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FACTORS ASSOCIATED WITH WOLBACHIA-AEDES POLICY IMPLEMENTATION IN TEMBALANG SUBDISTRICT, SEMARANG CITY

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ABSTRACT

Dengue fever represents a significant public health challenge in Indonesia. The Wolbachia-Aedes mosquito policy innovation, designed to impede dengue virus transmission, has been implemented in various urban areas as an effective control strategy. Nevertheless, public acceptance has emerged as a crucial determinant of the policy's successful implementation. This study seeks to examine public perceptions and sentiments concerning the Wolbachia-Aedes policy implementation. A quantitative approach with a cross-sectional design was employed in this study. A total of 110 respondents were selected through cluster sampling in Tembalang, Semarang City, Indonesia. Data collection was conducted via interviews utilizing a structured questionnaire. Findings indicate that 53.6% of respondents held a positive perception of the policy. This perception was significantly influenced by factors related to knowledge and information access ($p<0.05$). However, the majority of respondents underscored the necessity for enhanced dissemination and improved education regarding the Wolbachia-Aedes policy. Future research should investigate the potential adverse impacts of the Wolbachia-Aedes policy and provide more comprehensive scientific evidence. Additionally, intensive risk communication and outreach are imperative to cultivate greater community support for the policy's implementation.

ABSTRAK

Demam Berdarah Dengue (DBD) masih menjadi permasalahan kesehatan masyarakat di Indonesia. Beberapa kota menjadi *pilot project* dalam penerapan inovasi nyamuk Aedes ber-Wolbachia untuk menghambat penularan virus dengue sebagai strategi pengendalian yang efektif. Namun, penerimaan masyarakat muncul sebagai salah satu faktor kunci keberhasilan penerapan kebijakan ini. Penelitian ini bertujuan untuk menganalisis persepsi atau sentimen masyarakat terhadap penerapan kebijakan nyamuk Aedes ber-Wolbachia. Penelitian ini menggunakan metode kuantitatif dengan desain cross-sectional. Sebanyak 110 responden dipilih melalui *cluster sampling* di Tembalang, Kota Semarang, Indonesia. Data dikumpulkan melalui wawancara menggunakan kuesioner terstruktur. Hasil penelitian menunjukkan bahwa 53,6% responden memiliki persepsi positif terhadap kebijakan tersebut. Persepsi ini dipengaruhi secara signifikan oleh faktor pengetahuan dan akses informasi ($p<0,05$). Namun, sebagian besar responden menekankan pentingnya peningkatan sosialisasi dan edukasi mengenai kebijakan nyamuk Aedes ber-Wolbachia. Diperlukan eksplorasi potensi dampak negatif dari kebijakan nyamuk Aedes ber-Wolbachia dan penyediaan bukti ilmiah yang lebih komprehensif. Selain itu, komunikasi dan penjangkauan risiko yang intensif sangat penting untuk mendorong dukungan masyarakat yang lebih besar terhadap penerapan kebijakan.

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INTRODUCTION

Dengue hemorrhagic fever (DHF) remains a challenge to the public health system in Indonesia. Climate change and the existing tropical climate facilitate the proliferation of *Aedes aegypti* mosquitoes, resulting in a high annual incidence of DHF (Harapan, H., Michie, A., Mudatsir, M., Sasmono, R. T., & Imrie, 2019). In Indonesia, dengue hemorrhagic fever was first discovered in Surabaya and Jakarta in

1968, which then became a public health problem in Indonesia. In 2014, DHF had spread to all provinces in Indonesia. In 2019, DHF had spread to 481 of 514 districts or cities. Over the past 50 years, the incidence of DHF has increased significantly, with the highest cases recorded in 2009 and 2016. In contrast, the Case Fatality Rate (CFR) has decreased significantly over time from more than 20% of the infected population in the 1960s to 0.79% in 2016, although there are still areas with an incidence rate of more than 10 (IR>10) (Indonesian Ministry of Health, 2022). By the end of 2022, the number of dengue cases in Indonesia reached 143,000, with the highest number found in the provinces of West Java, East Java, and Central Java (Indonesian Ministry of Health, 2022)

