor and outdoor containers. Larva density per house and per container was also counted. Data counted to determined three indices below:

1. House Index (HI):
$$HI=\frac{Number\ of\ houses\ infested}{Number\ of\ houses\ inspected}\times 100\%$$
2. Container Index (CI):
$$CI=\frac{Number\ of\ positive\ containers}{Number\ of\ containers\ inspected}\times 100\%$$
3. Breteau Index (BI) :
$$BI=\frac{Number\ of\ positive\ containers}{Number\ of\ houses\ inspected}\times 100\%$$

From all indices, data scored to determine Density Figure (DF).[10]

In the analysis, Maya index also calculated to determine the amount of risk of transmission of dengue in the region. Maya Index obtained by calculating two indicators of risk indicators Breeding / Breeding Risk Indicator (BRI) and the risk of environmental cleanliness / Hygiene Risk Indicator (HRI), each of which is categorized into three levels of risk, namely high, moderate and low. BRI value obtained by dividing the number of controllable Site (CS) which is found in households with an average positive CS larva.[11] HRI obtained by dividing the number of Disposable Site (DS) in households with an average positive DS larva.[12]

This study provide the ethical approval from National Institute of Health Research and Development Ethics Committee, Indonesian Ministry of Health Number: LB.02.01/5.2/KE.105/2015, date of 25 February 2015.

RESULTS

Larva existing inspection were conducted for all containers consisted water inside or outside the house in three highest DHF case in local healthcare center of Municipal of Palopo (Wara), District of Bone (Watampone), and Municipal of Makassar (Mangasa) Province of South Sulawesi. Container that inspected in three endemic area were 1183 containers with 1025 indoor containers and 158 outdoor containers.

Table 1 showed that majority of container of each local healthcare center was outdoors (Wara 57.45 %, Watampone 26.76 %, and Mangasa 15.47 %), more indoors than outdoors positive containers found. Majority of containers found made from plastic and concrete. Table 1 also showed that the plastic containers (pail, basin, large water jar, drinking water dispenser) were the most found containers in all healthcare center. In compliance with that, more of *Aedes* larva found in the plastic container.

Mean of larva density per type of container for Watampone and Wara had the highest density on others type of container (pail cover, germ stone soaked, bottles, and other trash) that possibly intercept and retain falling water. Local healthcare center of Watampone had the highest larva density on 'other' type of containers beside basin for toilet and unintended tire, whereas in

Table 1. Number of Larva Found in Each Type of Containers in Households

No	Type of container	Wara				Watampone				Mangasa			
		n	(+)	μ	%	n	(+)	μ	%	n	(+)	μ	%
	Indoor												
1	Large basin for bathroom	104	11	11.63	10.58	70	17	10.07	24.29	20	4	1.55	20
2	Basin for toilet	8	4	35.5	50	6	4	111.17	66.67	1	0	0	0
3	Pail	163	16	10.5	9.82	141	14	5.39	9.93	157	18	20.55	11.46
4	Basin	40	2	4	5	58	2	1.21	3.45	66	3	3.14	4.55
5	Large water jar	23	7	6.61	30.43	9	0	0	0	11	6	41.55	54.55
6	Tire	0	0	0	0	0	0	0	0	0	0	0	0
7	Water Dispenser	16	8	10.88	50	24	8	4.04	33.33	41	7	4.85	17.07
8	Others	45	4	38.51	8.89	9	5	120.33	55.56	13	2	14.31	15.38
	Σ	**399**	**52**	**14.7**	**13.03**	**317**	**50**	**31.52**	**15.77**	**309**	**40**	**10.74**	**12.94**
	Outdoor												
1	Large basin for bathroom	3	1	100	33.33	3	0	0	0	2	0	0	0
2	Basin for toilet	0	0	0	0	0	0	0	0	0	0	0	0
3	Pail	18	6	26.33	33.33	33	3	0.61	9.09	18	2	84.17	11.11
4	Basin	0	0	0	0	7	1	0.86	14.29	0	0	0	0
5	Large water jar	8	5	223.75	62.5	3	2	53.33	66.67	3	2	73.33	66.67
6	Tire	7	6	62.86	85.71	7	5	107.14	71.43	3	3	112.33	100
7	Water Dispenser	0	0	0	0	0	0	0	0	1	0	0	0
8	Others	11	9	55.91	81.82	18	8	114.33	44.44	13	7	40.92	53.85
	Σ	**47**	**27**	**58.61**	**57.45**	**71**	**19**	**34.53**	**26.76**	**40**	**14**	**38.84**	**35**
	Total	**446**	**79**	**73.31**	**17.71**	**388**	**69**	**66.05**	**17.78**	**349**	**54**	**49.58**	**15.47**

