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Community Movement in Applying Mosquito Net on House Ventilations: An Initial Support for Green Architecture to Decrease Dengue Disease in Bandung Indonesia

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Abstract. Green architecture still has risk to dengue disease when trees cover house roofs' gutter. This study was aimed to continue a geographical information system (GIS) and remote sensing (RS) study on roofs factor association with dengue disease by initiating community movement in applyingmosquito net on house ventilations to cut the disease transmission and mosquito breeding sites inside house. Our methods was an operational research in which improvement of interventions, policies and regulations towards dengue disease prevention is our intended endpoint. Several steps were conducted such as: (1) research problems formulation from GIS-RS analysis from previous phase research in Bandung city, (2) informal and formal approach to community leaders and primary healthcare centre (Puskesmas), (3) Video education and focus group discussion (FGD), (4) initial application of mosquito nets on house in communities; and (5) advocacy to Mayor of Bandung city (was on progress).Our study resulted several supports: one of sub-city leaders (Camat) in the city, village leaders (Lurah), and sub-village leaders (Ketua RW) of 5 villages (kelurahan), one kelurahan which mainly comprised formal settlements needed more efforts, which was experts on dengue disease from university to directly explain the mosquito nets application to its community. Informal leaders in all kelurahan's community suggested only mothers movement was not enough, thus, youths in community was mentioned to help the community movement on the mosquito nets application.

1. Introduction

Dengue disease is a female *Aedes* species mosquito-borne disease caused by dengue virus. It transmits the virus from human to human by mosquito biting[1]. The disease may cause dangerous conditions to human when bleeding and shock occur [2, 3]. *Aedes* mosquitoes can disperse house to house to bite human because human is their primary mode. They seek human because of their thermal stimuli, carbon dioxide and acid odor stimuli [4]. The dispersal depends on the distance between houses. Crowded population such as in urban may lessen the mosquito dispersal. Rural communities where distance between houses is farther can also modify mosquito dispersal into longer distance [5]. The peak of dengue disease infections can be found when the dispersal is less than 100 meters [6, 7]. The nature cause of biting is that they need to continue their breeding phase from eggs, larvae, pupae and adult[8, 9].

Household is a major factor of *Aedes* species mosquito breeding sites in stagnant water [10]. Blocked roof gutter, for example by falling leaves from trees is one of causes of stagnant water [9, 11].Mosquitoes that emerge from breeding sites outside house can enter house through any ventilations for biting and finding inside-house breeding sites purposes. This conditions caused by house ventilations design is not covered by mosquito net [12]. However, application of mosquito net is effective for houses with regular function such as family activities. It is not effective to house with shop activities because door and ventilations are usually open. Additionally, house with poor hygiene behavior such as shown by poor garbage disposal is at-high-risk of dengue[13]. A study by Rinawan, et al about geographical information system (GIS) and remote sensing (RS) was applied to identify risks of houses as the breeding site of *Aedes* mosquito depicting results that Bandung city has higher risk to dengue disease. The breeding site of the mosquito at a house can be a risk ofdisease escalating to surrounding neighbourhood [6].

Green architecture of houses should also can prevent dengue disease by mosquito net on ventilations, or reduce the risk of mosquito biting by mosquito trap or distractordesign on house. Green architecture goals is not only good for environment, but also for human's health [14]. In its initiation, people movement that consists of youths and adult is crucial. It can be supported by scientist and or practitioner who can help lessen the gap between people in society and government [15]. This study was aimed to continue GIS-RS study on roofs factor association with dengue disease by initiating people movement to use mosquito net on house ventilations to cut the disease transmission and mosquito breeding sites inside house.

2. Method

Our methods was an operational research in which improvement of interventions, policies and regulations towards dengue disease prevention is our intended endpoint. Several steps were conducted such as: (1) research problems formulation from GIS-RS analysis from previous phase research in Bandung city, (2) informal and formal approach to community leaders and primary healthcare centre (Puskesmas), (3) Video education and focus group discussion (FGD), (4) initial application of mosquito nets on house in communities; and (5) advocacy to Mayor of Bandung city (was on progress).

2.1. Study Area

We started in one of subs-city (Kecamatan), Ujungberung of Bandung city where inhabited by 71,254 people in 612.79 hectares or approximately 116 inhabitants per hectare, which is less than the total density of Bandung city (2,455,517 inhabitantsin 16,731 hectares total area), 146 inhabitants per hectare. The city is the capital of West Java province in Indonesia, the third crowded city after Surabaya and Jakarta.

