Respati et al. Int J Trop Dis 2018, 1:008
Volume 1 | Issue 1
Open Access

International Journal of
Tropical Diseases

ORIGINAL ARTICLE

A Qualitative Ecohealth Model of Dengue Fever (DF) in Bandung, Indonesia

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Abstract

Background: Dengue Fever (DF) is a serious disease in Indonesia. The sustainability of a DF prevention program remains constrained despite continuing education programs and community participation efforts. Identifying the issues related to the cause of the disease is a major factor in its control. In this study we try to understand the complexity of the management of the disease.

Method: We apply an eco-health approach to explore DF management in Bandung city, West Java, an area of high DF incidence. A qualitative study was conducted using unstructured interviews and focus group discussions with cadres and community leaders directly involved in DF management. The verbatim data were transcribed and analyzed using NVivo software.

Result: Four major themes emerged: Prevention and control, community participation, housing and surroundings and weather. They were illustrated as a model. In more detail, sub-themes emerged and were interrelated with the basic model. We synthesized the results into six key principles based on process or purpose. Process principles were systems thinking, interdisciplinary or trans disciplinary research and participation. Purpose principles were sustainability, gender equality and social status and knowledge translation. The principles were expanded in a table to indicate how the overall findings related to the principles.

Conclusion: We concluded that system thinking, and interdisciplinary research facilitates optimal management related to the connections the DF program has with systems external to health. Translating research results into an understandable form for stakeholders, encourages community participation and understanding of DF. Finally, program sustainability requires the involvement of the complete community regardless of gender and social status.

Keywords

Dengue fever, Eco-health, Management

Introduction

The World Health Organization (WHO) estimates urban populations will increase by 1.84% per year between 2015 and 2020, 1.63% per year between 2020 and 2025, and as much as 1.44% per year between 2025 and 2030 [1]. The resulting increased density of dwellings in urban areas facilitates the exchange of bacteria, viruses and other health problems. One disease closely related to the density of human settlements and interactions between the mosquito vectors and environment, including climate, is dengue fever (DF) [2,3]. Dengue hemorrhagic fever virus is transmitted by peri-domestic mosquitoes, associated with water containers, and the vectors include *Aedes aegypti* and *Aedes albopictus* which latter can produce the diseases in humans [2]. Development related activities, particularly with regard to water storage, can increase the mosquito habitats and hence the risk of disease [4-6].

To manage disease effectively requires a holistic approach. This is embodied in the concept of ecological

Citation: Respati T, Feriandi Y, Ndoen E, Raksanegara A, Djuhaeni H, et al. (2018) A Qualitative Ecohealth Model of Dengue Fever (DF) in Bandung, Indonesia. Int J Trop Dis 1:008.

Accepted: October 10, 2018; **Published:** October 12, 2018

integrity discussed by Sieswerda, et al. [7]. It is a dynamic approach which facilitates maintaining public health and its reaction to changes in the global environment [1,2,8]. The Eco health approach endeavors to address challenges to prevent environmental degradation and improve ecosystems while utilizing the environment without compromising health [9,10]. A recent example of the application of the approach, in India, is in who focused on the interaction between ecological and socio-economic dimensions and the effects on health [9,11].

Community participation is important for the sustainability of a DF prevention program [12] but may face barriers. For example, knowledge and attitude to dengue were constraints for community participation in Aceh, Indonesia [13] and this may be despite continuing education programs [12,14]. Factors that affect knowledge of symptoms, prevention, and treatment seeking patterns for DF include level of education, occupation, knowledge of dengue, and local culture [13,15,16].

Identifying the cause of a disease is a major factor in its control. There are multifactor effects that are highly dynamic and change over time [15,17,18]. The failure of an intervention program in the health sector to achieve its objectives is usually due to the program not being designed comprehensively and not taking a whole of system perspective [2,18-20].

Dengue hemorrhagic fever (DF) with multifactorial risk factors requires an approach that explains the dynamics and complexity of the problem [6,21]. A systems approach is most appropriate to explain the relationships and roles of each variable in complex situations [6,22,23]. The eco-health approach uses systems to study changes occurring in the biological, physical, social and economic environments, as well as weather and relationships to health [22,24-26]. In the DF context it provides a comprehensive picture of the dynamics of the problems and is one that can be used to determine the most appropriate interventions [10,21,27]. This paper aims to analyze and describe factors contributing to DF in Bandung, West Java, Indonesia. It uses an eco-health approach and qualitative methods to comprehensively understand the complexity in the fight against the disease. It synthesizes the results into six principles associated with the main themes and sub-themes.

Materials and Methods

Context

Indonesia is one of the countries with the highest incidence of dengue [28]. West Java data indicates that, although dengue cases have tended to decline in recent years, the incidence rate still has not met the national achievement targets [29]. The decline in cases in West Java should be interpreted cautiously as it may only in-

