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Parcipatory action research for dengue control in Samarinda, Indonesia

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ABSTRACT

Dengue control with community empowerment is the 1 house 1 larva monitor officer/*Gerakan 1 Rumah 1 Jumantik* (G1R1J). G1R1J is a national movement of community empowerment at the household level in an effort to reduce dengue This research aims to implement G1R1J through participatory action research. This research was conducted in Samarinda City, East Kalimantan, Indonesia with a participatory action research approach. The activities carried out were workshops, socialization, focus group discussions, and mentoring. The research evaluation was in the form of entomological surveys, namely before and after the activity. The important points of this research are that in the community independently *Gerakan Emak-Emak Pembasmi Jentik Trisari* (GEMATRI) has been formed, and the involvement of the village in the form of socialization and training, murals initiated by cadres, and training initiated by the village. At the policy level there is a decree of delegation of authority and budget for activities including dengue from the health office to the sub-district, but the public health center (*Puskesmas)* plays a role in providing assistance and counseling in the community. The larva-free index also increased from 50.67 to 66.43. We believe that the participation of the community, health cadres, and policy makers is very important to reduce the incidence of dengue hemorrhagic fever (DHF) in the future.

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1. INTRODUCTION

Worldwide, *Aedes aegypti* and *Ae. albopictus* mosquitoes are the main cause of dengue infectious diseases [1]. About half of the global population is currently at risk of dengue, with 100-400 million infections occurring annually in tropical and sub-tropical regions worldwide, mostly in urban and semi-urban areas [2]. The number of dengue cases in Indonesia continues to increase up to the present time and is spread across 34 provinces, with the highest incidence rates reported in North Kalimantan, East Kalimantan, and Bali provinces [3]. The incidence rate of dengue in Indonesia tends to increase, starting from 50 cases per 100,000 population with a mortality rate of around 1-2%. Factors such as climate change, behavior, increased population mobility, and less community participation in mosquito nest eradication/*pemberantasan sarang*

nyamuk (PSN) are the causes of this situation [4]. However, when COVID-19 struck, the number of dengue cases reported showed a declining trend in 2020. In 2019, dengue cases were twice as high as the previous year (137,760 cases), while it was reported to have decreased in 2020 (95,893 cases). This was due to the weakening of the healthcare resilience system in Indonesia. At that time, it is possible that dengue cases continued to increase but were not well identified because the government focused on Coronavirus disease (COVID-19) [5].

ASEAN Dengue Day (ADD) in 2015 launched the *Gerakan 1 Rumah 1 Jentik Pemantau Jumantik/*Movement 1 house 1 larvae (G1R1J) to assist family-based communities in dengue control [6]. PSN aims to achieve a larva-free count/*angka bebas jentik* (ABJ) of more than 95% by involving the entire community to actively participate in preventing mosquito breeding. The community members trained by the local health center actively monitor the presence and development of mosquito larvae to control dengue fever in an area through the 3 M Plus program, which involves draining and tightly sealing water storage containers, as well as burying, disposing, or recycling used items, making them the primary implementers of G1R1J [7].

One of the areas in Indonesia that has implemented G1R1J since 2016 is East Kalimantan, specifically Sidodadi Village in Samarinda. However, the program only successfully operated for three to six months, and the dengue case rate is still high. East Kalimantan is currently considered the capital region of Indonesia, and the number of dengue cases reported through the regional information system/*sistem informasi daerah* (SIKDA) was 2,814, with 18 deaths, with an Incidence Rate of 290.6 cases per 100,000 population and case fatality rate of 0.6%. There is a high possibility that population movement will increase after the relocation of the capital city. To prevent the surge of dengue cases, the best efforts are needed for dengue prevention and control in the region [8].

