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ARTICLE

Evaluation of the Effectiveness of Vector Control Programmes in Hospitals Using the CIPP Approach: A Case Study at Dr. Wahidin Sudiro Husodo General Hospital, Mojokerto City

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Abstract

Environmental health is a critical factor in preventing vector-borne diseases in hospitals. The Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City has implemented a vector control programme in accordance with the Ministry of Health of the Republic of Indonesia Regulation No. 2 of 2023. However, monitoring results indicate that the larval index (LI) remains below the standard threshold of ≥95%, while rodent and cockroach densities exceed the established limits. This study aims to evaluate the effectiveness of the vector control programme using the CIPP model (Context, Input, Process, Product). The research method used was qualitative descriptive with SWOT analysis. Data were collected through observations and interviews with sanitation officers in 32 hospital service units. The evaluation results showed that the context, input, and process aspects met the requirements, with each receiving high scores. However, in the product aspect, weaknesses were still found in mosquito and rat population control. Based on the SWOT analysis, the programme is in the aggressive strategy quadrant, which emphasises the utilisation of internal strengths and external opportunities to improve vector control effectiveness. Key recommendations include expanding programme coverage to areas outside the hospital, strengthening the involvement of internal health workers, and modernising the technology-based monitoring system. With the optimisation of these strategies, it is hoped that the vector control programme will be more effective in maintaining environmental health standards in hospitals.

Keywords: Vector Control; CIPP Evaluation; SWOT Analysis; Hospitals; Environmental Health

1. Introduction

Environmental health is one of the key components in efforts to improve public health. This aligns with the Ministry of Health of the Republic of Indonesia Regulation No. 2 of 2023, which states that environmental health aims to prevent diseases and health disorders caused by environmental risk factors, including physical, chemical, biological, and social factors. One aspect of environmental health that requires attention is vector control and disease-carrying animals. The presence of vectors, such as mosquitoes, flies, cockroaches, and rats, can indicate a high risk of disease transmission through vectors in hospitals (Rachmawati, 2022).

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The hospital environment is an area that is highly susceptible to the presence of disease vectors. Hospitals, as healthcare institutions, can become breeding grounds for vectors if sanitation and hygiene are not properly managed. Poor sanitation conditions in hospital environments are closely linked to the incidence of dengue fever. The poorer the sanitation conditions, the more disease vectors are found, leading to higher case numbers (Herlinawati & Husna, 2023). The presence of vectors in hospitals not only threatens patients but also healthcare workers and visitors interacting within the environment. Control of vectors and disease-carrying animals is an integral part of efforts to prevent vector-borne diseases, both directly and indirectly, with the aim of reducing vector density by implementing preventive measures to prevent disease transmission (Atikasari & Sulistyorini, 2019).

A study by Aisyah & Ardan (2024) highlights the importance of integrated vector control programmes in hospitals to prevent the spread of infectious diseases. The program includes identifying vector habitats, implementing physical and chemical control measures, and conducting regular monitoring to evaluate the program's effectiveness. Regular evaluation of vector control programs in hospitals is a crucial step to ensure that the hospital environment continues to meet environmental health standards. Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City is one of the hospitals in Indonesia that has implemented a vector control programme in accordance with the Ministry of Health of the Republic of Indonesia Regulation No. 2 of 2023. However, monitoring data indicates that vector presence in the hospital environment still does not meet quality standards. This includes the larval index (LI) being below the standard threshold of ≥95%, while rat and cockroach densities exceed the established limits. This situation indicates weaknesses in the implementation of the vector control programme, which requires further evaluation.

Vector control in hospitals can be carried out using various methods, such as physical, chemical, biological, and environmental management. A multidimensional approach to vector control is essential to achieve effective and sustainable results (Rachmawati, 2022). For example, physical control through the use of mouse traps and mosquito nets can be combined with chemical control such as fumigation or the use of safe insecticides. A study by Sapphira & Sari (2022) shows that the success of vector control programmes is greatly influenced by the availability of trained human resources and increased knowledge related to dengue vector control materials in communication, information, and education activities for the community, which have been proven to reduce dengue vector density. However, despite various efforts, there are still gaps in research on the effectiveness of vector control programmes. Therefore, it is important to apply comprehensive evaluation models, such as the CIPP (Context, Input, Process, Product) model and SWOT analysis, to assess and improve vector control policies. The CIPP model allows for a comprehensive assessment of the context, inputs, processes, and outputs of vector control programmes, while SWOT analysis can help identify the strengths, weaknesses, opportunities, and threats faced in programme implementation. By combining these two approaches, it is hoped that the evaluation results will provide strategic improvements in vector control policies, thereby enhancing programme effectiveness and reducing the risk of disease transmission in hospitals.