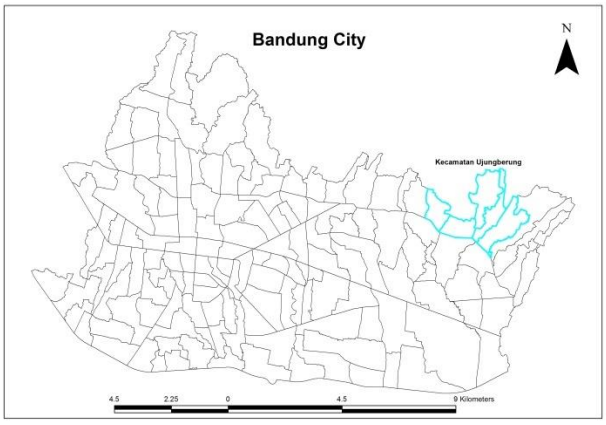

Figure 1. Bandung city map with Kelurahan administration border detail. The blue line highlight depicts the border of Kecamatan Ujungberung

Figure 1 depicts the city map with village (Kelurahan) administration border detail. Blue highlight is 5 Kelurahans in KecamatanUjungberung. Figure 2 illustrates the Kecamatan of Ujungberung using Red, Green and Blue color composite of Worldview 2 satellite data. Every Kelurahan has at least seven sub-Kelurahan (RW) depending on the size of the area. The northern part, Kelurahan Pasirwangi, is the highest contour reaching 925 meters above sea level, and the southern part, Kelurahan Cigending and some parts of Pasanggrahan is 687.5 meters above sea level.

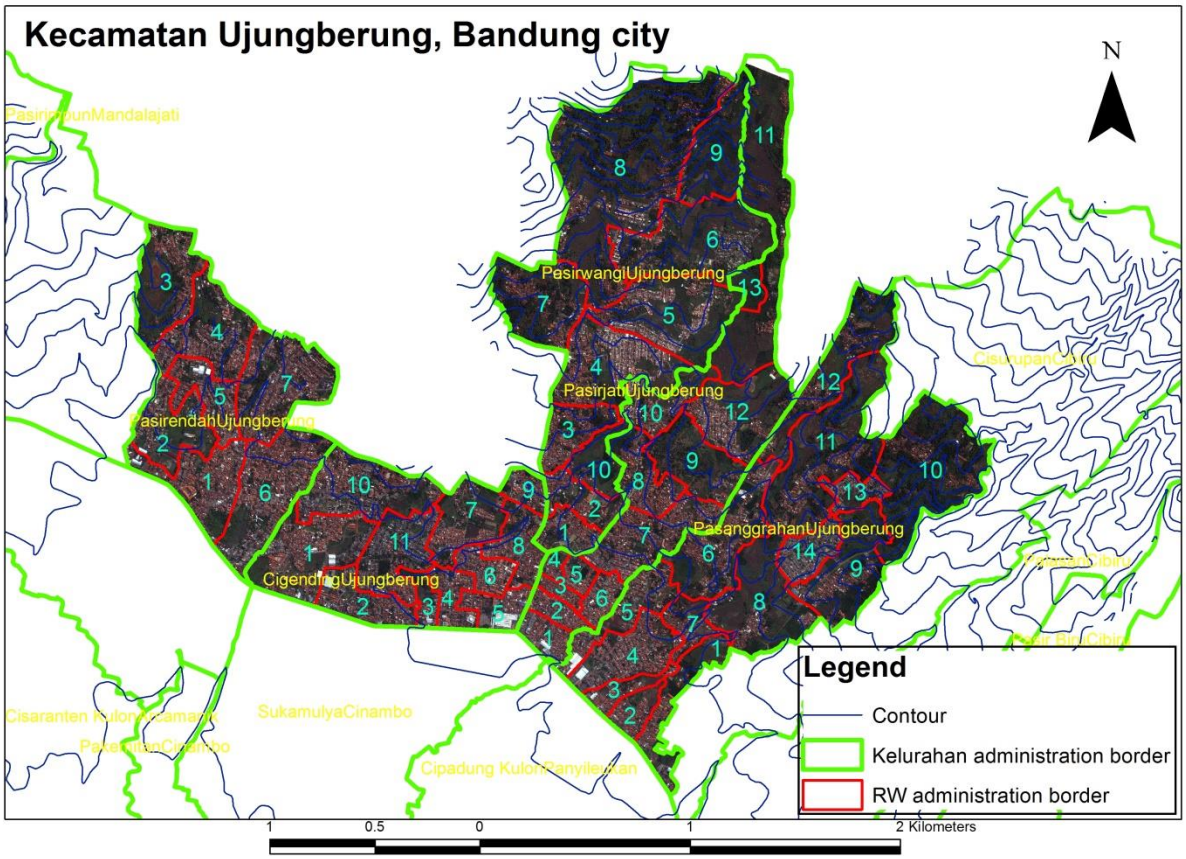

Figure 2. Administration border of villages (Kelurahan) and sub-villages (RW) numbered with light blue number on a Red, Green, and Blue color composite Worldview 2 satellite data, and contour data

2.2. Data and Analysis Procedure

Our data on the first phase: research problems formulation from GIS-RS analysis using dengue data from Bandung city health office. We also used Worldview 2 satellite data from Bandung city development planning agency to identify houses. Clearance of these data were already issued in the previous work by the government. On the first phase, we found that Kecamatan Ujungberung was at-high-risk of dengue disease infection chain. This problems was analysed using previous publication by Rinawan et al [6].