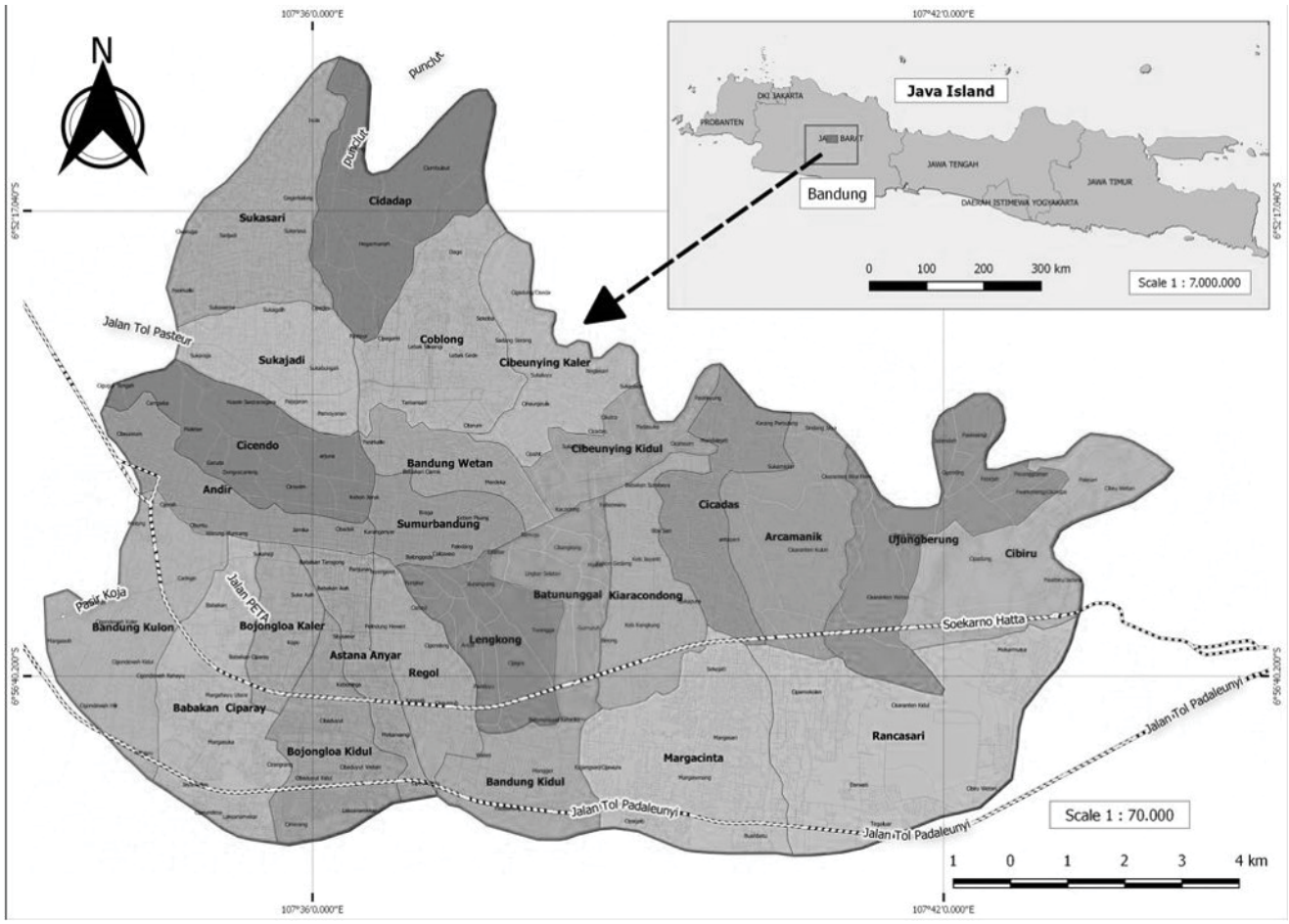

Figure 1: Map of study area.

dicate temporal variations in specific epidemic patterns or in the mosquito vector populations [28]. Evidence for this is that DF outbreaks that had generally followed a regular pattern, have recently become more irregular, making it more difficult to estimate the extent and nature of the problem [6]. From December 2015 to the end of January 2016 data from the Directorate of Disease Control of Vectors and Zoonosis of the Ministry of Health stated that DF outbreaks were reported in 9 districts and 2 cities from 7 provinces in Indonesia with 25 deaths [30]. West Java is one of the provinces that has the highest number of DF cases in Indonesia and Bandung is the city with the highest number of cases. For example, in 2016 there were 3,447 cases and 7 deaths in Bandung [30]. The DF problems in Bandung are becoming more complex as both urbanization and population mobility are increasing, the latter being evidenced by both the increasing number of vehicles on the highways and the frequency of flights in and out of Bandung.

Bandung city is located at 6° 54' S, 107° 36' E (Figure 1). The average altitude is approximately 768 m above sea level with the lowest area in the south at 675 m and the highest in the north at 1050 m above sea level. The total area of Bandung City is 16,730 hectares with a population of 2,461,931 people in 2012. The average annual temperature is 23.5 °C with an average maximum of 27.8 °C and an average minimum of 18.6 °C with an average annual rainfall of 200.4 mm and the average number of rainy days is 21.3 days per month [31].

Study design

The study is a qualitative one based on individual interviews and a focus group discussion. The instruments used were an in-depth interview guide and a discussion guide. Data were recorded by notes and with a tape recorder to store data.

The interview respondents were 14 people involved in DF programs especially in Bandung City. They are officers from the Health Office Bandung for the disease and environmental control, health promotion, health human resources and health services. We interview head of the Agency for Environmental Control (BPLH), officers from the Office of Bandung City responsible for city planning, basic sanitation and clean water infrastructures also for waste management. Several head of the public health center with officer for communicable disease program and basic sanitation and clean water program. In-depth interviews were conducted in the respondents' workplace with the length of interviews ranging from 30 minutes to 2.5 hours.

The instruments used in the interviews were unstructured interview guides developed in the field as needed. Unstructured interviews were chosen because they provide an opportunity to get the best in-depth data compared to other interviewing techniques. To augment the findings from the in-depth interview, a focus group with six participants held discussions with cadres and community leaders directly involved in DF programs in their areas. Informed consent was obtained from all individual participants included in the study.

Thematic analysis was the method used to identify and analyze themes. The analysis constructs the themes from the data collected which are objectively and systematically computed to produce descriptive descriptions of the text content. Thematic analysis was chosen because the main theme was already known (DF). The main purpose of this analysis was to summarize a large number of details into concepts, models or a more general picture.

