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Institutional strengthening as an anticipatory measure for dengue virus transmission to reduce the incidence of dengue fever☆

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Abstract
Objective: This paper aimed to prove whether it is necessary to support institutional strengthening to reduce dengue fever cases.
Method: This study used the Interpretative Structural Modeling Analysis (ISM) model, which was used to analyze complex matters of a system through patterns designed using graphics. This analysis model was conducted through the stages, namely (1) compiling a structural interaction matrix, (2) collecting a reachability matrix table, (3) compiling a power-dependent matrix driver, and (4) composing a structural model of each sub-element.
Results: The result showed that 2 out of 10 sub-elements had DP value equal to 1.00, which were the growth of sectoral-centric attitudes and weak inter-institutional commitment. While among institutions, there were three of 11 institutions that play a crucial role in reducing DHF, namely the Office of Health, Community health centers, and hospitals (DP = 1.00).
Conclusion: It can be concluded that strengthening the institutional system can help in reducing cases of dengue hemorrhagic fever (DHF).

Introduction

Cases of dengue fever are still a serious and dangerous health problem for the people of Indonesia in 2019.[1,2] One of the social impacts felt by the occurrence of unrest in the victim's family is how to deal with all possibilities due to the disease. From an economic point of view, people are faced with high medical costs, and other costs associated

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with care, and the loss of average working hours for families during treatment.

Dengue fever is an infectious disease caused by the dengue virus that is transmitted through the bite of the *Aedes aegypti* mosquito. *A. aegypti* larvae are very dependent on the frequency of disposal of the container, water source, and the environment.[3,4] This problem is becoming increasingly serious because dengue anti-virus drugs have not yet been discovered. Likewise, the vaccine to prevent dengue fever is still in the testing phase. The presence of anti-virus (drugs) and vaccines that have not been found lead the increase of burden for both the government and the general public. Therefore, the only way to overcome this problem is to eradicate the infectious vector (*A. aegypti*). This step can be implemented while the infectious vector is still in the form of larvae or after becoming an adult mosquito.

The vector eradication program carries a complex health problem because it must involve at least three inseparable components, namely government, society, and family. These three components often do not work together in facing the same problem because of the weak coordination function between institutions and the unclear role of institutions in the handling of dengue fever. Therefore, this study aims to prove the need for institutional strengthening support to reduce dengue fever (DHF) cases in the community.

Method

This research was conducted in South Sulawesi-Indonesia using a survey method through an expert system approach,[5] and interpretative structural modeling (ISM) analysis. ISM was used to analyze the causes of weak coordination between sectors, and the institutions that should play a role in reducing dengue fever. Data collection was carried out using observation and interviews using questionnaires. Data analysis techniques were carried out through the application of Interpretative structural modeling (ISM), with stages, namely: (1) compiling Structural self-interaction matrix (SSIM) namely input (assessment) from respondents to the previous sub-elements, as a result of consideration of contextual relations, by using symbols V, A, X and O. (2) compiling the Reachability matrix, by replacing symbols V, A, X, and O with numbers 1 and 0. (3) construct the power-dependent driver matrix (DP-P), (4) construct a structural model (level) of each element.

The matrix driver power-dependent consists of four sectors, as follows:

Sector 1: autonomous, indicates that the sub-elements in this position are not related to the system, or the relationship is minimal, although the link may be substantial.
Sector 2: dependent, indicates that the sub-elements in this position are not free, meaning that all the variables that exist are the result of actions on other variables.
Sector 3: linkage, shows that the sub-elements in this position are very important and must be carefully examined because relations with other variables are not stable. Every action on these sub-elements will produce success; on the contrary the lack of attention to these activities will cause program failure.
Sector 4: independent, shows that the sub-element in this position is a free variable, meaning that it is a large driver power, but the dependence on other sub-elements is small.

Results

ISM analysis results showed that of the 10 sub-elements analyzed, and there were eight sub-elements as variables causing the weak function of coordination between institutions in reducing dengue fever (Table 1). From the 10 sub-elements, two of them were the main causes of weak coordination function, namely the growth of sectoral-centric attitudes, and weak inter-institutional commitment.

Apart from relevant influence sub-elements analyzed above, the results of the ISM analysis also showed the existed role of institutions in the context of eradicating Dengue Fever. Among the 16 institutions analyzed, 11 of them were priority institutions in reducing Dengue Fever (Table 2). From 11 priority institutions, there were three institutions that play a key role in reducing DHF, namely the office of health, public health centers, and hospitals.[6]

Table 1 The position and comparison value of DP-D factors causes weak coordination among institutions.

Positions	Sub-elements	Value	
		DP	D
Independent	1. Well sectoral centric attitudes	1.00*	0.30
	2. Weak nature of the multisector	0.80	0.50
Linkage	1. Weak commitment among Institutions	1.00*	0.80
	2. Non-involvement of institutions in the preparation of the program	0.90	0.60
	3. Weak incentive support	0.80	0.60
	4. Low quality of human resources	0.70	0.70
	5. Weak vertical control	0.70	0.80
	6. Weak development	0.60	0.90

* Key points.

