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MALARIA VECTOR CONTROL AND THE ELECTRONIC MALARIA SURVEILLANCE INFORMATION SYSTEM (E-SISMAL) IN BANGKA BARAT REGENCY INDONESIA

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Abstract

Introduction: *Until the end of 2020, West Bangka Regency was the only one that has not been certified for malaria elimination, so that it has an impact on achieving malaria elimination at the provincial level of Bangka Belitung. The West Bangka Regency's Electronic Malaria Surveillance Information System (E-SISMAL) showed eight indigenous malaria cases and no malaria vector control reports in 2020. The indigenous cases in West Bangka Regency have prevented malaria elimination. This study aims to evaluate malaria vector control to help eliminate malaria.* ***Methods:*** *This research was a qualitative evaluation study with selected informants. E-SISMAL in West Bangka Regency was studied and was analysed with Nvivo 12 Plus for Windows. The variables studied were context, input, process, and product. Focus groups, in-depth interviews, participatory observation, and photovoice were used to collect data.* ***Results and Discussion:*** *The area's topography, miner's behaviour, lack of manual vector reporting, and extensive ex-mining pits were discussed. Each evaluation variable was constrained by the process (supporting data collection and sub-variables) and product (data coverage of malaria vector control in E-SISMAL).* ***Conclusion:*** *It can be concluded that each evaluation variable constrains malaria vector control in West Bangka Regency.*

INTRODUCTION

Malaria has become a worldwide and national priority, as stated in the World Health Assembly's (WHA) Global Commitment 2007 and Asia Pacific regional commitment 2015. Malaria is one of the primary and highly prevalent infectious diseases affecting public health. As an impact, infant mortality, under-five mortality, and a reduction in the quality of human resources are all high. Moreover, malaria can also cause various social, economic, and national security problems (1). Globally, in 2019 it was estimated that there were 229 million malaria cases in 87 malaria-endemic countries. Indonesia is one of the malaria-endemic countries that have indigenous malaria cases. The percentage of malaria deaths in children under five was 67 %, with the case fatality rate being 10 for each 100,000 population at risk in 2021 (2).

The Electronic Malaria Surveillance Information System (E-SISMAL) is an electronic report that calculates and recaps detailed data according to the integrated malaria reporting format (3). The vector disease transmission is prevented by reducing vector populations as much as possible so that there is no longer a risk of malaria in a certain area. Malaria vector control in E-SISMAL includes distribution of insecticide-treated mosquito nets and indoor Residual Spraying (IRS). In addition, control of breeding sites, larviciding, biological control, and environmental management are included in the Regulation of Ministry of Health of the Republic of Indonesia Number 374 in 2010 (4). Annual Parasite Incidence (API) in West Bangka E-SISMAL data in 2020 showed an increase over the last two years by 0.46 and an increase of 88 cases. However, this is still a concern for the government because there were 179 malaria cases with eight indigenous malaria cases but no malaria vector control reporting data. For this reason, this research was conducted on Malaria vector control in E-SISMAL in West Bangka Regency through the theory of Stufflebeam (5).

METHODS

In general, this research was qualitative evaluation research. It was conducted in three primary health care with indigenous cases and had the highest

Annual Parasite Incidence (API) in 2020, namely Sekar Biru, Puput, and Jebus. Sekar Biru had three indigenous malaria cases with an API value of 7.49. Puput had one case of indigenous malaria with an API value of 3.13. Jebus had four indigenous malaria cases with an API value of 0.42. This research was carried out over five months, from February to June 2021. Informants were selected using a purposive technique. The eleven chosen informants were the head of the malaria program at three selected primary health care, head of disease prevention and control division, head of the communicable disease eradication and prevention section of the District Health Office of West Bangka Regency, and two malaria program managers at the Provincial Health Office of Bangka Belitung Islands. The research variables included context, input, process, and product variables. The context variables consisted of the sub-variables of purpose, vision, and mission. The input variables included sub-variables of human resources (HR), budget, and infrastructure. The process variable consisted of sub-variables of collecting supporting data, increasing advocacy to the government and stakeholders, raising cross-program and cross-sector partnerships. The product variable includes the coverage of malaria vector control in E-SISMAL. Data was collected through Focus Group Discussion (FGD), in-depth interviews, participatory observation, and photovoice. Data validation was through triangulation.

