Introduction

Dengue hemorrhagic fever (DHF) is one of the endemic diseases in tropical areas, including Indonesia. The high density of rainfall and low sunlight is good conditions for *Aedes aegypti* to multiply [1]. In addition to climate factors, a dirty environment can also influence the *A. aegypti* mosquitoes' reproduction [2]. The non-hygienic environment is the result of the people's unhealthy behaviors, which are highly influenced by their perceptions [3]. In Indonesia, Yogyakarta Province was reported to have a high number of annual DHF case occurrences [4] (Figure 1) and Patukan has the highest incident rate (IR = 150.8) [5]. This number remains high despite several DHF controlling efforts, such as fogging, applying larvicide, and sending *J* umantik cadres to perform monthly larvae inspection at the house of every community member [6]. The annual DHF case occurrences in Yogyakarta are always high [7]. This pattern reveals that the efforts in controlling DHF cases have not reached a satisfying level yet [8]. The low community participation in the DHF control efforts is one of the influencing factors in the failures of some of these efforts. The community's lack of responsibility concerning the DHF issues might be caused by their low perceptions and understanding of DHF itself [9].

Putnam in 2001 argued that social capital shows the characteristics of social structures, such as networks, norms, and social beliefs for mutual benefits. The existence of good social capital can facilitate the health promotion process [10]. According to a health promotion program developed by Berkman, the aim to make a community empowered is an effort to strengthen social capital [12]. Social capital in the form of customs, culture, and norms adopted by the community has a role in shaping human behavior which, in turn, has an influence on the environment [13], [14]. Low social capital and perceptions about DHF contribute
to creating a neighborhood including the condition of the house that supports DHF transmission [15]. The socialization of DHF control has been conducted to the lowest level of the community, but the perception and social conditions of the community tend to underestimate DHF which prevents all DHF control programs from running well [15], [16], [17], [18]. It needs proper attention to change perceptions, social capital, and the house environment to be better through community-based health education [3], [19], [20], [21]. Research showed that the community's perceptions can be influenced by health education [22], [23]. The fact that DHF control has always been neglected by most communities makes every community-based DHF control effort prone to failure [3]. In general, many members of a community perceive DHF as a common and less threatening disease. To change this perception, health education with accurate DHF facts is necessary [24]. This study was aimed to assess the effect of providing health education about DHF on changes in the community's perceptions, social capital, and healthy house conditions.

Materials and Methods

Study design and participants

Participatory action research was used in this study (Figure 2). The research subjects were the households in Patukan hamlet Sleman Yogyakarta. The number of research subjects was 267 households by applying the total sampling technique. Patukan has the highest incident rate of DHF (IR = 150.8) [5].

Phase 1: Initial assessment before the intervention was carried out (November 2018)

Phase 2: Intervention (December 2018–February 2019)

Phase 3: Final assessment after 6 months of intervention (August 2019).

Intervention

Based on the initial data, the intervention applied in this research was health education about DHF. In delivering the DHF education, the researcher was assisted by ten fresh graduates from the Faculty of Public Health who had undergone a 1-week training to synchronize their perceptions on DHF and improve their understanding of DHF. The pre-post-test showed that the training of the trainer could improve the trainers’ understanding of DHF (p-value 0.000 < 0.005). Interventions were delivered naturally by collaborating with the routine activities carried out by the target community. The researchers explained the material and the participants were invited to discuss dengue issues. In this forum, the participants received accurate education about dengue. The community health center (Puskesmas) as the closest health service facility to the community and village government was involved in the implementation of this health education intervention. Health education about dengue was provided regularly.
Phase 1.
1. Preliminary assessment for perception, social capital, and healthy house condition
2. Action planning

Phase 2.
Intervention/action:
Health education on DHF. Based on preliminary data.

Phase 3.
1. Pre-perception, social capital, and healthy house condition
2. Health education
3. Post-perception, social capital, and healthy house condition
4. Analysis

according to the community meeting schedule for 3 months (December 2018–February 2019).

Research instrument
The data collection instrument in this research was a questionnaire that had passed the validity and reliability tests. The applied validity test in this research was construct validity by calculating the correlation between the research data and the existing measurement. The minimum standard for the validity measurement was based on the Pearson correlation ≥ of 0.30 [25], [26]. The validity test was conducted by testing the questionnaire to minimally 10% of the total respondents. In this research, the questionnaire was tested on 80 respondents (30%) [27]. The results of the validity and reliability tests are presented in Table 1.