Table 2 Position and value comparison of DP–D in the role of reducing DBD.

Position	Sub-elements	Value	
		DP	D
Independent	1. Public Health Service Office	1.00	0.19
	2. Community Health centers	1.00	0.44
Linkage	1. Hospital	1.00	0.69
	2. District Government Office	0.94	0.63
	3. Integrated Healthcare Center	0.94	0.63
	4. Empowerment of Family Welfare Community	0.87	0.69
	5. Environmental Service Office	0.87	0.75
	6. Cleanliness/Gardening Service Office	0.75	0.75
	7. University	0.63	0.75
	8. Larva Observer working group	0.94	0.63
	9. Healthy village forum	0.94	0.63

Discussion

Variable causes of weak coordination between institutions

The weak coordination function between sectors is an indicator of the weakness of the institutional system in eradicating dengue fever. To strengthen the institutional system, endogenous institutional changes are needed.[7] To achieve institutional change, this study first highlights the root causes associated with weak coordination functions. According to the results, six of 10 sub-elements analyzed were factors that caused the weak coordination function. Among the six factors, two of them were key factors in the weak coordination function, namely (1) the growth of sectoral-centric attitudes in independent positions (DP = 1.00), and (2) weak inter-institutional commitment in linkage positions (DP = 1.00). The complexity of the institutional system stems from two directions, namely weak commitment between institutions (external) that are macro in nature, and fertility of sectoral (internal) sectoral attitudes at the micro-level.[8]

In addition, the third place was the involvement of institutions in the preparation of programs in the linkage position (DP = 0.90). The existence of institutions that are not involved in the preparation of the DHF eradication program, has an impact on decreasing ownership of the program. The reduced sense of ownership of the dengue eradication program has a further impact on weakening inter-institutional commitment.

Therefore, to strengthen the coordination function, there are several important steps that must be taken. Firstly, there should be an effort to reduce the fertility of sectoral centric attitudes for institutions related to the DHF eradication program. Otherwise, it is impossible for inter-institutional commitment can be strengthened. Secondly, build commitment between institutions because it is an important sub-element as a glue for inter-institutional coordination. However, strengthening the commitment between institutions will not be possible, if among the related institutions still feel not involved in the preparation of the program.

In the next sequence, there were two sub-elements, namely: (1) weak multi-sectoral traits in the independent position (DP = 0.80), and (2) weak incentive support in the linkage position (DP = 0.80). Multisector is a partnership that involves governments, non-profit organizations, the private sector, and the public, community groups, and individual community members gather to solve problems that affect the whole community. Therefore, if the multisector nature is weak, it will affect the quality of coordination function among institutions. Likewise, incentives are variable rewards given to someone in an organization so that someone is motivated to improve their performance. Therefore, the lack of incentive support is a factor that hinders improvement in organizational performance, which starts from the weak function of coordination among institutions.

ISM analysis results showed that the quality of human resources (HR), especially health HR was still relatively low although it is understood that HR is a sub-element that determines the success of the program. The government should provide more resources related to health,[9] especially human resources as social capital.[10]

Therefore, to strengthen the coordination function in institutions to reduce the incidence of DHF, the opposite of the eight sub-elements as the findings of this study (Table 1), becomes a work program that must be realized, namely: (1) damping sectoral attitudes, (2) multisector collaboration, (3) building inter-institutional commitment, (4) involving institutions in the preparation of programs, (5) providing incentives, and (6) improving the quality of human resources, (7) strengthening vertical control, and (8) enhancing coaching development.

The eight work programs can be described in the form of a program structure model for strengthening the coordination function, as shown in Fig. 1.

Priority role agencies in reducing cases of dengue hemorrhagic fever (DHF)

The role of institutions underlies social and economic cases,[11] and one of the social cases is Dengue Fever. Based on the achievement of the value of the power driver (DP),

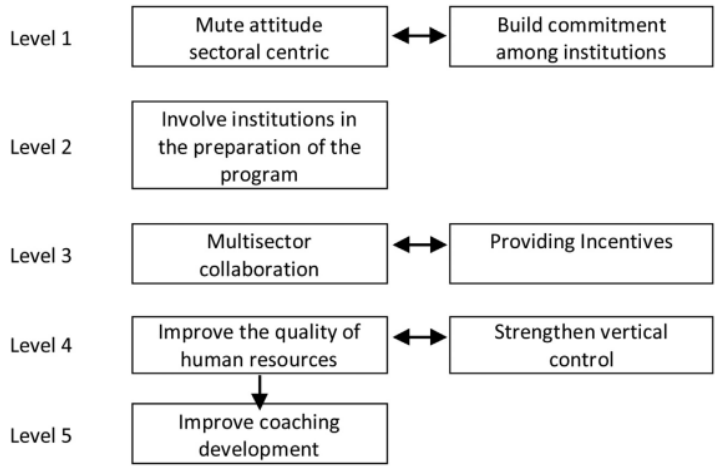

Figure 1 The structural model of the program strengthens the coordination function in dengue fever institutions.

five of 11 institutions were assumed to have the most significant role in reducing the case of DHF. The institutions at level 1, are the health service, the community health center and the hospital (DP = 1.00). At level 2 there are village/district government offices, Integrated health centers, larva observer working groups, and healthy village forums (DP = 0.94). At level 3 are the PKK and the Environmental Service (DP = 0.87), while at levels 4 and 5 are the Sanitation and Landscape Service (DP = 0.75) and the Higher Education (DP = 0.65).