Researchers used NVivover.10 software to process the data [32]. NVivo was chosen because this analytical tool can be used to organize and analyze non-numerical and unstructured large data sets. Before using the software, the results of in-depth interviews and the results of the focus group discussion were transcribed *Ad verbatim* (i.e., exactly as spoken). The inductive analysis served as a guideline in data management to search for themes, patterns, and categories for the source analysis in the data. Information represented in the form of circles corresponding to each factor. Sizes of circles represent the significance of the information based on number of topics mentioned by respondents and number of respondents who mentioned the topics in the interview and FGD.

We tested the validity of research data and its analysis to establish its credibility by triangulation and by assessing its transferability, dependability and confirmability.

This study has obtained ethical approval No. 464/UN6.c2.1.2/KEPK/PN/2014 dated 14 August 2014 from Health Research Ethics Committee of Faculty of Medicine, Universitas Padjadjaran and Badan Kesatuan Bangsadan Perlindungan Masyarakat Daerah (BKBPMD) West Java Provincial Government no. 070/3799/BKBPM dated October 30, 2014.

Results

The purpose of this qualitative research was to understand the factors influencing DF transmission in Bandung. The results are presented in the themes identified by the research (interviews and focus group discussion), based on factors that were considered to have important impacts on management of DF. Much of this is reported in the present tense as that was the way it was articulated. Quotations are identified by respondent number (e.g. Rn). Figure 2 shows the themes from the in-depth interviews. The size of each circle shows the relative magnitude of the participants' interest in the theme, based on the number of respondents who gave an opinion on the theme. In order of importance, the themes were: Dengue prevention and control; housing and its environment; the role of the community, and

the weather. Of course, the vector is shown in Figure 2, as it is a prerequisite for dengue transmission, but this is not described further as it has been addressed in terms of breeding sites in Respati, et al. [6]. The themes and their sub components are further described below.

Dengue prevention and control programs

The DF prevention and control program theme were considered the most important. In this theme six (6) subtopics emerged. These were: 1) Policy; 2) Implementation of prevention programs; 3) Resource capacity; 4)

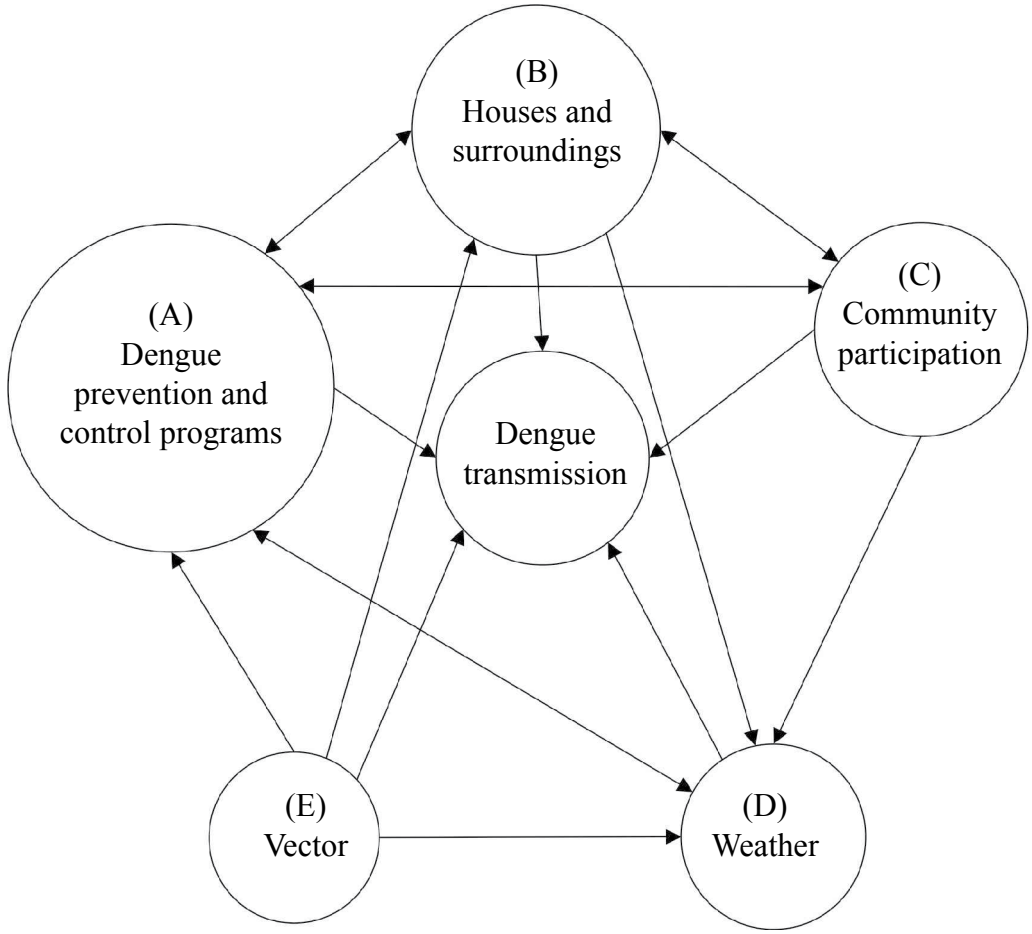

Figure 2: Ecohealth model concept map for DF.