The success of the CIPP evaluation model in various public health programme contexts. For example, a study by Aprilia et al. (2023) evaluated a vector control programme using the CIPP approach. The results showed that the success of the programme was greatly influenced by individual supporting factors, including capacity, motivation, and organisational commitment. Community participation and the involvement of health facilities and cross-organisational collaboration were identified as key factors in the success of the health programme.

The existence of a control programme is not sufficient without comprehensive evaluation. Evaluation is necessary to identify weaknesses in programme implementation and ensure that each intervention has the desired impact. The CIPP evaluation model (Context, Input, Process, Product) is one effective method for evaluating vector control programmes. This model allows for a comprehensive assessment of the foundation, input, implementation process, and results of vector control programmes (Rachmawati et al., 202).

2. Materials and Methods

2.1 Research Design

This type of research is descriptive using a qualitative approach with SWOT analysis. A qualitative approach is a detailed explanation of the results of research that has been conducted in the field. The researcher describes the findings in detail based on the actual conditions in the field obtained through observation and interviews with sanitation officers. To ensure the validity of the data, the researcher conducted triangulation of information by comparing interview results from various sources, including the head of the department and third-party pest control personnel. Additionally, field notes and relevant documents were used to support the validity of the data.

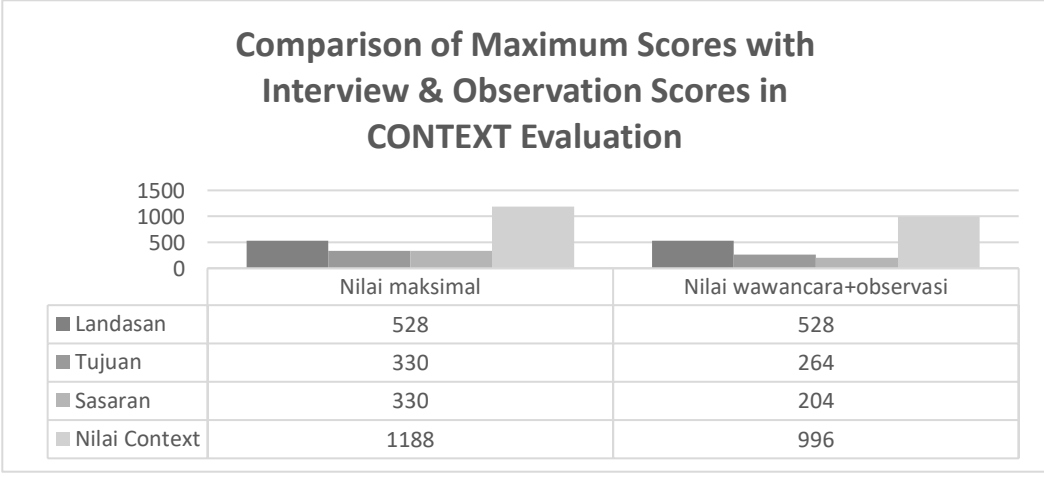
2.2 Research Subject

The subjects of this study were the heads of 32 rooms at Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City and the pest control company. The rooms include Gayatri Room, BDRS Room, HD Room, Cathlab Room, Radiology Room, ICU/ICCU Room, NICU Room, OK Room, CSSD Room, Tribhuana Room, Kertawijaya Room, Kertabhumi Room, Hayam Wuruk Room, Jayanegara Room, ICU Isolation Room, Kencono Wungu Room, Raden Wijaya Room, Chemotherapy Room, Nutrition Room, Laundry Room, IPS, IPL, Management Area, Mortuary, Emergency Room (IGD) and Ponek, Pharmacy Warehouse, General Warehouse, Outpatient Clinic Floor 1, Outpatient Clinic Floor 2, Executive Outpatient Clinic, Information and Medical Records, as well as the courtyard, garden, and drainage areas.