This condition impacts the public health and economy of the country. Various mitigation efforts have been carried out, such as fogging and mosquito nest eradication (*Pemberantasan Sarang Nyamuk*/PSN), yet they frequently yield suboptimal results in terms of program implementation. PSN with the 3M Plus method is actually quite effective in addressing the problem of dengue fever, but in practice, it is often not done regularly, not carried out simultaneously, and it is difficult to find all mosquito breeding sites, such as small containers that are overlooked. Meanwhile, fogging can only kill adult mosquitoes without destroying their eggs and larvae, so the mosquito population quickly recovers. The smoke from fogging, which does not reach all mosquito hiding places, can also make mosquitoes resistant to insecticides (Ramadhani, F., Yudhastuti, R., & Widati, 2017). In response to this problem, the Indonesian government introduced a policy for implementing the Wolbachia-*Aedes* mosquito innovation as stated in the Decree of the Minister of Health Number HK.01.07/MENKES/1341/2022 concerning the Pilot Project for Implementing Dengue Control Using the Wolbachia Method. This policy designated five regencies/cities—Semarang, West Jakarta, Bandung, Kupang, and Bontang—as pilot project sites (Minister of Health, 2022).

The insertion of *Wolbachia* bacteria into *Aedes aegypti* mosquitoes represents a groundbreaking approach to controlling dengue hemorrhagic fever (DHF) transmission. *Wolbachia*, a naturally occurring bacterium found in many insect species, has been shown to reduce the mosquito's ability to harbor and transmit various viruses, including dengue. When introduced into *Aedes aegypti*, the primary vector for DHF, *Wolbachia* establishes itself within the mosquito's cells and is passed on to subsequent generations through the eggs (Hoffmann *et al*, 2011). This innovative technique works through multiple mechanisms. Firstly, *Wolbachia* competes with viruses for resources within the mosquito, making it harder for the dengue virus to replicate. Secondly, it stimulates the mosquito's immune system, further inhibiting viral growth. Additionally, *Wolbachia*-infected male mosquitoes can mate with uninfected females, resulting in unviable eggs, potentially reducing the overall mosquito population over time. This method offers a sustainable and environmentally friendly alternative to traditional vector control strategies, as it does not rely on insecticides or genetic modification of the mosquitoes themselves (Hoffmann, *et al*, 2011), (Ross, *et al*, 2017).

Previous research has demonstrated the effectiveness of this method in reducing the number of DHF cases. The implementation of the Wolbachia-*Aedes* technology resulted in a reduction in cases of up to 77% in Yogyakarta (Utarini, *et al*, 2021). Therefore, this policy is considered a breakthrough in controlling DHF in Indonesia. Nonetheless, the success of this technology depends not only on its scientific effectiveness but also on public acceptance and support. In this case, public perception or sentiment toward the policy plays an important role, considering that the implementation of the Wolbachia innovation requires direct involvement from communities, such as participation in the distribution and monitoring of mosquitoes, known as foster parenting (*orang tua asuh*/OTA) (Rachmayanthy, 2023). Cultural diversity, access to information, and public perceptions can influence the successful implementation of the Wolbachia-*Aedes* policy (Liew, *et al*, 2021), (Lwin, *et al*, 2022).

METHOD

Type of Research

This quantitative study employed a cross-sectional approach, focusing on data collection at a specific point in time. The research was conducted over a three-month period from June to August 2024 in Tembalang Subdistrict, located in Semarang City, Indonesia. This methodological choice allowed researchers to gather a snapshot of the population's characteristics, behaviors, or outcomes of interest during the specified timeframe. The selection of Tembalang Subdistrict as the study location provides a specific geographical context for the research and has implemented the Wolbachia-*Aedes* policy.

Semarang City, being the capital and largest city of Central Java Province, offers a unique urban setting for the study.

Sampel Criteria

The research employed a combination of cluster and accidental sampling techniques to select 110 respondents from Tembalang Subdistrict, Semarang City, Indonesia. The inclusion criteria were carefully defined to ensure the relevance and reliability of the data collected. Participants were required to be over 17 years of age, ensuring a mature perspective on the research topic. Additionally, respondents had to be residents of Tembalang Subdistrict, providing a focused geographical scope for the study. To maintain the integrity of the research, exclusion criteria were also established. Respondents who chose to withdraw from the study at any point were excluded from the final analysis. Furthermore, during the data collection phase, any participants who failed to provide complete responses to the questionnaire were also omitted from the study. This approach ensured that only comprehensive and reliable data were included in the final analysis, enhancing the overall quality and validity of the research findings.