Until now, none of these 11 institutions have shown an optimal role. Health services, community health centers and hospitals (level 1) are three institutions that have recognized to demonstrate a role although they are still dominated in terms of community care and other treatments. This action has not been maximized in the field due to various reasons, such as there has not been found a drug and vaccine for DHF, and the focus fogging is carried out only when there is Dengue fever occurring. Also, Dengue Fever Counseling cannot be maximized due to the unpreparedness of residents as objects in the field.

Other institutions like District government centers, Integrated Healthcare Center, Larva *A. aegypti* observer working groups, and healthy village forums have important role in this issue as well because these institutions have an emotional relationship with the community members. The district government offices must have the mental readiness to behave that public health matters are part of its primary duty as a government apparatus at the lower levels. This aims to avoid the mistaken assumption that health affairs are the main duty of Community Health Centers and Health Offices.

Healthy village forums are a forum for rural communities to coordinate and integrate inter-village planning within the same sub-district. The forum is carried out by a village working group to realize a clean and healthy rural area. Also, family welfare empowerment is an organization to empower women to help support healthy development. Since one Of the 10 PKK work programs is health so that this organization is considered as a potential place for empowering public health (priority) in the linkage position (DP = 0.87). Related to intervention of the case, one of the PKK programs that

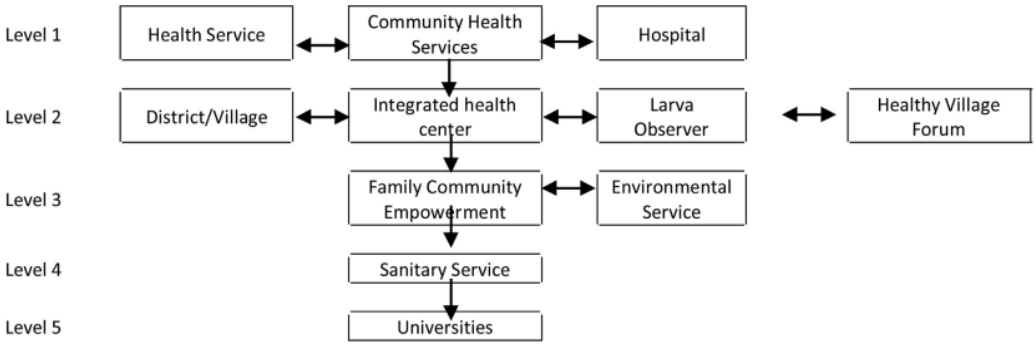

Figure 2 Structural model of priority institutions in dengue fever institutions.

can be developed is to use papaya leaves to eradicate *A. aegypti* larvae.[12]

The environmental and sanitation service are the two institutions as regional work units which have basic tasks and functions for the eradication of mosquito nest. Therefore, the ISM analysis results of this institution were in the position of linkage (DP = 0.87 and 0.75), which means it has an important role and is highly related to the Dengue Fever eradication program. Health and quality of human life are very dependent on the environment and ecosystem.[13] Apart from those institutions, university value based on ISM analysis was in a position of linkage (DP = 0.63). This means that this institution has a functional linkage to achieve changes in the Dengue Fever eradication program through research activities and community service. The direction of the resulting change depends on the role of the institutions that play a greater role in health service innovation.[14] The 11 institutions can be designed through a social behavior analysis approach in the form of a structural-functional relationship model according to priority in the institutional system for eradicating dengue fever (DHF),[15] as in Fig. 2.

Health offices, health centers, and hospitals are expected to increase their role in terms of preventive measures, and curative/care. District government offices, Integrated Healthcare Center, Larva *A. aegypti* observer working groups, healthy village forums, and PKK collaborate with the environmental and hygiene services in breaking the vector chain, through eradicating mosquito nests and periodic larvae checks. Furthermore, universities should contribute to research and development in reducing dengue cases in certain regions.

Conclusion

According to the results above, it can be concluded that there are eight sub-elements causing the weak coordination function between institutions that can affect to the weak institutional performance in eradicating dengue fever. Therefore, to strengthen the coordination function, empowerment must be carried out through eight work programs: (1) attenuation of sectoral centric attitudes, (2) multisectoral collaboration, (3) building commitment between institutions, (4) involvement of institutions in the preparation of programs, (5) giving incentives, (6) improvement of HR quality, (7) strengthening of vertical control, and (8) HR development. In order to reduce dengue hemorrhagic fever, it is found that there are 11 priority cast agencies with a variety of task areas, namely (1) curative/care and preventive, (2) termination of the vector life chain through eradication of mosquito nests and periodic larvae examination and (3) research/development and community service.

Conflict of interest

The authors declare no conflict of interest.

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