The questionnaire consisted of three sections: Perceptions of DHF, perceptions of DHF control, and social capital. Every item in the questionnaire had passed the validity test as the score of Pearson correlation > 0.30 and p < 0.05. Similarly, all items of the questionnaire were valid according to the Spearman reliability test. The reliability test showed that the Alpha Cronbach’s score was > 0.60, which means that the questionnaire was considered valid and reliable [26]. To measure the healthy house condition, a checklist based on the Ministry of Health of the Republic of Indonesia in 2002 was used.

Data collection and analysis
Data were collected using the same questionnaire and checklist for pre- and post-tests. The pre-data were taken in November 2018 and the post-data were taken in August 2019. The interval between the implementation of the intervention and the post-data collection was 6 months to see the consistency of changes [28]. The data obtained were analyzed by employing SPSS 24 using the Wilcoxon test because the data were not normally distributed [29].

Results

Participants’ socio-demographic
Table 2 lists the socio-demographics of the respondents in the research setting. The respondents were dominated by women (77.54%). The predominant occupation was housewife (49.8%) with the most common age range being more than 45 years (58.88%). The majority of the participants’ education was in senior high school (40.45%).

Perception of DHF pre- and post-intervention
Perception of DHF is what the community thought about DHF. The data from the perception about DHF measurement show 100% improvement on how the community perceived DHF as a disease that has to be eradicated (Table 3).

Wilcoxon test shows that the average perception of DHF before and after health education had a significant difference with p = 0.000 (Table 4). It was found that there was an improvement in the mean of the perception of DHF before and the 6th month after the health education.
**Perception of DHF control pre- and post-intervention**

Perception of DHF control emphasizes the community’s view of DHF control efforts [17], [28]. The results show that after the health education delivery, the community’s view on DHF was a disease that had to be controlled together increased to 100% (Table 5).

The mean score of the perceptions of DHF control before the intervention showed a consistent increase 6 months after intervention. The Wilcoxon test shows that the average score of the perception of DHF control before and after health education had a significant difference with p = 0.000 (Table 6).

**Healthy house pre- and post-intervention**

A healthy house as one of the risk factors for dengue transmission holds three components, namely, the parts of the house, sanitation facilities, and occupant behaviors. Table 8 shows that after the health education intervention, the average score of the

---

Table 1: The results of validity and reliability tests

| Variable       | Item | Pearson correlation | Alpha Cronbach |
|----------------|------|---------------------|----------------|
| Perception of  |      |                     |                |
| DHF            | 1    | 0.35 (valid)        | 0.724/reliable |
|                | 2    | 0.34 (valid)        |                |
|                | 3    | 0.31 (valid)        |                |
|                | 4    | 0.48 (valid)        |                |
|                | 5    | 0.44 (valid)        |                |
|                | 6    | 0.59 (valid)        |                |
|                | 7    | 0.58 (valid)        |                |
|                | 8    | 0.57 (valid)        |                |
|                | 9    | 0.51 (valid)        |                |
|                | 10   | 0.48 (valid)        |                |
| Perception of  | 1    | 0.35 (valid)        | 0.796/reliable |
| DHF control    | 2    | 0.37 (valid)        |                |
|                | 3    | 0.48 (valid)        |                |
|                | 4    | 0.45 (valid)        |                |
|                | 5    | 0.33 (valid)        |                |
|                | 6    | 0.56 (valid)        |                |
|                | 7    | 0.70 (valid)        |                |
|                | 8    | 0.36 (valid)        |                |
|                | 9    | 0.44 (valid)        |                |
|                | 10   | 0.34 (valid)        |                |
|                | 11   | 0.49 (valid)        |                |
|                | 12   | 0.53 (valid)        |                |
|                | 13   | 0.49 (valid)        |                |
|                | 14   | 0.61 (valid)        |                |
|                | 15   | 0.38 (valid)        |                |
|                | 16   | 0.59 (valid)        |                |
|                | 17   | 0.51 (valid)        |                |
|                | 18   | 0.35 (valid)        |                |
|                | 19   | 0.37 (valid)        |                |
| Social capital | A.   | 0.38 (valid)        |                |
|                | 1    | 0.46 (valid)        | 0.683/reliable |
| Participation  | 2    | 0.33 (valid)        |                |
|                | 3    | 0.35 (valid)        |                |
|                | 4    | 0.56 (valid)        |                |
|                | 5    | 0.38 (valid)        |                |
|                | 6    | 0.45 (valid)        |                |
|                | 7    | 0.56 (valid)        |                |
|                | 8    | 0.31 (valid)        |                |
|                | 9    | A.38 (valid)        |                |
| B. Concern     | 1    | 0.78 (valid)        | 0.793/reliable |
|                | 2    | 0.61 (valid)        |                |
|                | 3    | 0.55 (valid)        |                |
|                | 4    | 0.67 (valid)        |                |
|                | 5    | 0.57 (valid)        |                |
|                | 6    | 0.63 (valid)        |                |
|                | 7    | 0.63 (valid)        |                |
|                | 8    | 0.40 (valid)        |                |
|                | 9    | A.31 (valid)        |                |
| C. Trust       | 1    | 0.71 (valid)        | 0.636/reliable |
|                | 2    | 0.35 (valid)        |                |
|                | 3    | 0.64 (valid)        |                |
|                | 4    | 0.42 (valid)        |                |
| Social norm    | 1    | 0.69 (valid)        | 0.813/reliable |
|                | 2    | 0.60 (valid)        |                |
|                | 3    | 0.64 (valid)        |                |
|                | 4    | 0.77 (valid)        |                |
|                | 5    | A.79 (valid)        |                |
| E. Readiness   | 1    | 0.47 (valid)        | 0.633/reliable |
| to learn new   | 2    | 0.61 (valid)        |                |
| ideas          | 3    | 0.34 (valid)        |                |
|                | 4    | 0.68 (valid)        |                |
|                | 5    | 0.43 (valid)        |                |