Research Variable

The research examined the influence of several independent variables on public sentiments regarding the Wolbachia-*Aedes* policy. These variables included demographic factors such as gender, occupation, and income, as well as cognitive factors like knowledge and information access. By analyzing these variables, the study aimed to understand how different segments of the population perceive and respond to the policy implementation. Gender, occupation, and income were selected as demographic variables to explore potential differences in sentiments based on socioeconomic factors. Knowledge and information access were included to assess how understanding of the policy and exposure to relevant information might shape public opinion. The dependent variable, public sentiments on the Wolbachia-*Aedes* policy, likely encompassed various aspects such as acceptance, support, concerns, or opposition to the policy. This comprehensive approach allows for a nuanced understanding of the factors influencing public perception and could provide valuable insights for policymakers and public health officials in implementing and communicating about the Wolbachia-*Aedes* strategy.

Data Collection

The data collection process involved conducting interviews using a closed-ended questionnaire. This method allowed for standardized responses, facilitating easier quantification and analysis of the data. The researcher carefully designed the questionnaire to ensure it addressed the specific research objectives and captured relevant information from the participants. To ensure the quality and effectiveness of the data collection instrument, the researcher conducted a pilot study. The questionnaire was administered to 30 respondents who were not part of the main research sample. This preliminary testing served two crucial purposes: assessing the validity of the questionnaire, which determines whether it accurately measures what it intends to measure, and evaluating its reliability, which ensures consistency in the responses across multiple administrations. The results of this pilot study informed any necessary revisions or refinements to the questionnaire before its use in the main study, enhancing the overall robustness of the research methodology.

Data Analyze

The collected data were subjected to the Kolmogorov-Smirnov test to assess normality. Given the non-normal distribution of the data, frequency distribution was characterized using the median. A bivariate analysis was conducted employing the Chi-square test to identify factors influencing public sentiments. The findings provide a foundation for developing policy recommendations concerning the implementation of Wolbachia-*Aedes* technology.

Etichal Approval

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Public Health, Diponegoro University, under certificate number 244/EA/KEPK-FKM/2024.

RESULT

a. Characteristics of Respondents

The demographic profile of the study participants reveals a predominantly female sample, with 95.5% of respondents being women. This significant gender imbalance suggests that the findings may be particularly representative of female perspectives and experiences. The age distribution indicates that the majority of participants (62.7%) fall within the 46–55-year-old bracket, representing a middle-aged to early older adult population. This age group may have distinct characteristics, such as established life experiences, family responsibilities, and potentially transitioning toward retirement.

Educational attainment among the respondents was primarily at the senior high school level, with 52.7% having completed this level of education. This suggests a moderate level of formal education among the participants, which may influence their knowledge, skills, and perspectives on the study's subject matter. Notably, a substantial majority (83.6%) of the respondents reported having no income, indicating a population that may be financially dependent, unemployed, or engaged in unpaid work. This economic status could have significant implications for the study's findings, particularly if the research explores topics related to financial well-being, access to resources, or socioeconomic factors.

Table 1. Characteristics of Respondents

No	Characteristics	f	%
1	**Gender**		
	Women	105	95.5%
	Men	5	4.5%
2	**Age**		
	18-25 years	4	3.6%
	26-45 years	37	33.6%
	46-55 years	69	62.7%
3	**Education Level**		
	Elementary school	28	11.8%
	Junior high school	9	8.2%
	Senior high school	58	52.7%
	Vocational school	7	6.3%
	Undergraduate	23	20.9%
4	**Occupation**		
	Housewife	87	79.1%
	Entrepreneur	9	8.2%
	Salaryman	3	2.7%
	Seller	2	1.8%
	Civil servant	1	0.9%
	Others	8	7.3%
5	**Income**		
	Reported no income	92	83.6%
	Under Local Minimum Wage	14	12.7%
	Upper Local Minimum Wage	4	3.6%

b. Public Sentiments on the *Wolbachia-Aedes* Policy

The research findings presented in Table 2 provide valuable insights into public perceptions of the Wolbachia-*Aedes* policy. A significant majority of respondents expressed confidence in the safety of this innovative approach, with 71.9% either agreeing or strongly agreeing that it posed no risk to communities. Similarly, a substantial 73.6% of participants believed in the potential of *Wolbachia* to reduce dengue hemorrhagic fever (DHF) incidence. This positive sentiment extended to the policy's perceived effectiveness in reducing mosquito larvae populations, although specific percentages for this aspect were not provided.