2.3 Analisis Data

The data obtained from observation and monitoring results are then evaluated through CIPP and SWOT analysis, which consists of *Strengths*, *Weaknesses*, *Opportunities* and *Threats*. The SWOT analysis aims to maximise strengths and opportunities, and minimise weaknesses and threats. To ensure the reliability of the SWOT analysis, researchers conducted focus group discussions with the research team and experts in environmental health to assess and interpret the position of the strategy quadrants objectively. This process helps identify and validate factors contributing to the success or challenges of vector control programmes in hospitals. With this more comprehensive methodological approach, it is hoped that the research results will provide a more accurate and objective picture of vector control conditions at Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City.

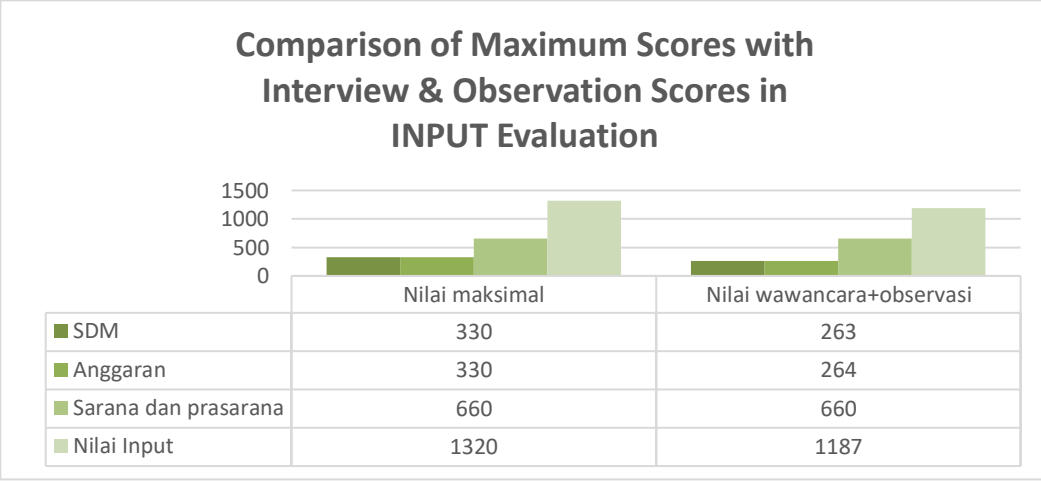
3. Results and Discussion



	Nilai maksimal	Nilai wawancara+observasi
Landasan	528	528
Tujuan	330	264
Sasaran	330	204
Nilai Context	1188	996

Figure 1. Results of Context Evaluation of Vector Control Program at Dr. Wahidin General HospitalSudiro Husodo Kota Mojokerto

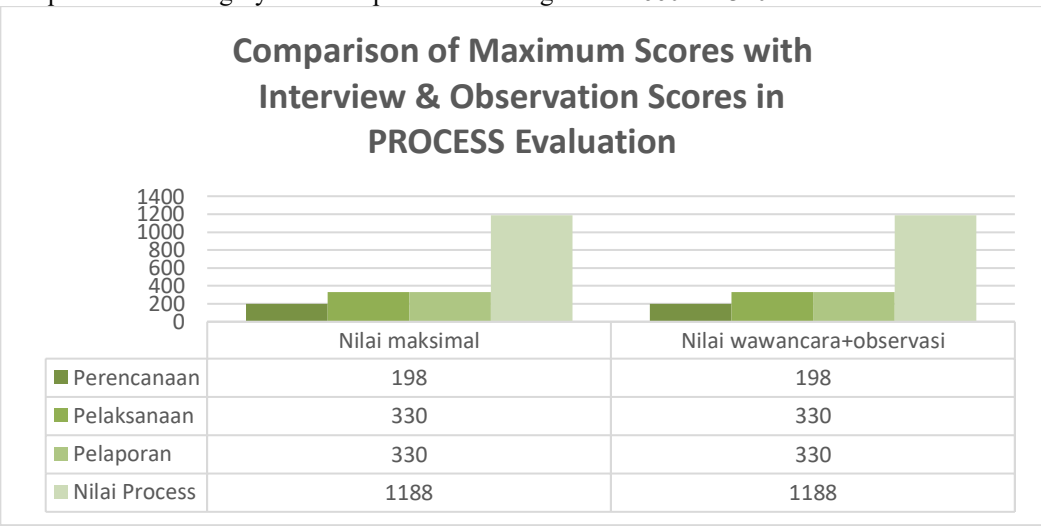
Based on interviews and observations conducted by researchers with 33 room managers at Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City, as illustrated in Figure 1, it was found that the evaluation of *context* includes the foundation, objectives, and targets, which are considered satisfactory with a score of 996. The score for the "meets requirements" category for the context variable is 594 to 1188.