Table 2. Figure of Total Containers, Positive Containers, and Larva Density

No	Variables	Local healthcare center			P
		Wara	Watampone	Mangasa	
1	**Total containers**				
	Indoor	399	317	309	0.002*
	Outdoor	47	71	40	
2	**Positive containers**				
	Indoor	52	50	40	0.527
	Outdoor	27	19	14	
3	**Larva density**				
	Mean per House	152	137	255	0.001*
	Mean per Container	89	93	151	0.008*

*Statistically Significant

Table 3. DHF Surveillance Indicators, Larval Free House Index, and Density Figure

No	DHF survey indicators	Wara	Watampone	Mangasa
1	*House index* (HI) (%)	46	47	32
2	*Container index* (CI) (%)	17.71	17.78	15.42
3	*Breteau index* (BI) (%)	79	69	54
4	Larval free house index (%)	54	53	68
5	*Density Figure (DF) (1-10)*	5-7	5-6	5-6

Table 4. Container Site Type Distribution and Larva Positive Container

No	Type of container	Wara		Watampone		Mangasa	
		∑	(+)	∑	(+)	∑	(+)
	Controlable Site						
1	Large basin for bathroom	107	12	73	17	22	4
2	Basin for toilet	8	4	6	4	1	0
3	Pail	181	22	174	17	175	20
4	Basin	40	2	65	3	66	3
5	Large water jar	31	12	12	2	14	8
6	Water Dispenser	16	8	24	8	42	7
	∑	**383**	**60**	**354**	**51**	**320**	**42**
	Disposable Site						
1	Tire	7	6	7	5	3	3
2	Others	56	13	27	13	26	9
	∑	**63**	**19**	**34**	**18**	**29**	**12**
	Total	**446**	**79**	**388**	**69**	**349**	**54**

Mangasa the highest larva density container was tire that derelict on the house yard.

Total container showed on table 2 in all local healthcare center showed that indoor containers were more found than outdoors significantly (P = 0.002) however, positive container showed no significant difference between outdoor and indoor. Mean of larva density counted by dividing the number of larva density with the positive house and container as denominator, the highest number found in local healthcare center of Mangasa significantly (P-value of mean per

Table 5. Breeding Risk and Hygiene Risk Indices

No	Category	BRI (%)			HRI (%)		
		Wara	Watampone	Mangasa	Wara	Watampone	Mangasa
1	Low	8	7	15	0	0	0
2	Moderate	81	82	64	97	92	79
3	High	11	11	21	3	8	21
	Σ	100	100	100	100	100	100

Table 6. Maya Index in Households

No	Category	Maya Index (%)		
		Wara	Watampone	Mangasa
1	Low	8	7	9
2	Moderate	78	74	58
3	High	14	19	33
	Σ	100	100	100

0.001; P-value of mean per container: 0.008) meanwhile 15.47% containers stated positive. Wara and Watampone gave the lower larva density.

One hundreds households inspected from all district/municipalities, larval free house indices showed were lower than national DHF eradication goal program which is below 100% from all containers inspected. Container index of Wara was 79 containers (17.71%) positive Watampone was 69 containers (17.78%) positive, and Mangasa was 54 (15.42%). When all indicators assessed and scored to determine DF, the larva density of all district/municipalities categorized as moderate to high.[10]

Table 4 showed that controllable site container; combined water storage that can be controlled both outside and inside the house. Majority of containers found were pail and large basin for bathroom except Mangasa which most found containers were pail instead of large basin.

Disposable site containers were uncontrollable and can be retained by water anytime which could be a potential breeding places such as derelict tires, soaked germ stone, pail cover, plastic trash like cup, wraps, mineral bottles, etc. All households in three district/municipalities checked, and it were found many tires and other containers.

In the calculation of BRI and HRI in table 5, Wara, Watampone and Mangasa mostly were in the moderate category and have the highest proportion in the HRI category in all three local healthcare centers.