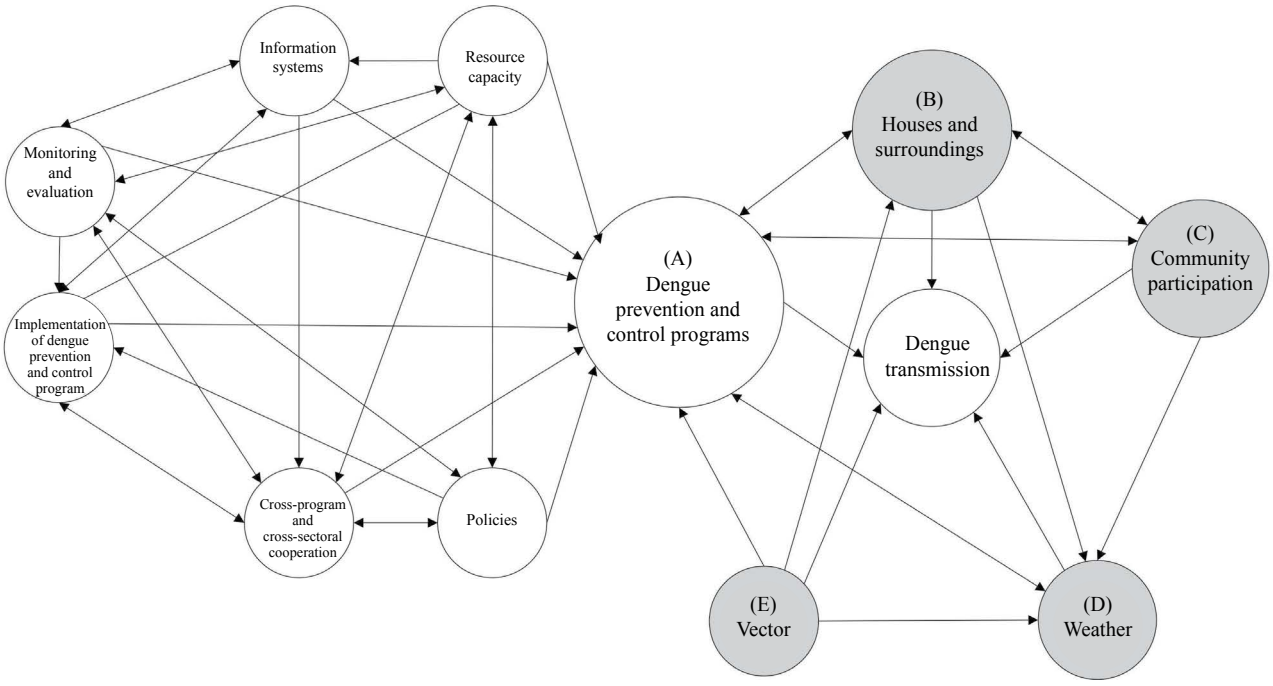

Figure 3: Ecohealth model concept map for DF prevention and control program.

Cross-program and cross-sectoral cooperation; 5) Information systems, and 6) Monitoring and evaluation. These and their connections to the main model are shown in Figure 3.

Policies: Policies are influenced by 1) Leadership; 2) Environmental management policy; 3) Program planning; 4) Enforcement of regulations; 5) The role of the media; and 6) Political commitment. Central government policy greatly influences local government policy. A respondent said that the function of the health service was as a "firefighter" in addressing a health problem. Usually, the issue of concern and its management is decided by its popularity in the mass media and community.

The reactive nature of responses to DF is still very strong in the governmental environment from central to regional. Abandonment of current on-going programs arises when a popular emerging phenomenon causes much community and media attention. In this situation health workers are forced to focus on solving the popular problem resulting in less attention for routine yet also important existing programs. As an example, one respondent said:

R5: "Sometimes ago, the issue of Ebola become the main concern among the community. This issue needs to resolve soon, and all effort was focusing on that. While the actual planned program was neglected since all resources used to tackle the Ebola issue".

In practice, existing programs seem not to be implemented in the interest of the program because of their apparent lack of urgency and popularity. The popularity of a health problem becomes very important in determining the activities to be undertaken by the relevant agencies. When there are health issues that are considered important then all resources such as human resources, facilities, and time are provided to specifically solve the case.

R1: "Our head of health department used to say that we are like firefighters. Prioritize putting out big flames ....so yes, big issues that are perceived by the community to be important will be extinguished or resolved first. Issues that are considered small or unimportant are oftentimes ignored".

Implementation of dengue prevention and control program: The government has established the Breeding Place Control Program (BPEP) as a priority program in the prevention and control of DF in Indonesia along with the establishment in 1992 of a Dengue Hemorrhagic Operations Working Group (POKJANAL). This working group consists of representatives of community groups. Unfortunately, the working group does not work well and has ceased working in many parts of Bandung. There were plans to revitalize the POKJANAL to be implemented in 2015, but this has not yet been realized. An ideal health program should have a monitoring system to provide feedback and facilitate improvement where necessary, ensuring that the program runs effectively. There is no monitoring and feedback system in the BPEB, so the community does not get inputs that can improve program achievement.

Resource capacity: "Poor structure-rich function" is a respondent description of the human resource situation at the moment. Some emerging themes include competencies, awards, workload, and continuing education. According to the respondents, the competence of health officers who manage a program is satisfactory. Although training and enrichment activities are carried out regularly, they often do not provide the skills needed by health workers in the field.

Some respondents said that the skills that are needed by health workers for community empowerment are the ability to listen. Listening capability is key to the success of an empowerment program because the real problems in the community can be identified. This is very important, and it is interesting that it has never been used as one of the indicators of achievement in the competence of officers. The training and refresher programs have not reached all the stakeholders involved. Health cadres stated that they were not equipped with sufficient knowledge and skills to implement a program.

Health worker are expected to be able not only to carry out basic tasks but also to carry out administrative tasks simultaneously. Often administrative tasks dominate work time. Some respondents delivered administrative workloads taking 60-80 percent of their time, leaving little time for functional tasks. They reported that the main administrative burden was the financial accountability report.

R12: "I am more afraid to think about wrong accounting or a mistake in financial report than to think about the programs succeeding or not".