**Social capital pre and post-intervention**

Social capital holds five components, namely, participation, concern, trust, social norms, and readiness in learning new ideas [11]. Of the five components, there are changes after the intervention (Table 7). This difference is statistically significant with p = 0.003 for participation, p = 0.000 for trust, and p = 0.000 for readiness to learn new ideas. Participation and social norms did not show any significant difference with p > 0.005 (Table 7).

**Table 2: Socio-demographic of research respondents (n = 267)**

| Gender          | Frequency | Percentage |
|-----------------|-----------|------------|
| Male            | 60        | 22.47      |
| Female          | 207       | 77.54      |
| Occupation      |           |            |
| Not working     | 3         | 1.12       |
| Housewife       | 133       | 49.8       |
| Self-employed   | 91        | 34.08      |
| Others          | 40        | 14.98      |

**Table 3: Perception of DHF (n = 267)**

| Perception of DHF | Pre ± SD | Post ± SD |
|-------------------|----------|-----------|
|                   | n (%)    | n (%)     |
|                   | Agree    | Disagree  |
|                   |          |          |
| Dengue hemorrhagic fever is a disease transmitted by the Aedes aegypti | 263 (98.5) | 4 (1.5) |
| Dengue hemorrhagic fever is a fatality disease | 261 (97.8) | 6 (2.2) |
| Dengue hemorrhagic fever is a disease that must be eradicated | 265 (99.2) | 2 (0.8) |
| Eradicating dengue fever is an obligation of health officers only | 213 (79.8) | 54 (20.2) |
| I would be partially responsible for any neighbor who suffers from dengue fever | 233 (87.3) | 34 (12.7) |
| Having a family member who suffers from dengue fever would cost expensive treatment | 216 (80.9) | 51 (19.1) |
| Everyone is possible to suffer DHF | 262 (98.1) | 5 (1.9) |
| DHF transmission can occur in every place and at any time | 248 (92.9) | 17 (7.1) |
| We must always be aware of the transmission of dengue disease | 263 (98.5) | 4 (1.5) |

**Table 4: The effectiveness of health education for the perception of DHF**

| Perception of DHF | Average Pre ± SD | Average Post ± SD | Difference (p-value) |
|-------------------|------------------|-------------------|----------------------|
|                   |                  |                   |                      |
|                   | 92.99 ± 10.48    | 96.74 ± 6.69      | 0.000*               |

*Significant. SD: Standard deviation, DHF: Dengue hemorrhagic fever.
parts of a healthy house improved. This difference was statistically significant with \( p = 0.000 \) for physical parts of the house, \( p = 0.017 \) for sanitation facilities, and \( p = 0.000 \) for occupant behavior (Table 8).

### Discussion

The majority of participants in this study were housewives with high school education backgrounds and age over 45 years (Table 2). The dominance of women in the effort of DHF control is notably high in Indonesia. In Indonesia, gender division of labor is common. Women are assigned to do domestic work while men do non-domestic work such as earning money [30], [31]. Efforts to control DHF at the house, such as draining water containers, cleaning the house, and preserving the house free of mosquito larvae, are considered domestic work that is performed by women [30], [31], [32].

This study was aimed to assess the effect of providing health education about DHF on changes in the community’s perceptions, social capital, and healthy house conditions. The wrong perception about DHF could influence the knowledge, attitudes, and practices of DHF control [17], [33], [34].