	Nilai maksimal	Nilai wawancara+observasi
SDM	330	263
Anggaran	330	264
Sarana dan prasarana	660	660
Nilai Input	1320	1187

Figure 2. Results of the Evaluation of the Vector Control Programme Input at Dr. Wahidin Sudiro Husodo General Hospital, Mojokerto City

Based on interviews and observations conducted by the researcher with 33 room managers at Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City, as illustrated in Figure 2, it was found that the evaluation of inputs, including human resources, budget, facilities, and infrastructure, falls under the category of meeting requirements with a score of 1187. The score for the "meets requirements" category for the input variable ranges from 660 to 1320.



	Nilai maksimal	Nilai wawancara+observasi
Perencanaan	198	198
Pelaksanaan	330	330
Pelaporan	330	330
Nilai Process	1188	1188

Figure 3. Evaluation Results of the Vector Control Programme at Dr. Wahidin Sudiro Husodo General Hospital, Mojokerto City

Based on interviews and observations conducted by the researcher with 33 room supervisors at Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City, as illustrated in Figure V.4, it was found that the evaluation of the *process* category, which includes planning, implementation, monitoring, evaluation, and reporting, falls under the "meets requirements" category with a score of 1188. The score for the "meets criteria" category for the *process* variable ranges from 594 to 1188.

Table 1. Evaluation Results of the Vector Control Program at Dr. Wahidin Sudiro Husodo General Hospital, Mojokerto City

Variabel	Eligibility	Not eligible
The presence of mosquitoes		1
The presence of flies	1	
The presence of cockroaches	1	
The existence of pinjal	1	
The presence of mice		1
Total	3	2

Based on Table 1, it is known that the variables that meet the requirements include the presence of flies, the presence of cockroaches, and the presence of fleas. Meanwhile, the variables that are included in the category of not meeting the requirements are the presence of mosquitoes and the presence of rats.

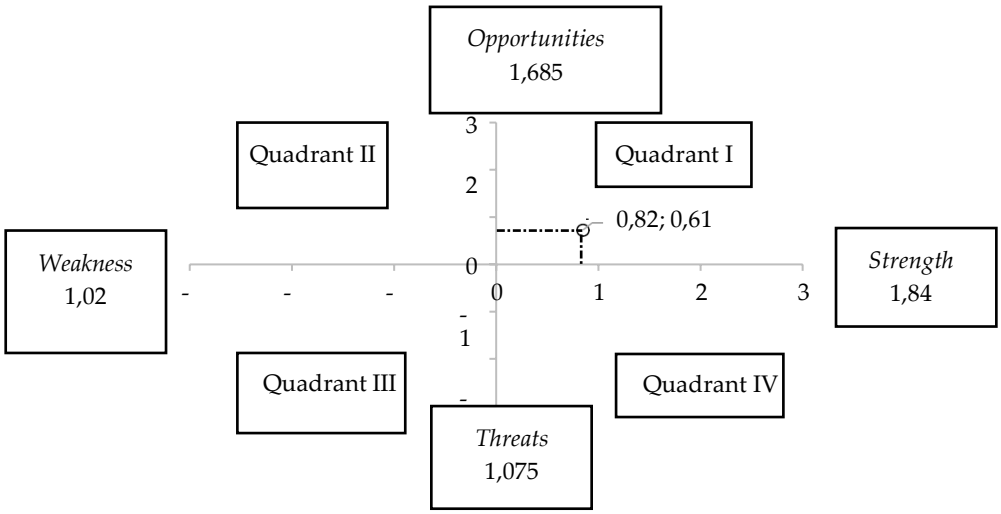


Figure 4. Quadrant of SWOT Analysis Results of Vector Control Program at Dr. Wahidin Sudiro Husodo General Hospital, Mojokerto City