Data processing was carried out through data reduction, data display, and conclusion drawing/verification stages. Data reduction was made by transcribing data using Microsoft Word. The data transcription included the informant's name, age, gender, education, years of service, field results from in-depth interviews, FGD, recapitulation of observations, and photovoice reduction. The reduced data was used as input in Nvivo 12 Plus for Windows series qualitative data processing application. Data analysis classified the information into specific themes according to the research variables and sub-variables by using the queries available in the NVivo 12 Plus for Windows application. The highest coverage value produced indicates the issue (factor) most frequently discussed and emphasized by informants related to research. The results were presented in the form of a flowchart for each variable and its narrative. Furthermore, the highest coverage value of each research variable is used to draw research conclusions.

Implementation of data collection was overseen by psychologists from the Department of Social Affairs and Community Empowerment of the Province of the Bangka Belitung Islands. This research received a certificate from the Ethics Committee at the Faculty of Public Health, Universitas Sriwijaya, 151/UN9.FKM/TU.KKE/2021.

RESULTS

Context

Coding of context variable data shows six factors from the sub-variables of purposes, vision, and mission-one factor in each of the goals and the vision sub-variable. There were three factors for the mission, vision, and purposes sub-variables. The coding of the context variable is shown in Figure 1. The three highest values affect the context variable of each sub-variable. The three values were the intensification of control vectors (1.63%), maximising the use of E-SISMAL data (2.38%), maximising the use of village funds (2.06%), acceleration vector control (3.15%) for the mission sub-variables, and accelerated malaria elimination (2.99%).

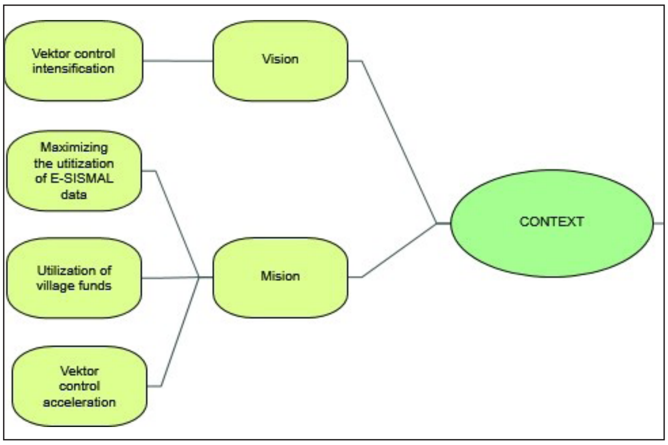

Figure 1. Flowchart of Sub-variables to Context Variables

Input

Coding of input variable data resulted in 22 factors from all sub-variables—nine factors in the budget sub-variable, six factors in the facilities and infrastructure sub-variable, and seven in the human resources sub-variable. The most important input variables of all sub-variables there are nine factors. These are shown in Figure 2. The coverage of the three highest sub-variable values that affect the human resource input variable is the limited human resources of entomology and epidemiology (8.52%); lack of internal program coordination (5.18%); primary duties, and functions (2.71%) as an influential HR sub-variable. Concerning the budget sub-variables, the most important are shown as limited funds (2.59%), local government support (2.78%), and the impact of Covid19 policies (2.21%) as budget sub-variables. In addition, facilities and infrastructure sub-variables include storage (8.69%), E-SISMAL equipment (7.45%), and equipment (6.31%).