### Table 5: Perceptions of DHF control (n = 267)

| Perception of dengue fever control | Pre n (%) | Post n (%) | Difference (p-value) |
|------------------------------------|-----------|------------|----------------------|
| Dengue is a disease that must be **controlled together** | 265 (99.2) | 267 (100) | 0 (0) |
| Eradicating dengue is the task of health workers only | 212 (79.4) | 213 (79.8) | 54 (20.2) |
| The community plays an important role in the DHF eradication | 255 (95.5) | 256 (95.8) | 11 (4.2) |
| I will allow the jumantik to observe the larvae at my house | 260 (97.4) | 262 (98.1) | 5 (1.9) |
| I feel embarrassed if there were any larvae at my house | 156 (58.4) | 158 (59.2) | 109 (40.9) |
| I don’t like when my house is inspected by a jumantik officer | 227 (85) | 229 (85.8) | 38 (14.2) |
| I am worried if my water tank is sprinkled with abate | 242 (90.6) | 244 (91.4) | 23 (8.6) |
| Abate is poisonous | 218 (81.6) | 220 (82.4) | 47 (17.6) |
| Foggling or spraying is the most effective way to eradicate DHF | 177 (66.9) | 178 (66.7) | 89 (33.3) |
| I support the eradication of dengue by foggling because it is easy and practical | 163 (61.0) | 164 (61.4) | 103 (38.6) |
| I can pay someone else to eradicate the mosquito nests (goods) is troublesome | 207 (77.5) | 209 (78.3) | 58 (21.7) |
| I don’t like the activity of mosquito nest eradication | 229 (85.8) | 231 (86.5) | 56 (21) |
| I don’t have any spare time to eradicate mosquito nests (PSN) | 224 (83.9) | 225 (84.3) | 42 (15.7) |
| I can pay someone else to eradicate the mosquito nests when I’m busy | 61 (22.8) | 62 (22.8) | 206 (77.2) |
| I will not sprinkle lindane powder (abate) from the officer into my wells or other clean water tanks | 186 (69.3) | 186 (69.7) | 81 (30.3) |
| I make sure that my house is free from any mosquito nest | 259 (95.9) | 261 (97.8) | 6 (2.2) |
| Eradication of DHF is my responsibility | 232 (86.9) | 234 (87.6) | 33 (12.4) |
| Cooperation in the DHF eradication is very important | 263 (98.5) | 265 (99.2) | 2 (0.8) |

*Significant, SD: Standard deviation.

DHF: Dengue hemorrhagic fever.

### Table 7: The effectiveness of health education for social capital (n = 267)

| Social Capital | Pre Average ± SD | Post Average ± SD | Difference (p-value) |
|---------------|------------------|-------------------|----------------------|
| Participation | 81.9 ± 38.1 | 83.5 ± 19.0 | 0.247 |
| Concern | 86.5 ± 11.1 | 89.3 ± 9.6 | 0.003* |
| Trust | 74.5 ± 20.4 | 80.2 ± 19.3 | 0.005* |
| Social norm | 37.5 ± 30.1 | 39.6 ± 31.3 | 0.462 |
| Readiness to learn new ideas | 83.7 ± 17.5 | 89.1 ± 14.3 | 0.005* |

*Significant, SD: Standard deviation.

### Table 8: The effectiveness of health education for healthy house (n = 267)

| Healthy house | Pre Average ± SD | Post Average ± SD | Difference (p-value) |
|---------------|------------------|-------------------|----------------------|
| Physical parts of the house (Doors, windows, walls, floors, ventilation, kitchen chimneys, and lighting) | 212.9 | 221.3 | 0.000* |
| Sanitation facilities (Clean water facilities, Source of clean water) | 294.7 | 304.9 | 0.017* |
| Toilet, Type of latrine, Wastewater disposal facilities, Garbage disposal facility, Type of trash can, and Waste management) | 254.4 | 273.0 | 0.000* |

*Significant, SD: Standard deviation.

Social capital consists of components of participation, concern, trust, social norms, and readiness to learn new ideas, and all of these components support each other in efforts to control DHF [28], [29], [30]. The implementation of health promotion depends on the social capital of a community but health promotion can strengthen the social capital of the community. The existence of the same goals that are conducted in controlling DHF, the interaction between individuals, community leaders, and health workers to increase participation, cooperation, mutual trust, and the desire to learn new things in DHF control can strengthen the social capital component [40], [41], [42], [43].