Several studies have shown that the main factors that cause dengue control programs in Indonesia to be unsuccessful are lack of community participation, lack of community involvement [9], and unclear guidelines [10], all of which impact the sustainability and effectiveness of the program in the long run. One research approach that can be used is participatory action research (PAR). The success factor of PAR is that everyone involved in the research wants to participate and is actively involved. The direct involvement of the community or group that is the subject of the research is very important because it gives them control over the process and results of the research. A confident relationship between researchers and participants and a willingness to listen, understand and consider multiple perspectives are also important. Several studies suggest that PAR can successfully enhance the achievement of a program, by paying attention to consistent communication, open participation, and inclusive decision-making [11]–[13]. In this study, our aim is to conduct PAR with the community of Samarinda City to enhance the implementation of G1R1J. By conducting PAR in this research, it is hoped that we can identify viable solutions based on area-specific specifications, ensure the acceptance of the G1R1J program by program implementers and the community, and facilitate sustainability through ownership transfer.

2. METHOD

2.1. Location and time of research

Samarinda is the capital of East Kalimantan Province in Indonesia and the largest city on the island of Borneo. Samarinda is directly adjacent to the Kutai Kartanegara. Located between 117003'00" East Longitude and 117018"14" East longitude and between 00019'02" South latitude and 00042'34" South latitude. It has an area of 783 square kilometers and is located about 113 kilometers from the nation's capital, Penajam Paser Utara. The area is hilly, with elevations ranging from 10 to 200 meters above sea level. Samarinda, which is bisected by the Mahakam River, is the gateway to the interior of East Kalimantan, accessible by river, road and air. The city is known for its rapid development, exemplified by Samarinda Port and Palaran Port, which are both the busiest ports in East Kalimantan and have the largest population in the region [14]. A map of the Research location in Samarinda City, Indonesia can be seen in Figure 1.

The qualitative study and the G1R1J intervention took place from April to December 2019. The research locations for collecting responses through stakeholder interviews were at the East Kalimantan Province and Samarinda City levels, see Figure 1. Health program coordination hierarchically follows instructions from the Ministry of Health, then is coordinated by the Provincial Health Office with the Samarinda Health Office. Furthermore, the implementer is the community health center/*pusat kesehatan masyarakat*. The intervention study was conducted in Sidodi Village, which is the village with the highest dengue cases in Samarinda City.

2.2. Respondent selection

The research activities were an entomological survey and intervention with community assistance using PAR [15]. The larval survey was conducted in dengue-endemic areas, namely in Sidodadi Village, as a pilot project. An entomological survey was conducted before and after the intervention. The study implemented interventions through community-based approaches and assistance using the PAR method, which collects information based on the wishes and lives of local people. PAR focuses more on the 'process', which is to apply an intervention model based on local specifics as well as the wishes of the community with an approach from the community itself (community-based intervention by using bottom-up planning). Health cadres were the team that participated in the study with the inclusion criteria of having been and currently being a cadre, residing in the study area for at least three years. The research team and *Puskesmas* implemented the *Jurbastik* program in the G1R1J through approaches and assistance provided to *jumantik* cadres/coordinators and the community as implementers or house and neighborhood *jumantik*. Participants in PAR are not limited, depending on the willingness of cadres/*jumantik* and the community, which voluntarily participates without coercion. Flow of data collection and intervention in Figure 2.