The consequences of the workload focusing on reporting leads to neglect of the functional roles which directly impact DF program.

Cross program and cross sectoral cooperation: Coordination and cross-sectoral cooperation are not well established. One influencing factor is the absence of a common goal determined at the beginning of the cooperation. At present, the different sectors have different success indicators. For example, the sector for the provision of public facilities works according to indicators of the achievement of the number of facilities built within a stipulated time. On the other hand, the health sector is in charge of preparing the community to make good use of the facility. The ideal approach is for both sectors to collaborate. Without this, public facilities cannot be fully utilized because the community may not be ready to receive them, or the facilities may not be ready when the community needs them.

Determining and understanding the common goals

by all sectors is crucial so that their respective roles can be carried out consistently with the intended purpose. The complexity that affects DF transmission is complicated because DF is still considered to be the exclusive responsibility of the health sector.

Information systems: The media is a very important element in determining the priority of an activity, as noted above. Bandung health office has a website (https://dinkes.bandung.go.id) which served as the main communication platform, however it will only accessed by people with special information needs such as academics and researchers and rarely by lay person. Communication media in electronic and paper form which were previously the main media of communication have been shifting towards social media. Social media is capable of rapidly generating or directing public opinion so that an event or problem becomes a common problem. This provides tremendous leverage that can be utilized to pool resources to solve problems. The power of social media has been proven by the many problems that arise in the community which then becomes a priority for decision-makers at the regional and central levels (referred to above in the policy context). Coverage by the media and the depth of the reporting has contributed significantly to increase public perception of the dangers of DF. Outbreaks of DF reported by the mass media have increased community activity to implement BPEP in areas with high cases.

Monitoring and evaluation: Ideally a program should always be monitored and evaluated in order to achieve its objectives. In the BPEP program there was no systematic monitoring and evaluation process and feedback was never received (see implementation above). The challenge of monitoring and evaluating a community health program is to build a simple analytical tool that can illustrate the level of community participation in order to evaluate its relationship with improving health status and other outcomes of the program.

Community participation

In community participation theme, several subthemes emerged, including: 1) Informal leadership; 2) Gender roles; 3) Health promotion; 4) Knowledge and attitude; 5) Behavior; and 6) Residence status. These and their connection to the model are shown in Figure 4. Community participation is multidimensional and very complex in its implementation. Community participation should be seen not only as an intervention to improve health status but as a dynamic process enabling society to be responsible for health as individuals and groups. Community participation is higher if communities are involved early in the process, integrated with basic health services, provide opportunities for direct discussion with health officials and cadres, and if communities are given the opportunity to choose the most appropriate time to carry out the activity.

Informal leadership: Community participation is heavily dependent on the role of cadres and community leaders (or "*TokohMasyarakat*" (Toma)). Leadership in a region becomes an important factor for the success of a health program. The cadre or group is the key to the success of community participation. In a community group that has an active informal leader, a prevention program for a disease is more actively undertaken [13].

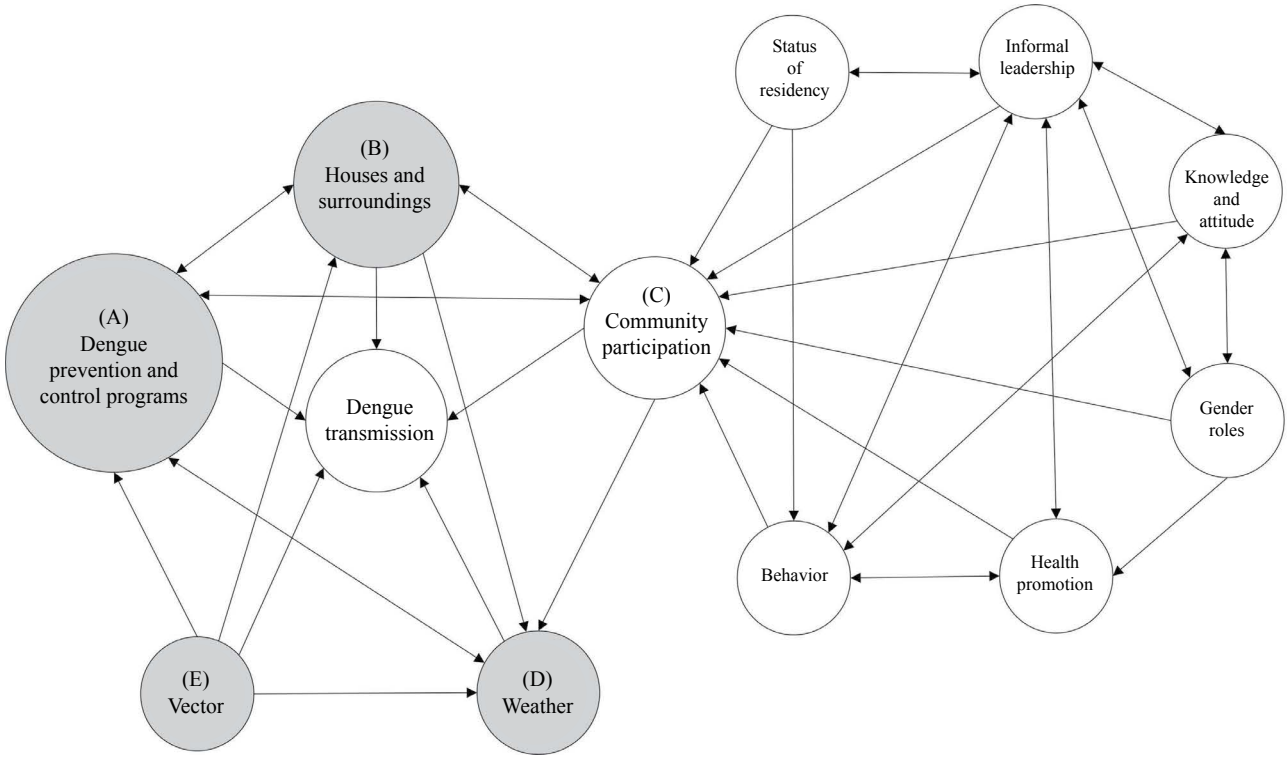

Figure 4: Ecohealth model concept map for community participation.