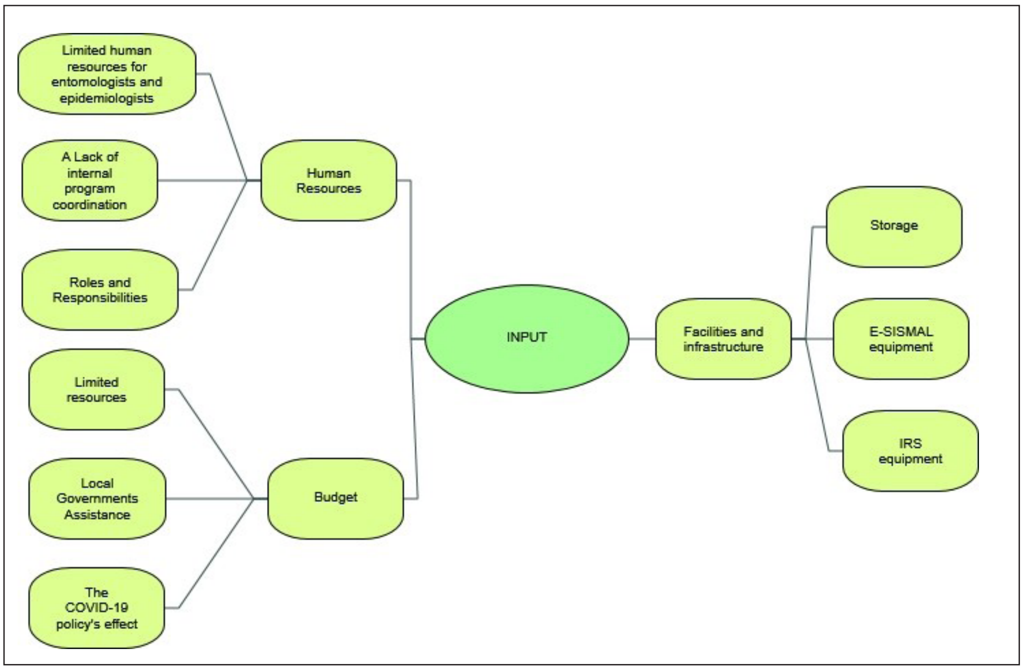

Figure 2. Sub-variable Flowchart of Input Variables

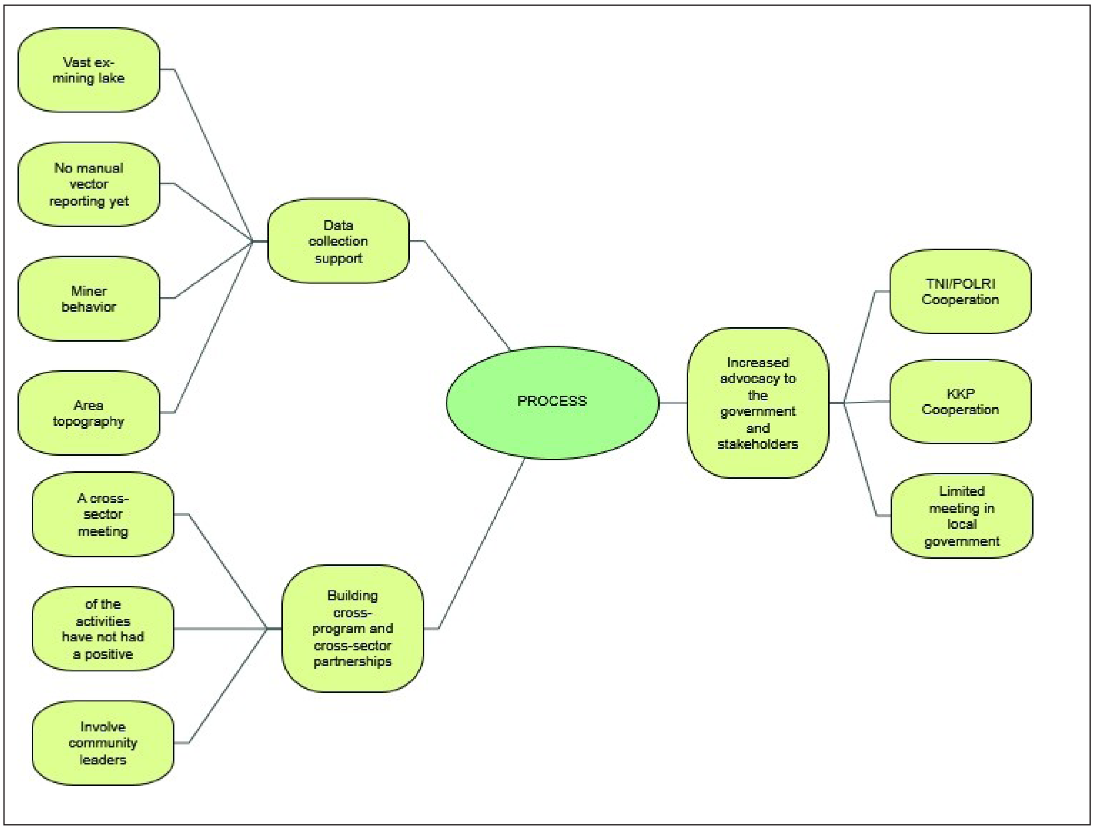

Figure 3. Sub-variable Flowchart of Process Variables

Process

The coding process variable data produced 24 factors from all sub-variables with six cross-program and cross-sector collaboration building sub-variable factors. In addition, twelve factors in the supporting data collection sub-variable and six in the sub-variable of increasing advocacy to the government and stakeholders. The coding of the main sub-variables in the process variable is shown in Figure 3.

The four highest values affect the data collection process variable. The values are in data collection support and include the area under ex-mining sites (29.10%), lack of manual vector reporting (29.19%), miner's behavior (39.81%), the topography of the area (45.32%). In the building cross-program and cross-sector partnerships, important sub-variables include: the existence of cross-sectoral meeting (4.76%), activities have not had a maximum impact (2.85%), involvement of community leaders (4.31%). The Indonesian National Armed Forces and Indonesian National Police cooperation (2.75%), Port Health Office cooperation (2.62%), limited meetings in local government (2.49%) are sub-variables to increase advocacy to the government and stakeholders.