Table 2. Frequency Distribution of Public Sentiments on the *Wolbachia-Aedes* Policy

No	Statements	Answer			
		Strong Disagree	**Disagree**	**Agree**	**Strong Agree**
1	The implementation of the *Wolbachia-Aedes* innovation is safe enough for communities.	6 (5.5%)	25 (22.7%)	17 (15.5%)	62 (56.4%)
2	The implementation of the *Wolbachia-Aedes* innovation can reduce the incidence of dengue hemorrhagic fever (DHF).	6 (5.5%)	23 (20.9%)	10 (9.1%)	71 (64.5%)
3	The implementation of the *Wolbachia-Aedes* innovation cannot reduce the number of mosquito larvae.	55 (50.0%)	14 (12.7%)	24 (21.8%)	17 (15.5%)
4	The implementation of the *Wolbachia-Aedes* innovation requires more research and evidence.	14 (12.7%)	5 (4.5%)	17 (15.5%)	74 (67.3%)
5	The implementation of the *Wolbachia-Aedes* innovation raises concern among communities, and enhanced dissemination is necessary for this technology.	11 (10.0%)	3 (2.7%)	11 (10.0%)	85 (77.3%)

Despite the overall positive reception, the data also revealed a strong desire for further scientific validation and improved communication. An overwhelming 82.8% of respondents emphasized the need for additional research and scientific evidence to support the Wolbachia-*Aedes* policy. Furthermore, 87.3% of participants stressed the importance of enhanced dissemination efforts to address community concerns about potential negative impacts. These findings underscore the public's cautious optimism—balancing enthusiasm for the policy's potential benefits with a demand for thorough scientific scrutiny and transparent communication. The overall positive sentiment toward the Wolbachia-*Aedes* policy, shared by 53.6% of respondents, suggests a generally favorable foundation for its implementation, provided that these additional research and communication needs are adequately addressed.

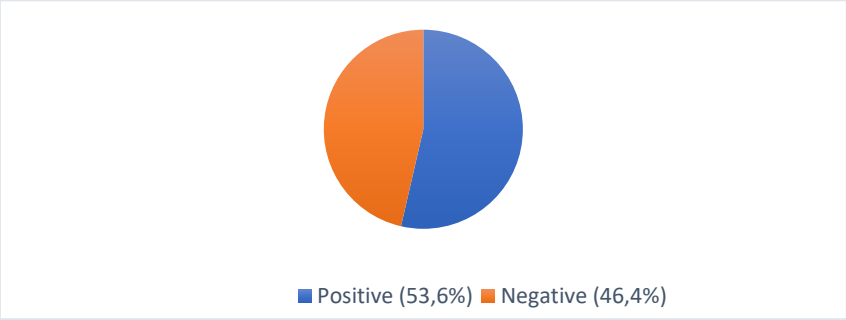

Diagram 1. Categories of Public Sentiments on the *Wolbachia-Aedes* Policy

The implementation of the Wolbachia-Aedes policy yielded mixed results according to respondent feedback. Those who perceived the policy as effective noted a significant decrease in dengue hemorrhagic fever (DHF) cases within their communities following the introduction of Wolbachia-infected mosquitoes. This positive outcome suggests that the strategy of using Wolbachia bacteria to

suppress dengue virus transmission in *Aedes* mosquitoes may have been successful in certain areas, potentially offering a promising approach for dengue control. However, the policy's effectiveness was not uniformly perceived across all respondents.