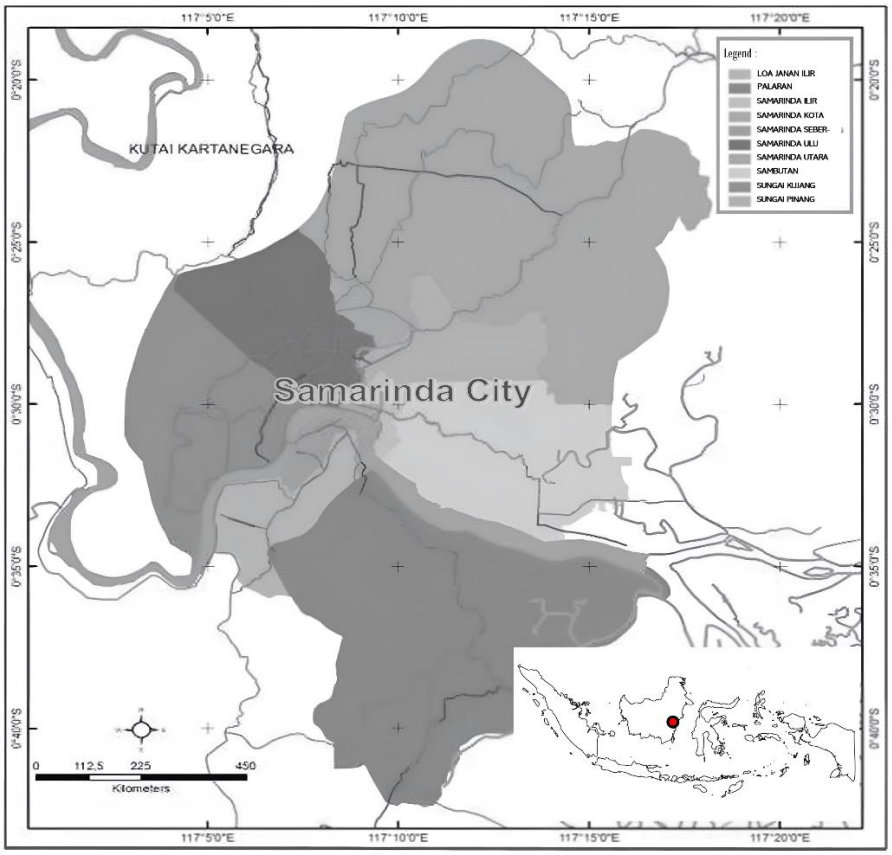

Figure 1. Map of research location in Samarinda, East Kalimantan, Indonesia

2.3. Data collection

This research design is a quasi-experiment with a PAR intervention approach. PAR data collection was carried out through interventions carried out four times. The intervention was in the form of assistance with prior socialization by the research team, then an evaluation of each assistance was carried out using the focus group discussion (FGD) method guided by the research team and the *Puskesmas*. Several indicators were asked, namely identification of problems found during home visits, efforts that have been made and agreement on solutions in solving problems. Evaluation of the PAR intervention was carried out by surveying larval density in the same 150 selected houses at the time of the pre-test and post-test. sample calculation using the two-population difference hypothesis test [16]. Respondents' participation in this study was optional with prior informed consent. The benefits for respondents are gaining knowledge can apply dengue

prevention efforts. Research Ethics Permit Number LB.02.01/2/KE.296/2018 from the Health Research and Development Agency, Ministry of Health of the Republic of Indonesia.