In Figure 4, the Vector Control Programme at Dr. Wahidin Sudiro Husodo General Hospital in Mojokerto City is in Quadrant I of the aggressive strategy, which requires leveraging existing strengths and maximising available opportunities. The rating is based on the impact of each factor. Based on the results of the SWOT analysis diagram, it can be determined that the total strength score (strength) is 1.84 and the weakness score (weakness) is 1.02, resulting in a difference between strength and weakness of 0.82, which is used to determine the X-axis. Meanwhile, opportunities (opportunities) received a final score of 1.685 and threats (threats) received a final score of 1.075. The Y-axis is 0.61. The evaluation of the vector control programme at Dr. Wahidin Sudiro Husodo General Hospital using the CIPP model (Context, Input, Process, Product) showed varying results in its implementation. Overall, the programme has been implemented effectively, as evidenced by a context evaluation score of 84% (meeting requirements), input evaluation of 90% (meeting requirements), and process evaluation of 100% (meeting requirements). However, the product evaluation revealed mixed results for various types of vectors. The context evaluation indicates that the vector control programme has a strong regulatory foundation, referencing Ministry of Health Regulation No. 2 of 2023 and Ministry of Health Regulation No. 50 of 2017. This regulatory framework is the main strength of the programme as it provides a clear framework for implementation in the field. Through the proper implementation of SOPs, companies can ensure that every step taken by employees is in line with established standards, reducing the likelihood of errors and improving the quality of final outcomes (Rahmawati & Suryana, 2024). The study found several challenges in implementation, particularly related to incomplete coverage of the control area. Research by Rahma et al. (2024) explains that vector control coverage must be comprehensive, covering areas inside and outside hospital buildings,

with a focus on vulnerable points as a strategic effort to reduce the risk of vector-borne disease transmission in health care facilities. These objectives and targets have not been fully achieved. Meanwhile, the best method of arthropod control is environmental control because the results can be permanent. The area outside the hospital has not yet received optimal treatment in the vector control programme. This is a matter of concern, given the findings of Indarsah (2021), who emphasised that environmental control, including plant cleaning, shading, and environmental modifications such as drainage and filling of vector breeding sites, are the best methods for permanent results. The limited coverage of these areas can reduce the overall effectiveness of the programme, as vectors can migrate from outdoor areas into the hospital. The programme's objective to control vectors and reduce vector-borne disease rates is in line with Ministry of Health Regulation No. 2 of 2023, Article 33, paragraph 1. However, implementation in the field shows that programme awareness has not been evenly distributed across all hospital units, with only three rooms explicitly including vector control programmes in their unit targets. Public education activities are also crucial to enhance community knowledge about vector types and disease-carrying animals, types of disease-causing agents, modes of transmission, prevention, and control measures (Kanan et al., 2023). This situation indicates the need for strengthened communication and coordination among units to ensure consistent understanding and commitment to the programme.

The input evaluation showed good performance (90%) with several key strengths in terms of resource management. The programme had adequate annual budget and a good financial documentation system through receipts from third parties. The availability of adequate budget was in line with the findings of Ganus (2021), who emphasised the importance of financial support for programme success. The input evaluation covers aspects such as human resources, funding, and supporting facilities and infrastructure. The purpose of this evaluation is to assess the adequacy of available resources in supporting the achievement of program objectives, as well as to examine the extent to which these resources are utilised efficiently and optimally.(Rama et al. 2023).

In terms of human resources, the programme has trained personnel from third parties to carry out vector control. However, the involvement of hospital staff, including directors, ward heads, and employees, still needs to be improved. These findings support Rachmawati's (2022) research, which identified that the absence of written vector control responsibilities in each room contributes to the presence of vector populations. Efforts to improve employee performance quality can be made by conducting training and competency development activities.(Wijaya 2023)The facilities and infrastructure for the programme are adequate, including equipment for mosquito larvae surveys and control of flies, cockroaches, and rats. However, there are still shortages in terms of equipment for determining insecticide resistance and efficacy, as well as tools for examining vector samples. Pelealu et al. (2022) emphasise that the availability of adequate facilities and infrastructure is a key factor in achieving programme success.