Product

The product data coding results show seven factors from the sub-variable coverage of malaria vector control at E-SISMAL. The essential product variables are shown in Figure 4. There are three highest values that affect the product variable. The sub-variables, namely vector control in E-SISMAL, are not broad yet (2.43%), and data analysis is not maximal (2.22%) scope of vector control sub-variable E-SISMAL. Conclusions were drawn by comparing the coverage of the sub-variables highest factor, which was assessed as the most influential sub-variable on malaria vector control in the E-SISMAL.

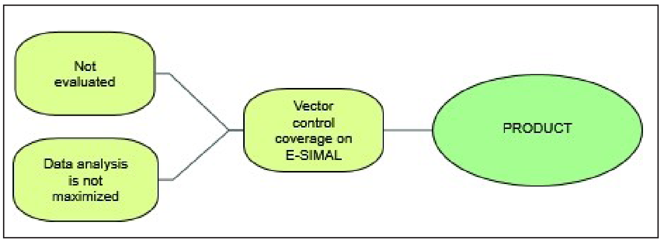

Figure 4. Sub-variable Flowchart of Product Variables

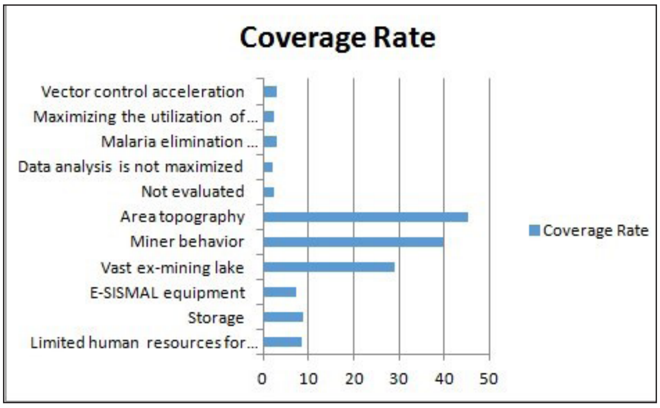

Figure 5. Graph of 24-factor Coverage values (NVivo 12 Plus For Windows)

Figure 5 shows that the most influential sub-variable comes from the problem process variable. In addition, the sub-variable, namely vector control data collection, consists of a large ex-mine pit (29.10%), the absence of manual vector reporting (29.19%), miner's behavior (39.19%), and the topography of the region (45.32%). The most influential variable is the factor of process and the product variables.