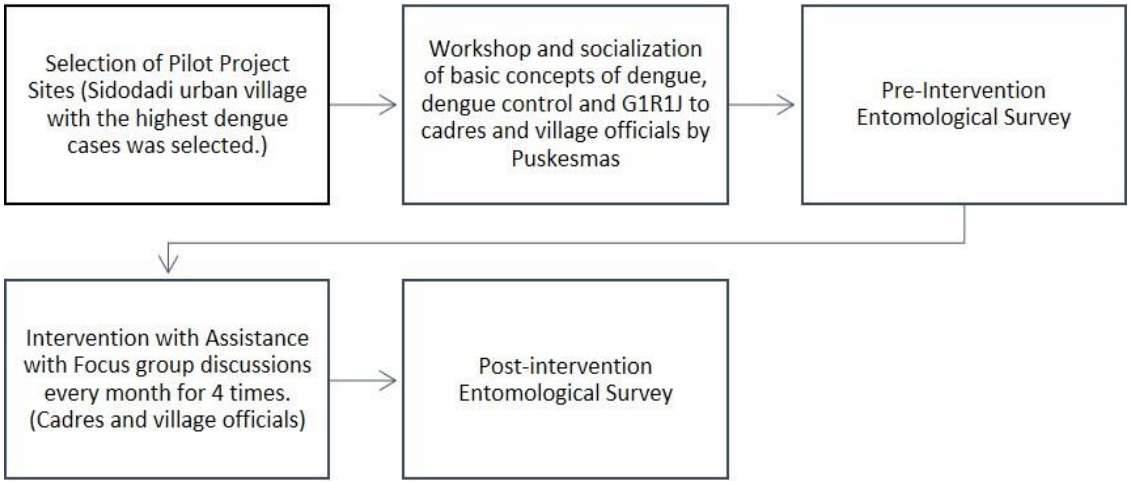

Figure 2. Flow of data collection and intervention

2.4. Data analysis

PAR data was analyzed by identifying the results of FGDs in the form of problems, causes, efforts that have been made, and agreed solutions that must be done to solve the problems found during the implementation of assistance. The qualitative data analysis method of FGDs involves steps such as transcription, understanding the context, coding, theme categorization, interpretation, testing, and reporting. The entomological data in each sample house was calculated as the container index, which is the number of containers containing water positive for *Aedes* spp. mosquito larvae divided by the number of containers found. The formula is dengue monitoring container index (CI), house index (HI), breteau index (BI) and larva-free index (LFI) were also calculated. The formula is [17]:

$$\text{CI} = \frac{\text{Number of containers positive for larvae}}{\text{Number of containers inspected}} \text{x}100$$

$$\text{HI} = \frac{\text{Number of infestation}-\text{positive houses}}{\text{Number of houses inspected}} \text{x}100$$

$$\text{BI} = \frac{\text{Number of containers positive for larvae}}{\text{Number of houses inspected}} \text{x}100$$

$$\text{LFI} = \frac{\text{Number of houses where no larvae were found}}{\text{Number of houses inspected}} \text{x}100$$

3. RESULTS

The number of participants in each mentoring program varies, as follows: i) Assistance I: The number of participants was 13 *jumantik* coordinators, 2 people from Sidodadi Village, 4 people from Segiri Health Center, and the research team; ii) Phase II assistance was attended by 19 j*umantik* coordinators, two people from the Segiri Community Health Center, 2 people from the East Kalimantan Provincial Health Office, and the research team; iii) Phase III mentoring was attended by 20 *jumantik* coordinators and the research team; iv) Phase IV assistance was attended by 20 *jumantik* coordinators, urban village staff, the Segiri Health Center dengue hemorrhagic fever (DHF) manager, and the research team. The results of the mentoring can be seen in Table 1.

Community awareness and knowledge of dengue control is still lacking, but the efforts of the *jumantik* coordinator up to the 4th assistance have been maximized with the assistance of the RT head, the village and sub-district and the *Puskesmas*. *Gerakan emak-emak pembasmi jentik trisari* (GEMATRI) has been formed, the involvement of the village in the form of socialization and murals, the sub-district in the form of circular letters, the health office by issuing a decree regarding the delegation of authority in the form

of a budget from the health office to the sub-district and village, and the *Puskesmas* by actively providing assistance and counseling as shown in Table 2 (see in appendix).

Table 1. The characteristics and number of participants in the FGDs

Mentoring	FGD participant characteristics	n
I (23 People)	Larva monitor officer/cadre	17
	Sidodadi village officer	2
	Segiri Public Health Center Officer	4
II (29 People)	Larva monitor officer/cadre	25
	Segiri Public Health Center Officer	2
	East Kalimantan Health Office Officer	2
III (20 People)	Larva monitor officer/cadre	20
IV (21 People)	Larva monitor officer/cadre	18
	Sidodadi village officer	2
	Segiri Public Health Center Officer	1

Implementation The PAR process in this study was carried out in several stages as shown in Figure 3. Before the mentoring activities were carried out, workshops and socialization were conducted to cadres/attent monitors, village and sub-district officials (Figure 3a) as the capital for intervention activities in the field. Participatory action research with FGDs was conducted until the fourth mentoring (Figure 3b), to identify problems and jointly decide on prevention efforts. Mentoring was conducted up to 4 times and then independently formed GEMATRI. Other activities included training conducted naturally, initiated by cadres as resource persons for residents, facilitated and funded by the village (Figure 3c). Murals were also created on unused walls as a means of health promotion (Figure 3d).

The results pre intervention showed that 656 containers were inspected, while the results post intervention the intervention reduced to 425 containers, due to containers that were not used, lost, discarded by respondents but the same houses were inspected. Pre and post the intervention, more containers were found inside the house and in an open state, but the number of containers that contained larvae decreased, as did the number of houses that were positive for larvae. The latent-free rate also increased from 50.67 to 66.43. These results provide a positive picture of the PAR assistance conducted in this study, see Table 3.