Health education is always followed by other community activities which are more easily accepted and provide a good relationship between participants and researchers. Good social relations and health education that are well...
received by the research participants can change their participation, concern, trust, social norms, and readiness to learn new information about DHF control for the better. This good change has also occurred due to the participation of the local village government and Puskesmas during the implementation of health education. They support the participants to take part in health education concerning prevention of DHF [9], [20], [44], [45].

A healthy house is one of the environmental factors that influence the transmission of DHF since the A. aegypti mosquito is an anthropophilic mosquito. The A. aegypti breeding occurs in settlements. The condition of the house can be a supporting habitat for the A. aegypti mosquitoes. The physical condition of the house, sanitation facilities, and the behavior of the occupants of the house determine the condition of the house [44], [45], [46]. The poor physical conditions of the house, such as low lighting and high humidity, are supportive of the breeding of the A. aegypti, which like dark and humid places, so these conditions should be minimized in the house [44], [47], [48], [49]. Sanitation facilities such as the availability of sufficiently clean water, so that people do not need to collect water, would reduce the mosquito’s breeding places [50], [51], [52], [53]. The availability of waste processing facilities at the house could reduce the disposable site of A. aegypti [22], [54]. Occupant behavior greatly affects the condition of the house. The habit of maintaining cleanliness, avoiding hanging clothes, and other habits could be supportive and preventive for mosquito breeding [21], [55]. This must be known by the community so that they could maintain the condition of their houses from being the breeding spots to the A. aegypti mosquitoes, through health education, information, and knowledge about DHF are provided so that public awareness increases [3], [24], [56], [57].

Health education about DHF affects perceptions, capital, and healthy house conditions. Post-intervention data were taken 6 months after the health education was done and the results still showed positive changes in all variables [58]. These changes are consistent. Health education that is given repeatedly over a long enough period influences the community’s understanding of DHF and its transmission risk factors [3], [59], [60]. DHF is a disease that is often neglected [18], especially at this time when most people are focused on efforts of COVID-19 control, including in Indonesia. DHF cases remain high and become the second most significant threat after COVID-19 [61], [62]. DHF control in Indonesia is still very dependent on larva investigators, health workers, and fogging officers. Since the role of the community has not been maximal in DHF controlling efforts, more community-based DHF control is needed [7], [42], [52], [63]. Continuous health education is important to remind the community about the dengue problem and the shared responsibility in DHF controlling efforts. Regular health education can increase public awareness to participate in controlling DHF. The health education also can involve the Puskesmas as the closest health service facility to the community and involve the village government for monitoring and evaluating the implementation and results of the interventions. Besides, the Puskesmas and the village government would be responsible for the sustainability of health education to the community after the research concludes. This is essential because health education must be presented continuously to maintain the community’s consistency in controlling DHF. The limitation of this study is that the assessment process after the intervention was not done every month so that the changes that occurred every month could not be known, but the assessment conducted at the 6th month still showed that the changes that occurred after health education were consistently good.

Conclusion

Health education can increase good perceptions about DHF and its control, social capital, and healthy housing conditions. It is very important to increase the active participation of the community in implementing DHF control. The implementation of this health education needs to be done continuously to maintain the consistency of changes that occur in the community. It is feasible by involving the community health centers (Puskesmas) and the village government as managers of the health education program about dengue after the research is conducted.

Data Availability

All the data analyzed for this study are included within the article.

Ethical Approval

This research had received approval from the Medical and Health Research Ethics Committee of FKKMK UGM number: KE/FK/1233/EC/2018 accepted on November 22, 2018.

Authors Contributions

Idea owner of this study: (TWS), (TBTS), (MAW), (EHM), and (RSP).
Study design: TWS, TBTS, MAW, EHM, and RSP.

Data gathering: TWS.

Writing and submitting manuscript: TWS and RSP.

Acknowledgments

This paper is dedicated to the late Dr. dr. Mahardika Agus Wijayanti, DTM and H, M. Kes. for his contribution to this research.

My sincere gratitude goes to:

1. LPDP The Ministry of Finance of the Republic of Indonesia.

2. All the participants.

References

1. Codeço C, Lima AW, Araújo SC, Lima JB, Maciel-de-Freitas R, Honório NA, et al. Surveillance of Aedes aegypti: Comparison of house index with four alternative traps. PLoS Negl Trop Dis. 2015;9(2):e0003475. https://doi.org/10.1371/journal.pntd.0003475 PMid:25668559

2. de Abreu FV, Morais MM, Ribeiro SP, Eiras ÁE. Influence of breeding site availability on the oviposition behaviour of Aedes aegypti. Mem Inst Oswaldo Cruz. 2015;110(5):669-76. https://doi.org/10.1590/0070-4290.20152140490 PMid:26154742