Some individuals reported that the Wolbachia-Aedes technology application was ineffective, citing two primary reasons. First, there was a perceived lack of adequate information dissemination about the program, which led to public debate and potential misunderstandings regarding its implementation. This highlights the importance of comprehensive community engagement and education for the success of such public health interventions. Second, the continued occurrence of DHF cases in some residential areas caused several respondents to question the program's efficacy. These contrasting perspectives underscore the need for a thorough evaluation of the policy's implementation, including factors such as coverage, consistency, and long-term monitoring of dengue incidence rates, to accurately assess its impact across different localities.

c. Factor Influencing Public Sentiments on the *Wolbachia-Aedes* Policy

The cross-tabulation analysis reveals interesting patterns in public sentiment toward Wolbachia-Aedes across different demographic and socioeconomic groups. Female respondents, unemployed individuals, and those with income below the minimum wage demonstrated more positive opinions about Wolbachia-Aedes, with percentages ranging from 54.3% to 54.7%. Notably, respondents with good knowledge of the subject and easy access to health information showed even higher levels of favorable sentiment—65.5% and 70.2%, respectively. These findings suggest that education and information accessibility play crucial roles in shaping public opinion on this issue (Table 3).

Table 3. Factor Influencing Public Sentiments on the *Wolbachia-Aedes* Policy

No	Variable	Public Sentiments						
		Poor		Good		Total		Sig
		f	%	f	%	f	%	
1	**Gender**							
	Women	48	45.7	57	54.3	105	100	0.531
	Men	3	60	2	40	5	100	
2	**Occupation**							
	Unemployed	42	45.7	50	54.3	92	100	0.735
	Employed	9	50	9	50	18	100	
3	**Income**							
	Under Minimum Wage	48	45.3	58	54.7	106	100	0.242
	Upper Minimum Wage	3	75	1	25	4	100	
4	**Knowledge**							
	Poor	32	58.2	23	41.8	55	100	0.013*
	Good	19	34.5	36	65.5	55	100	
5	**Information Access**							
	Poor	34	64.2	19	35.8	53	100	<0.001*
	Good	17	29.8	40	70.2	57	100	

*significant (p<0.05)

Further analysis of the research results indicates that knowledge and information access are statistically significant factors ($p<0.05$) influencing public sentiments toward the Wolbachia-Aedes policy. This underscores the importance of public education and information dissemination in garnering support for such initiatives. Interestingly, demographic factors such as gender, occupation, and income were not found to have a significant impact on public sentiments. This implies that targeted educational campaigns and improved access to health information could be more effective in influencing public opinion than focusing on specific demographic groups. The findings highlight the need for comprehensive public health communication strategies to enhance understanding and acceptance of innovative vector control methods like Wolbachia-Aedes.

DISCUSSION

The predominance of female respondents (95.5%) in this study underscores the significant role women play in family health management. This gender imbalance is not uncommon in health-related research, particularly when focusing on household dynamics. Women, especially those in the role of housewives, are often considered the primary caregivers and decision-makers regarding family health matters. Their influence extends beyond personal health choices to shaping the overall health behaviors and practices of the entire household. This strategic focus on women in public health campaigns recognizes their pivotal position in implementing and maintaining healthy living practices within the family unit. Women typically oversee dietary choices, hygiene practices, and healthcare decisions for family members. Their engagement with health information and their tendency to disseminate this knowledge within their social networks make them valuable targets for health education and intervention programs. By leveraging women's influence, public health initiatives can potentially achieve a broader and more sustainable impact on community health outcomes, as the health behaviors adopted by women are likely to be passed on to children and other family members, creating a ripple effect of positive health practices (Ariawan, *et al*, 2020).

The predominance of respondents aged 46–55 years (62.7%) in the study reflects a demographic group typically characterized by high levels of community engagement and civic participation. This age cohort often represents individuals who have established themselves professionally and personally, allowing them more time and resources to invest in community affairs. Their life experience and social connections make them valuable assets in neighborhood activities, as they can leverage their networks to mobilize support for various initiatives. Furthermore, this age group's heightened interest in public health issues can be attributed to several factors. As they approach or enter middle age, health concerns become more prominent, leading to increased awareness of preventive measures and innovative health solutions. Their support for the Wolbachia-Aedes innovation demonstrates a willingness to embrace novel approaches to combat health challenges. Additionally, their role as agents of change extends beyond mere support; they actively participate in campaigns and outreach activities, utilizing their communication skills and community standing to educate and influence others. This proactive involvement suggests that the 46–55 age group plays a crucial role in bridging the gap between health authorities and the broader community, facilitating the implementation and acceptance of public health initiatives.