Gender roles: It was the view of participants that community-based services can burden women disproportionately, both because of their traditional role as primary carers and because their level of participation is higher than that of men. In societies heavily influenced by economic rationalism, care and involvement in community activities are not fully appreciated as these are not seen as bringing material wealth or increasing productivity. Those who undertake maintenance (mainly females) have decreased value and community-based services have effectively encouraged the marginalization of women and strengthened the dominant patriarchs.

Ideally community participation should involve all parties regardless of gender or social status [16]. Regarding DF environmental care includes managing mosquito breeding sites and this is regarded as a specific obligation of women. Because of the view of the low priority of women's empowerment, the management is not effective. Most of the cadres were female and the researchers found only one male cadre from all over the study areas. Women's role is more unbalanced because, although it plays a major role in health program activities, it is rarely involved in decision-making. Male involvement in community activities is minimal. So far 80% of the activities are by women. Some of the reasons for the inactivity of men include the perception of complexity in the administration of recording and reporting. In addition, men seem to have a more indifferent attitude towards the condition of the environment.

Health promotion: Programs implemented in improving the role of the community will determine its success. Some types of activities carried out are forms of counseling, training, and mentoring. Assistance is the best alternative to increase community participation in terms of program success and sustainability and independence. Mentoring is not currently a top choice because of the effort and the lengthy time required for it.

Continuity of a program was one of the expectations of the respondents. Energy to introduce new programs and ensure that communities can be actively involved is enormous [21]. Continuity is needed because the adaptation time of a program is relatively long and requires constant efforts from cadres, community and religious leaders and program managers. An abandoned program usually leaves a fairly complicated problem, from the utilization of the associated infrastructure to its maintenance.

Migrant population: Population issues are a very challenging issue in community participation. The migrant population is an inevitable phenomenon that will arise when an economic center develops. The issue of urbanization and migration becomes very important in the transmission of disease [12]. The need for shelter and place of activity greatly influences the change in land use patterns which ultimately lead to changing patterns of disease. The involvement of the migrant population in maintaining the environment is not good. This often complicates programs that should be executed simultaneously and together.

R5: "..... they do not have a sense of belonging, have no love for Bandung so well because their condition just to survive in this city".

An understanding of the place of residence and its environment as a unit that requires the co-operation of the inhabitants to maintain it, is difficult to communicate to (some) migrants. This is especially so in a very diverse society both in terms of population status, economic level, educational level, and various other population factors.

Knowledge and attitude: In general, community knowledge about DF has been satisfactory. However, it does not seem to have led to a better attitude towards assisting the DF program [12,15]. The constraints involve socio-economic factors including globalization (the rapid movement of infected person viruses and mosquito vectors), urbanization, the density of vulnerable people, and various types of mosquito breeding places. Experience of the disease greatly determines the level of community participation in its prevention. People who have had the disease, or when it has involved their closest relatives, improve their role in protecting the environment.

Behavior: Behavior is an important sub-theme in a health program. Encouraging behavior relevant to dealing with health is a major goal in the face of problems. The ideal behavior in the prevention of a disease such as DF is varied and should be able to respond to its incidence. Sufficient knowledge about DF does not always lead to behavior for preventing its transmission. It is essential to translate acquired appropriate knowledge into behavior.

In order for a program to run on an ongoing basis, DF prevention programs should be a joint learning process aimed at giving power and responsibility to the community. To achieve this, activities should be aimed at improving the capacity of local communities, improving available infrastructure, and encouraging group activities that will encourage community co-operation. Positive feedback and simple incentives are more effective for improving positive behavior than punishments such as fines. This result is consistent with other studies that emphasize the importance of community empowerment in community-based health programs [12,33].

Houses and surroundings

The houses and surroundings theme comprised four sub-themes or emerging issues. These were: 1) Land use; 2) Availability of clean water; 3) Breeding sites; and 4) Basic sanitation. These are shown in Figure 5. Housing density increases the risk of DF reflected in the larg-