The second phase which was actually concurrent preparation of interventions, were informal and formal approaches to community leaders and primary healthcare center (Puskesmas). This was conducted by voluntarily expressing our intention to head of Puskesmas and of Kecamatan (Camat) in order to initiate community movement to prevent dengue disease in the Kecamatan.

The third phase data includes participation of mothers' community from each of Kelurahan in Kecamatan(67 persons) in health education using video that was made based on Health Beliefs Model (HBM) [16]regarding dengue disease symptoms, risk, severity, mosquito screen use on house ventilations. We evaluated the video by pretesting and post-testing using 15 knowledge 'true' and 'false' questions based on HBM.The true-and-false questions were: 1. Dengue disease is caused by

virus, 2. dengue disease is transmitted by physical contact, 3. One of dengue disease's symptoms is under skin bleeding, 4. First symptoms is fever, may be continued with under skin bleeding and or stomach ache, 5. If no management after dengue disease, every patient will be cured spontaneously, 6. Dengue disease can be fatal, 7. *Aedes* mosquito is more attracted to dark place, 8. Hematemesis is one of dengue disease complications, 9. *Aedes* larvae is found in dirty water, 10. Method of identifying larvae is only using bare-eyes, 11. Water receptacles cleaning is done every 1-month period, 12. Prevention is only done when dengue disease is found, 13. Mosquito net use is part of prevention steps, 14. Mosquito net is effective if used for small ventilation only, 15. Monthly report on *Aedes* larva to Puskesmas is one of important movement in dengue disease prevention.We rated the scores and compared them using Wilcoxon signed rank test (a non-parametric test) because the data was not in normal distribution (Kolmogorof-Smirnov $p< 0.05$). These 15 questions were initially made with local content, and their construct to identify them as a set of 'knowledge' factor questions have not yet been measured.

After the video education, we continued with FGD to assess what was the problem in practicing community movement in dengue disease prevention. We did not record their voice when conducting FGD, only wrote it. Figure 3 shows the seating position when performing video education and FGD.

Figure 3. The seating position when video education and FGD

The fourth phase was initial application of mosquito nets on house in communities by discussing which house has better understanding and cooperation; andfifth, advocacy to Mayor of Bandung city was still on progress.

3. Results

Our study continuation resulted several supports: one of Camat of Kecamatan Ujungberung, village leaders (Lurah), and sub-village leaders (Ketua RW). Of 5 villages (kelurahan), one kelurahan which mainly comprised formal settlements needed more efforts, which was experts on dengue disease from university to directly explain the mosquito nets application to its community.

Table 2 shows participation of mothers community in pre and posttest, which was high enough 64 of 67 persons in the test. The 3 were late. 55 persons (86% of 64 persons) can answer all questions of pre and posttest.

Table 1. Participation of mothers community

Participation	N
Invitations	67
Participate in test	64
Full answers on pre and post-test	55

Table 2 shows ranks of posttest minus pretest using Wilcoxon Signed Ranks Test. It resulted significance ($p = 0.003$) with higher positive ranks of 32 persons and the rest negative and ties ranks.

Table 2. Ranks of posttest minus pretest using Wilcoxon Signed Rank Test.

Ranks	N
Negative ranks	12
Positive ranks	32
Ties	11
Total	55

From the FGD, informal leaders in all kelurahan's community suggested only cadres' movement was not enough, thus, youthscommunity such as youth organization in community (KarangTaruna) was mentioned to help the community movement on the mosquito nets application. The community wanted to initiate the mosquito net application even though they thought it would be not effective because only cover small ventilation using mosquito net from kinds of "tile" clothes. Figure 4 shows the small ventilations where they initiated community movement on the use of "tile" clothes as mosquito net.

Figure 4. The small ventilations on the upper part of window

The process of informal and formal advocacy was also done to the head of Bandung city health office, resulting informal manner on approaching the mayor to decide meeting time because formal manner may require much longer time to meet the Mayor.

4. Discussions

Combination of informal and formal networking to community leaders and government authorities can support initiation of a program [17-19]. In our result, mother community knowledge can be changed into better understanding using video. The role of researcher from university, professionals, and primary health care centre can be a middle networking catalyst besides the role of youth with creativity in educating mothers while advocating government authorities[15]. The middle networking can engender bridging ideas from community to government including by performing health advocacy that green architecture of a house can also be a healthy-oriented architecture [14], for example using mosquito net on house ventilations and other tools design to decrease mosquito bite and infections[12].

Only mosquito net application is not enough in green architecture because not every house characteristics is mosquito-proof [13]. However, to start with small steps is better to stimulate community movement than no start at all, or waiting too long to start a step. More importantly, the community and primary health care centre have collaborated to perform a program. Top-down program from government may not be effective without movement response. Henceforth, government should support stimulation of community to initiate a small movement then a bottom-up ideas may arise to lessen the gap between top-down decision and bottom-up ideas [15, 20].

5. Conclusions

We conclude that this work on operational research still needs to come up with further collaborations with creative ideas from creative youth, researcher, and professionals. Therefore can support more a health-oriented green architecture program for community. It may be easier to educate mothers community to understand dengue disease, but it is still questionable on how to educate youths in community including to collaborate them with mothers community.

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