The high education level among respondents (52.7%) indicates a population with enhanced cognitive abilities and critical thinking skills. This educational background likely contributes to a better comprehension of complex scientific concepts, such as the Wolbachia-Aedes policy for controlling *Aedes aegypti* mosquitoes. Individuals with higher education are often more receptive to new ideas and innovative approaches, potentially leading to greater acceptance and support for the implementation of this novel mosquito control method. Their ability to understand and interpret scientific information may also facilitate more effective communication and dissemination of knowledge about the policy within their communities (Villegas-Chim J, *et al*, 2022). The predominance of housewives (79.1%) among the respondents highlights a crucial demographic for the successful implementation of the Wolbachia-Aedes policy. Housewives often serve as primary caretakers of the home environment, making them key stakeholders in maintaining conditions that support the policy's objectives. Their regular presence in and around the household allows for consistent monitoring of mosquito populations and implementation of preventive measures. Moreover, housewives frequently act as information hubs within their social

networks, potentially amplifying the reach and impact of educational efforts related to the Wolbachia-Aedes policy. Their engagement and support could significantly influence community-wide acceptance and participation in this innovative approach to mosquito control (Villegas-Chim J, *et al*, 2022). In implementing the Wolbachia-Aedes policy, a community-based approach can be used to engage housewives as the main actors. Campaigns should be tailored to the respondents' educational background, using simple language and media that are easy to understand (Cofie, *et al,* 2013).

In this study, a significant proportion of respondents (83.6%) reported having no income, highlighting their limited economic resources. For the program to be successful, it is imperative to formulate and implement policies that do not impose financial burdens on these communities. This could include measures such as the free distribution of Wolbachia-infected mosquitoes or securing funding from governmental and donor agencies. Furthermore, the safety of the Wolbachia-Aedes innovation must be a key consideration in its implementation. The study found that a majority of respondents (56.4%) perceived the Wolbachia-Aedes innovation as safe for their communities. However, a notable minority (28.2%) expressed concerns regarding its safety, which may stem from a lack of information or direct experience with the program (Siagian, 2023).

Similar concerns were reflected in respondents' perspectives regarding the effectiveness of program implementation. The majority of respondents (64.5%) believed that the Wolbachia-Aedes innovation could reduce the incidence of DHF. This indicates a general understanding of the benefits of this policy. In this case, clear risk information and communication are needed to increase their knowledge of the safety and effectiveness of the Wolbachia-Aedes innovation (Schmälzle, R., Renner, B., & Schupp, 2017).

The study conducted in Yogyakarta, Indonesia, represents a significant breakthrough in the fight against dengue hemorrhagic fever (DHF). By releasing mosquitoes infected with *Wolbachia* bacteria, researchers achieved a remarkable reduction in DHF cases and related hospitalizations. *Wolbachia* is a naturally occurring bacterium that, when introduced into *Aedes aegypti* mosquitoes, inhibits their ability to transmit the dengue virus to humans. This innovative approach targets the vector of the disease rather than the virus itself, offering a potentially more sustainable and environmentally friendly method of dengue control. The results of this study are particularly promising, given the substantial impact observed. A 77% reduction in DHF incidence suggests that *Wolbachia*-infected mosquitoes can effectively suppress dengue transmission within a community. Furthermore, the 86% decrease in hospitalizations indicates that this method not only reduces the overall number of cases but also potentially mitigates the severity of infections that do occur. These findings have important implications for public health strategies in dengue-endemic regions, offering a potential tool to significantly reduce the burden of this disease on healthcare systems and improve overall community health outcomes (Utarini, *et al*, 2021). It is expected that outreach through local media, community-based campaigns, and dissemination of scientific evidence can increase public acceptance.

In this study, only 37.3% of respondents agreed that the *Wolbachia–Aedes* innovation was not aimed at reducing mosquito larvae. This indicates a misconception regarding the mechanism of action of *Wolbachia*, which reduces the mosquitoes' ability to spread the virus rather than decreasing the number of larvae directly (Hoffmann, *et al*, 2011). Expanding on the importance of disseminating accurate information about *Wolbachia*'s mechanism of action is crucial for successful policy implementation. To address potential concerns and ensure community support, it is essential to provide clear and accessible explanations of how *Wolbachia* works. This includes detailing how the bacteria interfere with virus replication in mosquitoes, reduce their lifespan, and affect reproduction. Additionally, emphasizing the safety of this method for humans and the environment is crucial. By proactively sharing this information through various channels, such as community meetings, educational materials, and media campaigns, policymakers can build trust, address misconceptions, and foster public acceptance of *Wolbachia*-based interventions. This transparent approach will likely contribute to smoother implementation and greater long-term success of the policy.