Figure 3. Process of participatory action research: (a) Workshop and socialization activities for cadres and village officials, (b) Focus group discussion and mentoring for cadres and village officials, (c) Cadres conduct training for residents facilitated by the village with funds from the village, (d) Mural initiated by residents

Table 3. Data on entomological indicators at pre and post time in Sidodadi Village, Samarinda City

Variable	Pre				Post			
	N	%	Positive *Aedes* larvae	Positive *Aedes* pupae	N	%	Positive *Aedes* larvae	Positive *Aedes* Pupae
Container location								
Inside the house	201	15.4	38	9	68	16.00	15	7
Outside the house	455	84.6	82	26	357	84.00	53	18
Container condition								
Opens	147	22.4	28	6	112	26.4	16	8
Closed	509	77.6	92	29	313	73.6	52	17
Total	656	100.0	120	35	425	100.0	68	25
Containers inspected			656				425	
Containers positive for *Aedes* larvae			120				68	
House inspected			150				140	
Aedes larva positive house			74				47	
CI			18.29				16	
HI			49.33				33.57	
BI			80.00				48.57	
LFI			50.67				66.43	

4. DISCUSSION

The PAR approach in this study, namely in the form of socialization, workshops, and assistance to local governments, cross-sectors, *jumantik* coordinators, cadres, and especially the community, gave some positive results on the implementation of G1R1J in the study area. One of the successes of the carried-out PAR approach was marked by a decrease in the entomological index. The results of pre- and post-measurements showed a decrease in the number of containers and houses positive for *Aedes larvae* and an increase in the number of free larvae. As we all know, dengue is transmitted through the bite of Aedes mosquitoes carrying the virus and infecting humans. Dengue virus infection in humans can lead to various conditions, ranging from asymptomatic, mild non-specific fever, Dengue Fever, to the more severe forms such as DHF and dengue shock syndrome (DSS). DHF is characterized by fever for 2-7 days accompanied by bleeding manifestations, while DSS is a severe condition of dengue characterized by circulatory failure manifested by rapid and weak or even undetectable pulse [18].

To control dengue fever, the Indonesian government has chosen to control the dengue vector through various methods: chemical, physical, and biological. However, since 1992, chemical control has been gradually reduced and the focus shifted to vector control through the PSN. In 2015, the G1R1J team was formed, which monitors the presence of larvae by entering community households. *Jumantik* cadres collect and periodically report field data to the villages, which are then forwarded to the local health centers to calculate the larval indices, which then serve as considerations in vector control policy-making. In some areas, G1R1J as a vector surveillance program has been successful [5], [19] but it differs from Samarinda City, where it was only implemented for three months.

G1R1J is considered an effective community empowerment model in vector control, so its implementation needs to be enhanced and continuously evaluated [5]. The results of this research indicate that the mentoring activities conducted within the PAR approach during the study are deemed capable of revitalizing and even enhancing G1R1J in Samarinda City, providing valuable insights for the government's consideration. Through the PAR approach, communities can address the specific problems they face according to their own capabilities, which may not be the same in other areas, as a step in controlling dengue in their area [20]–[22]. Several studies in various countries have successfully implemented the PAR approach method, using community empowerment as the implementing unit for dengue control [23]–[27].

Another positive result of the PAR approach carried out in this study is that the awareness of implementers from the local government in the research area has also begun to form. A study mentioned the lack of enthusiasm and commitment from the leadership, unskilled officers, excessive workload, low readiness and awareness of the community, and cross-sectoral dependence on actions from the health sector as some of the obstacles to the failure of the implementation of dengue control programs [27]. The dengue prevention and control program through G1R1J is not only the obligation of the health sector but a shared responsibility. A health program can run optimally if it is supported and there is a commitment from policymakers, leaders, implementers, and beneficiaries, as well as cross-sector cooperation [27].