Based on the calculation above, Maya Index produced in table 6 showed that three local healthcare center have largest Maya index in the moderate category, even in Mangasa which has a high enough Maya index in the high category (33%).

DISCUSSION

Three hundred houses in most endemic local healthcare center of three district/municipalities in South Sulawesi have very low larval free house indices. Study area remain have high risk toward *Aedes* mosquito bite and transmitting the DHF viruses. Larval density for all local healthcare center was moderate to high when related with DF. There is consistence with research held by Joharina and Widiarti in East Java which had a high DF.[10]

Maya index calculation also showed majority classification from the moderate category and some pretty high in the high category in the Mangasa. This is consistent with research in South Tangerang which has a moderate risk level in the DHF transmission.[11] Research in South Denpasar was also mention that there was a relationship between HI, BI, CI, Pupa Index, and Maya index with incident of DHF.[12]

Majority of containers and positive containers lied inside the house. The success of mosquito propagation is supported by the prolonged water retention and size of the container.[15] Inhabitant adapted to live in the geographical condition where water not available all the time by retained more clean water for stock. This habit gives the advantage and opportunity for *Aedes* mosquito to propagate inside of the house.[14-16]

Majority of containers made from plastic, fiber, and concrete. Table 1 showed that plastic container such as pails were the most found container in households. In other research, *Ae. aegypti* larva also found in plastic and concrete container.[17] Mostly Indonesian people have pretty big size bathroom basin and toilet basin separately made from brick concrete or tile coated. These containers used collectively by all family members and repeatedly retaining water without being drained for a long time period. This condition cause the mosquitoes to lay their eggs and propagate inside and transmitted the disease[16] in around the household cause recurring of the disease and failed the program.

Table 2 shows statistically significant differences between indoor containers used for storing more water by the majority of respondents compared to outdoor containers, although there was no significant difference to the positive container. It uniquely found in Mangasa that the type and number of containers were less than Watampone and Wara but has higher larval density significantly. Hence Mangasa needs to get more attention than other local healthcare center in terms of handling cases of DHF in the area.

Eradication mosquito nests program have already held incessantly with the '3M' slogan (draining, covering, and burying) which orientated to endeavoring inhabitants to keep their neighborhood clean. Many rules and technical guidance have nationally made for this program.[19] The role of larva inspector (in bahasa Indonesia: *jumantik*) is a very mainstay in DHF prevention efforts, however recently, roled as motivator and stimulator showed that it does not work effectively, they usually only check inhabitants container regularly but lack of information about the importance of DHF prevention on household level they elucidate to the inhabitants.[20]

DHF eradication program considered as the most important political policy than policy for prevention.[21] It clearly visible in almost all the territory of Indonesia that have quick response (usually fogging response) if DHF outbreak emerge, but not as fast as response to surveillance reports for prevention.[22] Response also fast when there's a special order from official authorities without study first. In the long term, it will lead the resistance of insecticide used toward *Aedes* mosquito.[23] This study also reported mosquito resistant to insecticide that used in program to majority area studied.[6]

This recurring policy action also utters community perception that responsibility toward of this problem relies on government only instead of collective responsibility for taking care the quality of environment to prevent DHF outbreak.[24] We found that majority of respondents thought that this survey was for preliminary inspection before insecticide fogging to their neighborhood in fact, they assumed that the number of larva found inside their home was because it has been a long time that the place was not fogged.

The result clearly showed that larva density on household container inspected was high. It simply proves that lack of awareness and lack of consciousness about taking care of their household area. Strong campaign, door to door case detection and larva surveillance, and especially educating propaganda concerning DHF prevention[25-26] should be done to move community concern (including policy maker) to stay with health officer to keep DHF away from their neighborhood.

Larva inspection should regularly widely hold while giving sustainable information to inhabitants about the importance to control mosquito population in their area. Community activity involvement to clean up the environment to eliminate mosquito breeding places and improve the infrastructures mainly clean water network to provide sustaining water for community need so that people do not necessary anymore to retain clean water inside their house. Continuous informing and educating the community including stake holder about DHF preventing efforts is more effective and cheap approach than facing once there is a case.

CONCLUSION

The study result showed that larval free house indices were very low contrarily larva densities were very high. Density figure were categorized moderate to high. The risk of transmission (according to Maya index) in the study areas were categorized as moderate.

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