3. Kusuma Y, Burman D, Kumari R, Lamkang A, Babu B. Impact of health education based intervention on community's awareness of dengue and its prevention in Delhi, India. Glob Health Promot. 2019;26(1):50-9. https://doi.org/10.1177/1757975916686912 PMid:28349734

4. DIY DKP. DHF Cases in Yogyakarta. Yogyakarta: DIY DKP; 2020.

5. Sleman District Health Office. DHF Cases in Sleman Yogyakarta. Yogyakarta: Sleman District Health Office; 2019. https://doi.org/10.1093/trstmh/trv028 PMid:25890933

6. Rakhmani AN, Limpanont Y, Kaewkungwal J, Okanurak K. Surveillance of dengue fever in suburban Surabaya, Indonesia: A qualitative exploration of perceptions of dengue fever control in caregivers of children under 5 years, in the Peruvian Amazon. PLoS Negl Trop Dis. 2017;11(9):e0005755. https://doi.org/10.1371/journal.pntd.0005755 PMid:28873408

7. Sulistiyawati S, Astuti F, Unmiyati S, Satoto T, Lazuardi L, Nilsson M, et al. Dengue vector control through community empowerment: Lessons learned from a community-based study in Yogyakarta, Indonesia. Int J Environ Res Public Health. 2019;16(8):1013. https://doi.org/10.3390/ijerph16081013 PMid:30897770

8. Tana S, Unmiyati S, Petzold M, Kroeger A, Sommerfeld J. Building and analyzing an innovative community-centered dengue-ecosystem management intervention in Yogyakarta, Indonesia. Pathog Glob Health. 2012;106(8):469-78. https://doi.org/10.1179/2047773212y.0000000062 PMid:23318239

9. Suwanbamrung C. Community capacity for sustainable community-based dengue prevention and control: Domain, assessment tool and capacity building model. Asian Pac J Trop Med. 2010;3(6):499-504. https://doi.org/10.1016/ s1995-7645(10)60121-6

10. Spiegel J, Breilh J, Witches A, Mitchel-Foster K, Delgado J. Integrating participatory community mobilization processes to improve dengue prevention: An eco-bio-social scaling up of local success in J Trans R Soc Trop Med Hyg. 2015;109(6):419. https://doi.org/10.1093/trstmh/trv028 PMid:25890933

11. Gudmundsson G, Mikiewicz P. The concept of social capital and its usage in educational studies. In: Studia Edukacyjyne, 1st ed. Poland: Adam Mickiewicz University Press; 2012. p. 55-79.

12. Erikkson M. Social Capital, Health and Community Action. Social Capital, Health and Community Action Implications for Health Promotion; 2010. p. 17-44. https://doi.org/10.3402/gha.v4i0.5611

13. Akinlude E. Theories and concepts for human behavior in environmental preservation. J Environ Sci Public Health 2017;1:120-33.

14. Andersson N, Nava-Aguilera E, Arrostegui J, Morales-Perez A, Suazo-Laguna H, Legorreta-Soberanis J, et al. Evidence based community mobilization for dengue prevention in Nicaragua and Mexico (Camino Verde, the Green Way): Cluster randomized controlled trial. BMJ 2015;351:h3267. https://doi.org/10.1136/bmj.h3267 PMid:26156323

15. Ibarra AM, Luzadis VA, Cordova MJB, Silva M, Ordoñez T, Ayala EB, et al. A social-ecological analysis of community perceptions of dengue fever and Aedes aegypti in Machala, Ecuador. BMC Public Health 2014;14(1135):1135. https://doi.org/10.1186/1471-2458-14-1135 PMid:25370883

16. Ibarra A, Ryan SJ, Beltrán E, Mejía R, Silva M, Muñoz Á. Dengue vector dynamics (Aedes aegypti) influenced by climate and social factors in ecuador: Implications for targeted control. PLoS One. 2013;8(11):e78263. https://doi.org/10.1371/journal.pone.0078263 PMid:24324542

17. Raikhmani AN, Okanurak K, Kaewkungwal J, Limpanont Y. Knowledge, perception, and dengue prevention behavior in lowokwaru sub district, urban area in Malang, Indonesia. J Adv Heal Med Sci. 2017;3(1):17-26. https://doi.org/10.20474/jahms.3.1.3

18. Frank AL, Beales ER, de Wildt G, Meza Sanchez G, Jones LL. We need people to collaborate together against this disease: A qualitative exploration of perceptions of dengue fever control in caregivers of children under 5 years, in the Peruvian Amazon. PLoS Negl Trop Dis. 2017;11(9):e0005755. https://doi.org/10.1371/journal.pntd.0005755 PMid:28873408