DISCUSSION

Context

The context variables consist of the purposes, vision, and mission of malaria vector control at E-SISMAL in the West Bangka Regency. The informants stated that the goal of malaria vector control is to accelerate malaria elimination by 2023. However, there are no institutional documents exploring malaria vector control's plan in the West Bangka Regency to accelerate malaria elimination by 2023. So not many informants focus on the objectives of the malaria vector control program at E-SISMAL in West Bangka Regency. The vision of this activity was the intensification of vector control which includes mapping in receptive areas and vector types by 2021. In West Bangka, there has never been vector mapping related to specific malaria vectors. If the vector type is known, the bionomic vector can also be known. This case is significant for malaria vector control and can help select appropriate vector control methods. Bionomics of Anopheles mosquitoes includes behavior, reproduction, population age, distribution, seasonal fluctuations, physical environmental factors (seasons, humidity, wind, sun, water currents), chemicals (salt content and pH), and biologics (mangroves, algae vegetation) around the breeding site (6).

Understanding several bionomic factors, such as the timing, rhythm, and magnitude of outdoor transmission by vectors, is significant for effective vector control interventions (7). Mosquitoes have anthropophagus and endophilic behavior. However, they can be controlled using insecticide-treated mosquito nets and appropriate personal protection for outdoor activities (8). Intensification of vector control in an integrated manner is needed to accelerate malaria elimination (9). Activities can involve cross-sectoral roles and active participation from the community.

The mission factor maximizes the utilization of E-SISMAL data, village funds, and vector control. This is stated in the Regional Regulation of the West Bangka Regency Number 13 of 2015 concerning the Control of Mosquito Vectors that Cause Infectious Diseases in the Community. However, the implementation is still constrained by the input, process, and product variables. Policymakers and regulators need to support the success of malaria vector control (10).

Input

The input variables consist of human resources/ health workers, budget, and infrastructure. Low resources in vector control are a significant challenge for malaria elimination in endemic areas in Indonesia (11). A scarcity of entomologists and epidemiologists constrains the malaria program in West Bangka Regency. Malaria program managers have educational backgrounds as nurses and health analysts, so they have additional duties as the Covid19 control team members in their current work area. The main tasks and functions of the malaria program are carried out by one person who manages the malaria program in the district and at their primary health care to implement malaria vector control. However, data entry was carried out by district malaria officers and not carried out by malaria health centre officers. This was because vector control data had not yet been analysed in E-SISMAL. Based on the description above, the malaria program managers have not focused on implementing malaria vector control at E-SISMAL in West Bangka Regency.

The lack of internal coordination among the malaria control team in the West Bangka Regency impedes the planning and implementation of malaria vector control (12). The budget for malaria control is minimal and is limited to epidemiological investigation activities in the community. The budget for malaria vector control activities in West Bangka Regency has not been supported by reports on malaria vector control at the community health centre and districts. Vector control report data should be used to plan malaria vector control activities in the target population in West Bangka Regency. Entomological information contributes to the development of vector control and malaria elimination strategies (13). Routine epidemiology and vector surveillance combined with real-time data reporting are essential to sustainable malaria vector control (14). This means that timely and quality entomological surveillance is needed (12). Education, collective action, and planning are part of malaria vector control interventions, especially in community mobilization (15). Suppose the educational background of the officer is not in entomology and epidemiology, and there is a lack of internal coordination in the implementation of vector control. In that case, vector control is likely to be poor. Malaria program managers who do not have an entomology or epidemiology education can collaborate with environmental health workers (Sanitarians) to remedy the situation. It is consistent with the scope of work for sanitarians based on Presidential Regulation Number 66 of 2010 concerning Environmental Health, namely vector control.

The limited budget for the malaria program is due to the Covid19 budget policy on the Health Operational Assistance (BOK) in primary health care funds, of which 60% is for Covid19 control and 40% for other activities. Malaria is not included as a priority in the minimum health service standard (SPM) program. This can be seen from the minimal malaria vector control conducted at the Health Centre and the West Bangka health office. As a result, the disease factors and API are very high in the Primary Health Care of Sekar Biru and Puput. The local government of West Bangka Regency is open to budgeting proposals from health. However, it must follow the supporting data and its budget allocation. In Africa, Covid19-related reduction and cessation of some malaria activities resulted in double deaths in 2020 and led to even more significant increases in the following years (16).