The assistance through the PAR approach also increased the efforts and motivation of the *jumantik* coordinators and cadres so that G1R1J could continue to run, one of which was the initiatives taken by cadres to increase community awareness in the form of proposals to include the role of the RT head, conducting home visits every Saturday and Sunday, appealing to residents at routine religious activities, community service, and the formation of a community social media group to remind them to carry out dengue control

activities. In addition, the initiative to plant mosquito repellent plants and murals along the roads in the study area and the special name GEMATRI formed from G1R1J in the study area can increase the enthusiasm of the *jumantik* coordinators, cadres, and communities to carry out the movement. However, this enthusiasm, effort, and motivation must still be encouraged and supported by G1R1J implementers from the government [28], [29]. So that the community is appreciated and does not feel alone in carrying out the movement. Officers must continue to actively participate in mentoring, counseling, socialization, and occasionally conducting refreshers so that the skills and enthusiasm of the *jumantik* coordinator and cadres, and especially the community, can continue to increase in carrying out G1R1J.

Another thing obtained from the PAR approach that has been carried out is that online application reporting has been formed in Sidodadi Village using Google Forms so that the progress of filling out the control card can be monitored. Online applications are needed, especially in the COVID-19 pandemic situation [5], which requires health protocols to maintain distance. These efforts must always be supported, with the online application making it easier for officers to continue to be committed to carrying out their duties, and it is also hoped that it can motivate the community to continue to participate, care, and be aware of G1R1J because it has been made easier by the online application.

Although community awareness up to the fourth assistance is still not fully formed to implement G1R1J, with some of the positive results described above, the PAR that has been carried out is considered to have been largely successful. The community awareness that has not been fully formed is possible due to several factors, including the assistance that has been carried out only four times and the socialization that has been carried out, which is still not optimal [30]. The solution that can be offered is to routinely carry out assistance using the PAR approach supported by the local government and cross-sectors and conduct massive socialization, both through social media and scheduled in turn throughout the DHF-endemic areas in Samarinda City.

Community awareness can be formed, but it must be with maximum effort from both the government, cross-sectors, officers, and the community itself. Increasing community knowledge is one effort that can be made to enhance community awareness [30]–[34]. to the causes and risk factors for transmission and prevention of DHF [30], [33], [35] so that they know and want to make changes consciously about the impact and dangers of DHF so that they can behave willingly to take prevention and control measures to protect themselves, their families, and the environment to avoid disease and live healthy [36], [37] one of which is by participating in G1R1J. The weaknesses in this study are that, in addition to the assistance carried out only four times, this study also did not measure the level of awareness and knowledge of the community, so that it can be reference material for further research so that measurements can be carried out thoroughly.

5. CONCLUSION

The PAR approach can provide positive results for the sustainability of G1R1J in the context of dengue prevention and control in endemic areas of Samarinda. With the assistance carried out using the PAR method, the entomology index of *Aedes* has been reduced, the commitment of the government has been formed, and the efforts and enthusiasm of the implementers have increased. To fully form community awareness, the Samarinda government must continue to provide assistance with PAR, improve socialization efforts, and regularly provide refreshments for coordinators and cadres.

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APPENDIX

Table 2. Identification findings accompaniment in the FGD (Continue)

No	Problem	Reason	Efforts already made done	Agreement method solution (incl support cross sector)
Mentoring I				
1.	There are people who do not ready to enter his house	Owner house embarrassed if fill his house visible to the coordinator *jumantik* specifically part behind house	The coordinator makes an approach	Continue socialization and appeal to inhabitants for inspect flick and fill out the control form larvae in their respective homes through meetings inhabitants

Table 2. Identification findings accompaniment in the FGD (Continue)