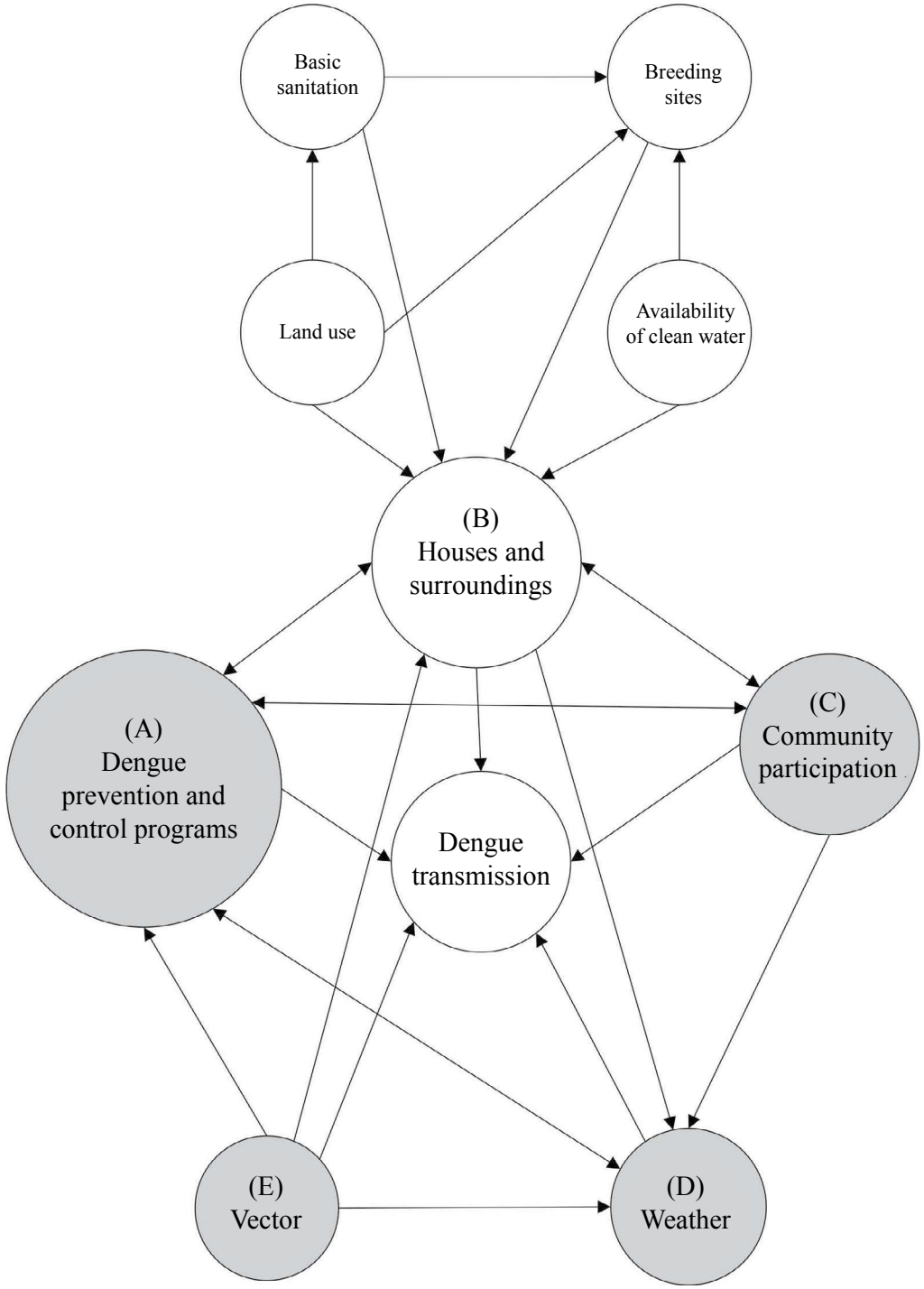

Figure 5: Ecohealth model concept map for houses and surroundings.

er number of cases in high density areas. At least part of the problem is that the health service does not have the authority to control urban development. As well, construction activities can lead to increased mosquito habitats as puddles are allowed to remain long enough for an adult mosquito emergence (this may be less than 1 week under hot conditions).

Land use: Land use is a major issue, especially in densely populated areas. Empty land owned by both government and non-government agencies may be used by people making temporary structures and these may exacerbate the mosquito problem (for example by having open water storage containers). The absence of a mechanism to prevent the occupation of vacant land allows the issue to become more widespread and denser, with accompanying risk of mosquito borne disease. In the areas of such unplanned growth and developments, basic facilities conducive to health such as electricity, basic sanitation, and clean water are difficult to manage.

Clean water: Clean water is still a constraint in the home environment. Water shortage is not only experienced by people with low socioeconomic levels but also by residents in luxury housing. Containers are a temporary problem-solving alternative but are one that may increase mosquito breeding.

R14: "We went there to see the big house, really

nice, luxurious. We confused. “Why DF is here. Later it was revealed that even though it was a luxury house they had a bit of trouble with water from the taps because sometimes it died. The homeowner took the initiative to provide large containers of water filled so that if the water stops running they still have water supply".

Basic sanitation: Studies show the relationship between basic infrastructure facilities, especially environmental sanitation with the incidence of diseases, especially vector borne diseases [21,28]. Environment that does not have adequate basic sanitation will increase the risk of vector-borne diseases due to the high availability of breeding sites.

Mosquito breeding sites: Mosquito breeding places are a crucial factor in the transmission of DF. Prevention programs are mainly aimed at addressing mosquito breeding places so as not to allow mosquitoes to breed and become vectors of dengue transmissions [33]. The challenge is to mobilize the community to eliminate breeding place by paying more attention to the requirements for good water reservoirs, such as screening or covering to prevent mosquito oviposition and larval development in the containers [24]. Understanding the importance of preventing mosquito breeding places still requires considerable effort to be understood by all the sectors involved.

Weather

Weather is theoretically a factor that greatly affects DF [2,3,33] but this factor has not been a factor of concern in DF programs. The weather factor is still a discourse at the central level. Handling of diseases related to climate change to date has not yet been considered important. The relationship between temperature and rainfall in DF has not been a concern either for the public or government mainly because its influence cannot be seen directly. For the general public climate changes are only words from the mass media, both print and electronic. Growing understanding that leads to concerns about climate change is still an area that needs informed government attention.

Synthesis: The Ecohealth Approach in the DF Control Program

The Ecohealth approach was the basis of this research. This section brings together the findings described above and synthesize them into six (6) key principles. These are based on process and on purpose (or Ecohealth objectives). Process principles include system thinking, transdisciplinary research, and participation. Ecohealth objectives are characterized by sustainability, gender equality and social status, and knowledge translation.

Process principles

System thinking principle: The first principle is of systems thinking. A system approach was the main principle for Ecohealth. It provides an opportunity to understand and work with complexity. System thinking aims to gain an understanding of the relationships, interactions, feedbacks, and processes that occur between elements that make up the whole system [6,23]. In the case of DF in Bandung, complexity is derived from DF itself and its vectors, health systems and systems outside the health area, society and environmental conditions that interact and constantly change.