19. Ogden J, Morrison K, Hardee K. Social capital to strengthen health policy and health systems. Health Policy Plan. 2014;29(8):1075-85. https://doi.org/10.1093/heapol/czt087 PMid:24277736

20. Asri, Nuntaboot K, Festi P. Community social capital on fighting dengue fever in suburban Surabaya, Indonesia: A qualitative study. Int J Nurs Sci. 2017;4(4):374-7. https://doi.org/10.1016/j.ijnss.2017.10.003 PMid:31406780

21. Haryono H, Suyadi S, Hakim L, Yanuwidi B. The role of
environmental and behavior factors to dengue fever incidents. J Appl Environ Biol Sci. 2016;6(4):1-8.
22. Getachew D, Tekie H, Gebre-Michael T, Balkew M, Mesfin A. Breeding sites of Aedes aegypti: Potential dengue vectors in dire Dawa, East Ethiopia. Interdiscip Perspect Infect Dis. 2015;2015:706276. https://doi.org/10.1155/2015/706276 PMid:26435712
23. Bota R, Ahmed M, Salah M, Aziz A, Knowledge, attitude and perception regarding dengue fever among university students of interior Sindh. J Infect Public Health. 2014;7(3):218-23. https://doi.org/10.1016/j.jiph.2013.11.004 PMid:24613408
24. Sumito S, Kusnanto H, Istiono W. The Effect of lecture and small group discussion method in health education towards dengue hemorrhagic fever vector larva free proportion in Gunungkidul Regency. Rev Prim Care Prat Educ (Kajian Prakt dan Pendidik Layanan Prim) 2019;2(1):25-31. https://doi.org/10.22146/rpcpe.44471
25. Baum FE. Power and glory: Applying participatory action research in public health. Gac Sanit. 2016;30(6):405-7. https://doi.org/10.1016/j.gaceta.2016.05.014 PMid:27491431
26. Budiastuti D, Bandur A. Research Validity and Reliability. 1st ed. Jakarta: Mitra Wacana Media; 2018. p. 169-73.
27. Alwi I. Empirical criteria in determining sample size. Form J Ilm Pendidik MIPA. 2012;2(2):140-8.
28. Lally P, Jaarsveld C, Potts H, Wardle J. How are habits formed: Modelling habit formation in the real world. Eur J Soc Psychol. 2010;40:625-34. https://doi.org/10.1002/ejsp.674
29. Waruwu MK, Sukartini T, Indarwati R. The Relationship between attitudes knowledge and motivation and mother behavior in eradicating mosquito nests (PSN) DBD. Prodi Ners. 2014;1(1):43-51.
30. Chanyasanha C, Han M, Teetipsatit S. Dengue hemorrhagic fever (DHF) in the work area of Guntung Payung Community Health Center. Publ Kesehat Masy Indones. 2015;2015:706276. https://doi.org/10.1201/b10683
31. Tandos R. Empowering Indonesian female domestic workers. J Ilmu Dikwah. 2014;34(2):181-96. https://doi.org/10.21580/jd.34i.2.53
32. Pujiyanti A, Trapsilowati W. Knowledge, attitudes and behaviors of housewives in preventing dengue fever in Kutowinangun Village, Salatiga. J Vektora. 2014;4(2):102-16.
33. Wanti, Yudhastuti R, Notobroto H, Subekti S, Sila O, Kristina R, et al. Dengue haemorrhagic fever vector larva free proportion in the Aedes aegypti larvae in dengue haemorrhagic fever in the endemic area Banjarbaru. Epidemiol Penyakit Bersumber Komunitas. 2014;9(6):14-24. https://doi.org/10.18291/ps.4044
34. Briand K, Leclercq N, Chiodini PL, et al. Entomological index and home environment conditions to the density level of _Aedes_ larvae in emerging transmission areas in rural Cambodia. Dengue Bull. 2016;32:145-55.
35. Astuti, Elisabeth DL. Relationship of physical environmental indexes and home environment contribution to the density of *Aedes* larva in rural area in Yogyakarta. J Ilmu Kesehat Masy. 2018;9(3):130-3. https://doi.org/10.21109/kesmas.v13i4.2701
36. 36. Aliyu M, Omoniyi K, Adebajo S, Oluwatosin M, Busari O. Effect of Health Education Based Intervention on Community’s Perception, Healthy House, and Social Capital of Dengue in a Community Health Center. Publ Kesehat Masy Indones. 2020;15(1):32-9. https://doi.org/10.21109/kesmas.v15i1.3294
37. Astuti, Elisabeth DL. Relationship of physical environmental conditions to the density level of Aedes sp larvae in elementary schools of kasihan subdistrict, Bantul, special region of Yogyakarta. J Ilmu Kesehat Masy. 2018;9(3):216-25.
38. Garcia-Betancourt T, Higuera-Mendieta DR, González-Urbe C, Cortés S, Quintero J. Understanding water storage practices in Banjarbaru. Pathog Glob Public Health. 2015;2015:706276. https://doi.org/10.1155/2015/706276 PMid:26037532
39. Cátedra J, Ruchetti E, Zumbo B. Social and health: Implication for health promotion by lay citizens in Japan. Glob Health Promot. 2015;22(4):5-19. https://doi.org/10.1177/1757975914547547 PMid:25319376
40. Conyer T, Galván J, Zuniga P. Community participation in the prevention and control of dengue: the patio limpio strategy in Mexico. Paediatr Int Child Health 2012;32(Suppl 1):10-3. PMid:22668443
41. Astuti, Elisabeth DL. Perceptions, rationale and socio-demographic characteristics. PLoS One. 2015;10(6):e0129054. https://doi.org/10.1371/journal.pone.0129054 PMid:26061628
42. Ayewewickreme W, Wickremasinghe AR, Karunatilake K, Sommerfeld J, Axel K. Community mobilization and household level waste management for dengue vector control in Gampaha district of Sri Lanka; an intervention study. Pathog Glob
53. Arunachalam N, Tyagi B, Samuel M, Krishnamoorthi R, Manavalan R, Tewari S, et al. Community-based control of Aedes aegypti by adoption of eco-health methods in Chennai City, India. Pathog Glob Health. 2012;106(8):479-87. https://doi.org/10.1179/2047773212y.0000000060
PMid:23318240