Adequate financial support for malaria vector management in West Bangka Regency is required to minimize future indigenous cases. The facilities and infrastructure for controlling malaria vectors at E-SISMAL in West Bangka Regency are constrained by the storage of tools and materials not following storage requirements by typically using a warehouse mixed with other items. The personal program manager owns most of the E-SISMAL equipment used; the office provides only internet access. Indoor residual spraying (IRS) equipment is limited to the West Bangka Regency Health Office and the Bangka Belitung Islands Provincial Health Office. Improved diagnostic facilities will provide good epidemiological and entomological data and evidence for vector control and sustainable control in the target population (17). IRS activities cannot be carried out simultaneously in different primary health care areas due to the limitations of the equipment. This case has caused several primary health cares to be hampered in increasing the control of vectors in their area. The malaria surveillance system needs to be supported by professional human resources, adequate funds and facilities, and infrastructure. Officers can process, analyse data correctly, and take advantage of the information generated. So that activities can be carried out optimally, especially in decision making (18). Some of the challenges in controlling malaria include surveillance programs, limited funding, and lack of personal protective equipment (19). In Bhutan, adequate skills and knowledge, access to training, and support for computer equipment and information systems are also challenges in using a surveillance system to support malaria elimination (20). Malaria elimination also depends on the quality of health workers and the available budget (11). So, research, vector control surveillance, capacity building, and health worker access to qualified equipment will support malaria vector surveillance (21).

Process

The process variables consist of collecting supporting data, raising cross-program and cross-sector partnerships, and increasing advocacy to the government and stakeholders. The topography of the area influences data collection. It includes swamps, forests, beaches, and swamps with sandy sloping coastal areas, lowlands, and hills with forests. As well, damaged roads are challenging to reach by malaria officers. One of the obstacles to data sampling and vector analysis is often hampered by geographic area (22). Research has found miners live close to mining sites, breeding places for malaria vectors in West Bangka. Some mining sites are also less safe to visit, making access difficult for officers. This situation is due to the community's customary belief factor, which does not allow entry into the area, and the rules made by the miners in the region.

Miners often are itinerant and seek treatment at a practicing doctor using different identities from their domicile. The lack of training and understanding of practicing doctors regarding the management of malaria vector control makes it difficult for primary health care officers to track data on patients seeking treatment. What is needed is good coordination and understanding regarding the management of malaria vector control between practicing doctors, and primary health cares officers to be carried out correctly. On the other hand, the lack of manual reporting of malaria vectors at the primary health care and the Health Office. It makes it difficult for officers to carry out the epidemiological investigation and choose appropriate malaria vector control methods. Community participation in malaria vector control must be promoted (10). It can be supported by policies and commitments implemented in stages from the district to the lowest administration level. The community and cross-sectoral roles should form a malaria vector control team in the community. The community needs to conduct training related to malaria vector control with assistance from local health workers. One of the challenges of malaria elimination is human mobility, which imports infection through many factors from non-endemic areas to endemic areas (23). Miners outside the Bangka Belitung Islands Province are primarily from the Provinces of South Sumatra, Jambi, and Lampung. They go back and forth at specific periods, from their homes to the tin mining site. This situation makes it difficult for officers to carry out epidemiological investigations and select malaria vector control methods.