No	Problem	Reason	Efforts already made done	Agreement method solution (incl support cross sector)
2.	*Jumantik* House ladder No fill out the control form flick that has given	Forgot, lazy, busy	Help fill out the control form	Commitment and ability to teach and encourage community members in their environment to fill out larva control forms and have formed GEMATRI
Mentoring II				
1.	Still found larvae	There is still a lack of awareness among residents about implementing 3M plus	Socialize to important citizens of 3M plus (*menguras, menutup, membuang atau mendaur ulang barang bekas*/drain, cover, dispose or recycle used goods	1. Continue to make home visits for outreach and encourage residents to check for larvae and fill out larval control forms at their homes every Saturday or Sunday 2. There is an initiative from the village head to draw murals on the dividing walls around Jalan Trisari 3. There is an initiative to develop lavender flower seeds by RT (*Rukun Tetangga*/ Neighborhood Association) 21 residents
2.	Still their residents who cannot be visited and do not want to be examined	because they weren't there and thought they were sales	Make an approach	RT head is ready help if there are its citizens don't Want to open door and give directions
3.	There are residents who object to the larva monitoring schedule being carried out once a week	PDAM (*Perusahaan Daerah Air Minum*/ Regional Drinking Water Company) that doesn't flow	Make an approach	RT head is ready help if there are its citizens don't want to open door and give directions
4.	There are still residents who ask for larvicide	lack of awareness for 3M plus	Socialize to important citizens of 3M plus	The coordinator, assisted by the RT head, provides understanding to residents
Mentoring III				
1.	*Jumantik* House ladder No fill out the control form flick that has given	Forgot, lazy, busy	Help fill out the control form	Commitment and ability for teach and exhort inhabitant people in their environment for fill out the control form flick
2.	The control cards provided were lacking and some were missing	The cards given do not match the number of residents and there are residents who lose them	Continue to provide direction and advice to residents even though there is no control card	The *jumantik* coordinator who has excess cards will give them to those who have less
3.	There is no data package to send reports	Sending reports using the internet	Ask friends to send	Efforts from the village head to provide transport money and issue a delegation decree authority budget from the Health Department to sub-districts and sub-districts
4.	There are still houses that the *jumantik* coordinator has not been able to visit	Busy	The coordinator makes an approach	Invite the RT head to provide direction and support public health center active follow do assistance and counseling
5.	There are still residents who complain that the bathtub draining schedule is too fast if it is done once a week	because it is constrained by PDAM which often does not flow	Make an approach	RT head is ready help if there are its citizens don't want to open door and give directions
6.	Larvae were still found in the drum during a visit by the *jumantik* coordinator	Because PDAM does not flow, rainwater is collected but not covered	Socialize to important citizens of 3M plus	1. Continue to make home visits for outreach and encourage residents to check for larvae and fill out larval control forms at their homes every Saturday or Sunday 2. There is an initiative from the *Jumantik* coordinator to create a WA (WhatsApp) group for residents to remind them to do 3M plus 3. There are community service activities encouraged by the RT head 4. There are routine *yasinan* activities carried out to educate

Table 2. Identification findings accompaniment in the FGD (Continue)

No	Problem	Reason	Efforts already made done	Agreement method solution (incl support cross sector)
				residents about G1R1J
7.	Lack of public awareness for 3M plus	There are still residents who ask for abatement and fogging	Socialize to residents the importance of 3M plus	1. Continue to make home visits for outreach and encourage residents to check for larvae and fill out larval control forms at their homes every Saturday or Sunday 2. The sub-district has carried out outreach activities to provide understanding to residents about the importance of 3M plus and the dangers of dengue fever 3. There is a letter circular from subdistrict
8.	The existence of neighboring RTs does not implement the one house one *jumantik* movement	Don't be exposed	-	Socialize the one house one *jumantik* movement in social activities by joining other RTs who are not exposed to the one house one *jumantik* movement
Mentoring IV				
1.	There are new arrivals who have not been exposed to the socialization of the 1 house 1 *jumantik* movement so they refuse to be visited by the *jumantik* coordinator	The existence of separate houses or boarding houses causes many residents to be homeless	Make an approach	Invite the RT head to provide direction
2.	Residents have start follow participate do monitoring of larvae and PSN, though Still there are those who refuse with a number of reasons	Haven't prayed yet, haven't showered yet, and the home environment is clean	Make an approach	Invite the RT head to provide direction
3.	Larvae are still found, including in drums in empty houses	The house is empty, not willing to be drained because the water is used for daily needs and other things	Make an approach	Invite the RT head to provide direction
4.	Residents are still found who do not record their control cards	Forgot, don't want to fill it in because of the hassle, the control card was lost	Make an approach	Invited the RT head to provide direction and did form application reporting online you can make it easier party public health center monitor report charging card control

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