The evaluation of the process of achieving the optimal value (100%) shows that the programme implementation has been carried out in accordance with the established plans and regulations. A good planning system is reflected in the clear control schedule and effective coordination between relevant parties. This is in line with Viani's (2017) opinion, which emphasises the importance of careful planning in achieving programme objectives. Before vector control is implemented, officers will coordinate the implementation plan for vector control. With the coordination of the plan before the implementation of vector control, officers can carefully select and determine which steps are necessary and which are not.(Arief Fardiansyah et al. 2022). The implementation of the programme has met occupational safety standards with the use of PPE in accordance with Ministry of Health Regulation No. 2 of 2023. The monitoring and evaluation system is conducted on a regular basis with proper documentation. However, there is still room for improvement in efficiency through the digitalisation of reporting systems and real-time monitoring. Real-time monitoring efforts have been implemented effectively and achieved the national targets set in the implementation of the dengue fever control programme.(Lestari et al. 2023).

Product evaluation showed mixed results for various types of vectors. The fly population index (1.28), cockroach (0.1), and pinjal (1.0) met the standard environmental health quality standards. However, the larval-free rate (94%) was still below the minimum standard of 95%, and the mouse trap success

rate (3.5%) was far above the maximum standard of 1%. This product is the final outcome, and it is hoped that the results of the evaluation process will assist decision-makers in making informed decisions.(Agustin and Siyam 2020)These results indicate the need for more intensive control strategies for mosquitoes and rats. In accordance with Ministry of Health Regulation No. 2 of 2023, the programme needs to strengthen internal and external vector density monitoring and document the results in surveillance reports for evaluation and continuous improvement.

Based on the SWOT analysis results, this programme is in quadrant I, which indicates an aggressive strategy. This shows that the programme is in an advantageous position, with internal strengths that can be optimised and external opportunities that can be exploited for further development. Therefore, several strategies can be implemented to improve the programme's effectiveness. One of the main strategies is the use of appropriate technology in vector monitoring and control. The use of this technology will enable the monitoring process to be carried out more quickly, accurately, and efficiently, thereby increasing effectiveness in identifying and controlling the presence of disease vectors. Additionally, strengthening cross-sectoral collaboration is a crucial strategic step, particularly with other educational and health institutions. Through this collaboration, knowledge and resources can be exchanged more effectively, enabling vector control to be carried out in a more comprehensive and sustainable manner.

On the other hand, more comprehensive training programmes need to be developed to increase the involvement and capacity of internal staff. Research conducted by Sazali, M. et al. (2024) on dengue vector mosquito control training using Lethal MosquiTrap Modification (LMM) in Ampenan District, Mataram City, shows the importance of sustainable training programmes to increase community capacity.(Sazali et al. 2024)With ongoing training, field staff will have a better understanding and skills in implementing vector control programmes, thereby improving programme effectiveness. Research on efforts to prevent and control dengue fever vectors through education, detection, and measurement of the Aedes aegypti mosquito ovitrap index indicates that current dengue prevention efforts primarily rely on vector control, which requires active community involvement.(Aisyah and Ardan, 2024). In addition, the implementation of a digital monitoring system is also a measure that needs to be considered in order to improve efficiency and accuracy in reporting and programme evaluation. This system enables real-time data processing, allowing for faster and evidence-based decision-making.

Finally, in facing the challenges of climate change that can impact disease vector distribution patterns, adaptive strategies are needed for vector control. By developing more flexible and responsive methods to environmental changes, this programme can remain effective under various conditions. This is in line with the findings of a study by(Rocklöv and Dubrow 2020), which indicates that climate change has caused shifts in the geographical distribution and transmission season of vectors such as Aedes aegypti mosquitoes, necessitating more dynamic and locally evidence-based control approaches. Through this series of strategies, it is hoped that vector control programmes can continue to evolve and have a more significant impact on maintaining environmental and public health.

4. Conclusion

The findings of this study have several practical implications for the development of vector control programmes in hospitals. First, there is a need to expand the scope of the programme to areas outside the hospital with a more comprehensive environmental control approach. Second, strengthening internal hospital involvement through the appointment of a person in charge in each unit and ongoing training programmes. Third, modernising monitoring and evaluation systems through the adoption of digital technology to enhance programme efficiency.

For further research, it is recommended to conduct a longitudinal study to evaluate the effectiveness of the programme in the long term, especially in relation to vector resistance to the control methods used. In addition, research on the impact of climate change on vector populations in hospital environments is also needed to develop more effective adaptation strategies.

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