The results of the study indicate that there are other systems outside the DF program that affect the continuity of the program. These include the health service system, sanitation and clean water supply system, cultural system, economic system, information system, social and political system, and health financing system. The synergy between central and local government, legal and regulatory systems, and cross-program and cross-sectoral cooperation also influence the running of the DF program especially if mass media involvement is utilized well.

The principles of transdisciplinary/interdisciplinary research: The second principle is of inter and transdisciplinary approaches to DF management. DF problems cannot be seen in isolation but must be able to be explained by the whole system involved. This requires an interdisciplinary or transdisciplinary approach, where many actors are involved collaboratively from different disciplines to analyze and potentially solve the problem [20]. Dissemination of good information and continuous knowledge collection are the key to understanding DF problem in Bandung. Some of the research activities that support transdisciplinary research for DF include vaccines, vector ecology, vector control, feasibility studies, and epidemiological surveillance.

Principles of participation: The third principle of community participation is multidimensional and very complex in its implementation. This third principle demonstrates that community participation should be seen not only as an intervention to improve health status but must also be seen as a dynamic social process responsible for the health of individuals and groups. Greater community participation, when communities are involved early in the process, integrated with basic health services, provides opportunities for direct discussion with health officials and cadres, and the timing of activities [16].

The results of the study illustrated the factors that influence community participation in Bandung City. These included advocacy skills; informal leadership; involvement of community institutions and NGOs as well as private parties that are strongly determined by role models. The public mindset of healthy living behaviors supported by appropriate health promotion will support better participation [14].

Based on purpose or ecohealth objectives

Sustainability principles: The fourth principle of

Table 1: Summary of themes and subthemes.

Eco Health Principles		Main theme	Sub-Themes
Processes	**System thinking**	Complexity of DF and its vector	Vector control and disease transmission
		The complexity of the health program system	Health financing subsystem
			Human resources subsystem
			Subsystem of community empowerment
			Subsystem, information, and health regulation
			Environment sanitation
			Characteristics of society
			Community knowledge
			Influence of DF experience on perception
			Community attitudes/perceptions
			The role of informal leaders
		Complexity of society	Subsystem for the provision of facilities
	Interdisciplinary research	Complexity beyond the health system	Budgeting subsystem
		DF prevention and control research	Dengue prevention and control program research
		Involvement of community groups	Pokja and pokjanal DF
		Knowledge management	Cross sector role
	Community participation		Components of community empowerment
		Community empowerment	Information dissemination
Purpose	**Sustainability**	Program context	DF prevention and control program
		Reinforcing factors	Strengthening government efforts to support continuing DF prevention and control
		Enabling factors	Community empowerment
	Gender and social equality	Gender equality	The role of women and men in preventing and controlling DF
		Social equality	Involving community groups with diverse demographic and socioeconomic characteristics
	Knowledge of real action	Characteristics of target communities	Capacity and characteristics of society
		Contextuality of the community environment	The context of the program target environment
		Capacity of resources	Capacity of society
		Communication strategy of the program	Communication strategy with health services
		Monitoring and evaluation of the program	Monitoring and evaluation of health services

sustainability requires that programs implemented for the prevention and control of DF must support environmental and social sustainability. The availability of program innovation supported by informal leadership and political commitment to law enforcement from bureaucracies that strengthen regulation was considered to be the basis for program sustainability. Government stimulus can be a factor that promotes sustainability, but on the other hand, inappropriate stimuli will hinder the program. Community involvement is an ideal component but requires a great deal of commitment and over a long time.

Gender equality and social status principles: The fifth principle shows that community-based services can burden women disproportionately, both because of their traditional role of primary careers and because their level of participation is higher than that of men. In some families, women usually have a great burden being responsible for and caring for people. This practice puts an extra burden on female family members. In this study, the results show that in addition to the involvement of women, socioeconomic status and migration factors can be decisive in the operation of a DF program [34].

Knowledge translation principles: The sixth principle relates to knowledge translation. Effective exchange of knowledge about DF programs is important not only between health workers and communities, but also between communities and health workers and decision makers. Knowledge will only be effectively disseminated if the human resource capacity is sufficiently competent and has an appropriate strategy for interacting with the community. The results of the study should be translated into efforts to improve the program that can be directly felt. Table 1 synthesizes the information into the six key principles providing a summary of the outcomes of the research.

Conclusions

The project has proceeded from characterizing individual and group perceptions of important issues in the DF system to identifying key principles that encompass the main issues. This is a holistic Ecohealth approach that has produced useful information that can assist in improving DF management in Bandung (and more generally).

The strength of the research lies in its open Ecohealth approach and inclusion of a range of stakeholders to ensure main factors were not overlooked. The theme of dengue prevention and control program was the most

decisive factor in disease prevention, followed by community participation, housing and environmental factors, and finally the weather (which latter is outside the control of mangers though impacting on DF transmission). Each of the four main factors (excluding weather) has sub-themes and these have been described, illustrated in the text and synthesized into the six principles which can be used to guide further development of the DF programs.

Based on the Ecohealth approach, system thinking principles have been substantially, though not yet completely, applied in the DF programs. Systems thinking and interdisciplinarity facilitates optimal results because of the connections the DF program has with other systems external to the health system. Community participation supported by interdisciplinary or transdisciplinary research will provide a better understanding of factors contributing to DF. Based on the objectives, the sustainability of a program must be supported by the involvement of all members of the community regardless of gender and social status, and able to translate the research results into a form that can be understood by both community and program holders.

Acknowledgments

Authors would like to thank the Health Office Bandung City, the Bandung Agency for Environmental Control (BPLH), LAPAN Bandung, BMGH Bandung and the Office of Bandung City Major.

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