Cross-program and cross-sector partnership-raising activities have been carried out. The activity is in cross-sectoral meetings between Village Government (Pemdes), noncommissioned law enforcement officers posted in villages and wards and affiliated with the civilian administration (Babinsa), primary health care, and involve community leaders (TOMA). Increased advocacy to the government and stakeholders has been carried out, including Indonesia Nasional Armed Forces and National Police Cooperation, Port Health Office collaboration, and limited meetings with the Regional Government. There is an understanding in a cross-sectoral collaboration that malaria is a responsibility of the health sector only. The cross-sectoral role in controlling malaria vectors is not sustainable because cross-sectoral vector control activities are not carried out continuously. Only the health sector carries out, and health workers only carry it out. During the Covid19 pandemic, the research area was a Covid19 red zone, so the role of cross-sectors was not maximized in controlling malaria vectors. The research results show that the factors that support malaria eradication include a series of preventive behaviors at the individual level and network utilization at the primary health care level (24). Stakeholder collaboration, community participation, and officers determine the success of vector control in endemic areas (25). Stakeholder Involvement from cross-sector cooperation has a significant impact on malaria elimination (26).

Product

Product variables include vector control sub-variables in E-SISMAL. The influencing factors are the absence of optimal evaluation and the analysis of vector control both manually and in E-SISMAL. The Malaria Management Program of the Health Office of West Bangka Regency said that malaria vector control in E-SISMAL includes data analysis does not fulfill their expectation. It is proven that the results of the vector analysis have not appeared in the E-SISMAL application. However, in reality, the central government and provincial governments have not used the data in E-SISMAL to conduct policy reviews and feedback. They only carried out related to medicine and logistics. It makes the Health Office of West Bangka Regency has not focused on malaria vector control data on E-SISMAL.

In contrast, information technology is beneficial for translating digital surveillance into primary intervention in reducing malaria incidence (27). In Indonesia, malaria control efforts are generally carried out in two integrated ways: case management and vector control (4). Malaria program control becomes incomplete if it only focuses on the case without being associated with the malaria vector. Activities to increase the scope of surveillance and integrate case data, other information, visualization, and use of data can accelerate malaria elimination (28). Furthermore, inadequate practical knowledge of insecticide resistance management (IRM) is evident in vector control policies (29). The research results showed that the most influential factors were the area's topography, the behavior of miners, the absence of manual vector reporting, and extensive ex-mining pits. Each evaluation variable constrains malaria vector control at E-SISMAL in West Bangka Regency. The E-SISMAL application should present the results of the analysis of malaria vector control data in each area. This case allows malaria vector control efforts to progress and the relationship to malaria elimination in malaria-endemic areas to be determined. This helps to monitor the process of accelerating malaria elimination in the West Bangka Regency. Therefore, it is necessary to improve the E-SISMAL application system to analyse malaria vector control data in the future.

The most influential factor is the vector control strategy variable supporting data collection and vector control analysis in the non-integrated E-SISMAL application. It means that the control of malaria vectors at E-SISMAL in the West Bangka Regency does not become effective. The collection of updated entomological and epidemiological data should be the basis for planning malaria vector control activities in West Bangka Regency. For example, IRS spraying, mosquito nets used by the community with supervision by health workers, and the distribution of larvae-eating fish obtained from non-governmental organisations can reduce malaria incidence in the community (30). Malaria vector control efforts cannot stand alone but must be integrated with all society and government components. Continuous increase in political commitment is critical in the long-term control of malaria (31). Malaria vector control necessitates cross-sector collaboration and government support to achieve malaria elimination in West Bangka Regency by 2023. One of the new interventions of community mobilisation in malaria vector control is evaluation (15). Evaluation activities must continue to be carried out continuously on every aspect of malaria vector control in West Bangka Regency; these include context, input, process, and product. The output of each evaluation can be used to improve the Integrated Vector Management Programs for Malaria Vector Control. The findings of this study are critical in assisting with malaria vector control and accelerating malaria elimination in West Bangka Regency and Bangka Belitung Islands Province.

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CONCLUSION

The current study concludes that technical issues limit achieving malaria vector control's objectives, vision, and mission in West Bangka Regency. Lack of funds, local government support, Covid19 policies, storage, and availability of IRS and E-SISMAL equipment are all factors that affect malaria vector control. The topography is challenging for accessing areas. The process variables show that extensive under-mining miners' behavior moving close to breeding places also influences malaria vector control. Factors that affect the product variable include the lack of evaluating and analysing data on malaria vector control data at E-SISMAL. It is evidenced by the absence of data on malaria vector control in the E-SISMAL application.

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