Moreover, 67.3% of respondents concurred that this innovation necessitates further investigation and should be substantiated by robust evidence. Although several studies have documented the implementation of the *Wolbachia–Aedes* policy, including in Yogyakarta and Singapore (Utarini,*et al*, 2021), (Lim JT, *et al*, 2022), further investigation is required to address public concerns regarding the safety and efficacy of the innovation. This necessity arises from the fact that 77.3% of respondents

agreed that the implementation of this policy elicited concerns within communities and necessitated improved dissemination. A comparable situation was observed in Singapore, where limited knowledge about the *Wolbachia* technology correlated with heightened skepticism regarding the implementation of the innovation (Soh, *et al,* 2021).

Based on the cross-tabulation analysis, female respondents tended to express more positive opinions regarding *Wolbachia–Aedes* (54.3%). Women play a major role in implementing health programs, especially as caregivers, both in health promotion and in supporting their implementation (Kar, *et al*, 1999). However, there was no significant correlation between gender and public sentiment toward the *Wolbachia–Aedes* policy. Respondents with incomes below the minimum wage showed good sentiment (54.7%), which differs from several studies indicating that health problems are more prevalent among low-income communities. According to Harris et al. (2011), workers with annual household incomes below $35,000 experience more chronic diseases and have poorer health status (Harris, *et al*, 2011). Although sentiment and perceptions of the program were not discussed directly, there was no significant correlation between economic status and public sentiment toward the *Wolbachia–Aedes* policy.

Respondents who possessed substantial knowledge were more likely to exhibit a positive sentiment toward the *Wolbachia–Aedes* policy (65.5%). These findings diverge from research conducted by Liew et al. (2021) in Singapore, which indicated that knowledge did not significantly correlate with public sentiment regarding the *Wolbachia–Aedes* policy (Liew, *et al*, 2021). The presence of diverse information related to the *Wolbachia–Aedes* policy affects public sentiment, particularly concerning the safety of the innovation.

According to Shapiro et al. (2011), one strategy to overcome this issue is the establishment of a health information organization that enables the sharing of secure and integrated clinical information among multiple stakeholders, including clinical and public health partners, through a health information exchange (HIE) (Shapiro, *et al*, 2011). Additionally, social media can be utilized to disseminate health information, particularly concerning the effectiveness of *Wolbachia–Aedes* innovation (Ghahramani, *et al,* 2022).

Based on the results, respondents with easy access to health information tended to have a positive opinion regarding *Wolbachia–Aedes*, and this factor showed a significant effect. Health information access is closely linked to health literacy, which plays a key role in health promotion and program implementation (Suka, *et al, , 2015)*. The use of technology can enhance health information access—for instance, through social media and instant messaging. Research conducted by Stockwell et al. (2013) demonstrated that the use of technology can improve the promotion of vaccination programs (Stockwell, M. S., & Fiks, 2013). This strategy can also be employed to enhance the promotion of *Wolbachia–Aedes* policy implementation, particularly in disseminating information regarding potential adverse effects and providing more comprehensive scientific evidence. Furthermore, intensive risk communication and outreach are crucial for cultivating greater community support for the policy's implementation.

CONCLUSION AND SUGGESTION

The implementation of the *Wolbachia–Aedes* policy has received substantial community support, as indicated by 53.6% of respondents expressing favorable attitudes toward this innovation. Factors related to knowledge and access to information have significantly influenced these positive sentiments, whereas variables such as gender, occupation, and income do not appear to be associated with public perceptions. Nonetheless, targeted interventions, including direct dialogue and community engagement, are necessary to address negative sentiments that persist within certain groups regarding this policy. By employing appropriate strategies, such as utilizing social media and other digital technologies to promote and strengthen health information systems, the *Wolbachia–Aedes* policy can achieve broader public acceptance and make a meaningful contribution to dengue hemorrhagic fever (DHF) control efforts.

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