54. Nofita E, Rusdji SR, Irawati N. Analysis of indicators entomology Aedes aegypti in endemic areas of dengue fever in Padang, West sumatra, Indonesia. Int J Mosq Res. 2017;4(2):57-9.

55. Tambo E, El Dessouky AG, Khater EI. Innovative preventive and resilience approaches against aedes-linked vector-borne arboviral diseases threat and epidemics burden in Gulf Council Countries. Oman Med J. 2019;34(5):391-6. https://doi.org/10.5001/omj.2019.73
PMid:31555414

56. Satoto T, Diptyanusa A, Setiawan Y, Alvira N. Environmental factors of the home affect the density of Aedes aegypti (Diptera: Culicidae). J Kedokt Yars. 2017;25(1):41-51.

57. Ameliwati, Agrina, Dewi A. The effectiveness of health education using audiovisual media on increasing family behavior in preventing dengue hemorrhagic fever (DHF). Enferm Clin. 2019;29(2013):30-3. https://doi.org/10.1016/j.enfcli.2018.11.013
PMid:30745163

58. Bhanu V, Shobha C, Narahari M, Kurian J, Lalremeinuata B, Laldinpuii E, et al. Study of impact of health education on knowledge, attitude and practice related to dengue fever. World J Pharm Pharm Sci. 2015;4210(10):748-61.

59. Usman H, AlSahafi A, Abdurashid O, Mandoura N, Al Sharif K, Ibrahim A, et al. Effect of health education on dengue fever: A comparison of knowledge, attitude, and practices in public and private high school children of Jeddah. Cureus. 2019;10(12):e3809. https://doi.org/10.7759/cureus.3809
PMid:30868023

60. Hasanah N, Indriatje. Health education in increasing prevention behavior of dengue hemorrhagic fever in families at Gubeng Village, Surabaya, Indonesia. Indian J Public Heal Res Dev. 2019;10(11):1977. https://doi.org/10.5958/0976-5506.2019.03845.2

61. Harapan H, Ryan M, Yohan B, Abidin RS, Nainu F, Rakib A, et al. Covid-19 and dengue: Double punches for dengue-endemic countries in Asia. Rev Med Virol. 2020;31(2):e2161. https://doi.org/10.1002/rmv.2161
PMid:32946149

62. Masyeni S, Santoso MS, Widyaningsih PD, Asmara DW, Nainu F, Harapan H, et al. Serological cross-reaction and coinfection of dengue and COVID-19 in Asia: Experience from Indonesia. Int J Infect Dis. 2021;102:152-4. https://doi.org/10.1016/j.ijid.2020.10.043
PMid:33115680

63. Asian Development Bank, World Health Organization. Managing Regional Public Goods for Health: Community-based Dengue Vector Control. 1st ed. Manila: Asian Development Bank, World Health Organization; 2013. p. 3-17. https://doi.org/10.22617/brf200128-2