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Original Research

Dengue Fever Prevention Behavior at the Household Level in High and Low Incidence Areas: A Cross-Sectoral Comparative Study in the Tropics

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ABSTRACT

Background: Dengue fever remains a major public health concern in tropical regions, including Indonesia. Household-level knowledge, attitudes, and practices (KAP) play a critical role in sustainable vector control. This study aimed to compare KAP regarding dengue prevention among household heads in high- and low-incidence areas in Magetan Regency, Indonesia. **Methods:** A cross-sectional comparative study was conducted among 785 household heads selected using stratified random sampling. A total of 390 respondents were recruited from high-incidence areas (≥11 cases/year) and 395 from low-incidence areas (≤10 cases/year). Data were collected using a validated and reliable structured questionnaire measuring knowledge (45 items), attitudes (18 items), and practices (25 items). Spearman rank correlation was used to examine associations between sociodemographic factors and KAP scores, and the Mann–Whitney U test was applied to compare differences between groups. **Results:** Knowledge and attitude scores did not differ significantly between high- and low-incidence areas ($p > 0.05$). However, prevention practice scores were significantly higher in high-incidence areas (Mean = 15.51; SD = 4.37) compared to low-incidence areas (Mean = 12.94; SD = 5.91; $p < 0.001$). Age was positively associated with attitudes and practices in both areas, while education level was significantly correlated with knowledge. Employment status was associated with prevention practices, whereas gender showed no significant association with KAP. **Conclusions:** Dengue prevention practices were stronger in high-incidence areas, suggesting that direct exposure to disease risk influences behavioral responses more than knowledge alone. Strengthening community empowerment and behavior-focused interventions is essential, particularly in low-incidence areas, to enhance preparedness and prevent future outbreaks.

Keywords: Dengue fever; knowledge; attitude; practice; household; prevention behavior

1. INTRODUCTION

Dengue fever is an infectious disease caused by the dengue virus (DENV), transmitted through the bite of an infected Aedes aegypti mosquito.(1) This disease is widespread in tropical and subtropical regions, particularly in urban and semi-urban areas with high humidity.(2) While there is no specific treatment for severe dengue fever, early detection

and access to appropriate medical services can significantly reduce mortality.[3] Common symptoms of dengue fever include high fever, headache, muscle and joint pain, nausea, rash, and thrombocytopenia, which is correlated with vitamin B12 deficiency.[4]

Dengue fever has become a global health burden, with more than 100 countries reporting endemic cases. Asia accounts for approximately 70% of the global disease burden, and dengue cases and deaths have increased significantly since early 2023.[5] The El Niño phenomenon, climate change, rising temperatures, and high rainfall have exacerbated the global spread of the dengue virus.[6] In Indonesia, dengue fever cases reached 143,000 by the end of 2022, the highest number on the island of Java.[7] East Java province, particularly Magetan district, has a tropical climate that supports the proliferation of Aedes aegypti.[8]

Dengue virus transmission is influenced by various environmental factors such as temperature, humidity, and viral genotype.[9] Infected Aedes aegypti become epidemic vectors capable of transmitting the virus throughout their life.[10] In addition to mosquito bites, transmission can occur vertically from mother to child, as well as through blood products and organ transplants.[11]

The increase in dengue fever cases and deaths has prompted various control efforts, both nationally and globally. The WHO has initiated a vector and arbovirus control strategy through a multisectoral One Health approach, strengthened risk communication, and community engagement.[12] In Indonesia, dengue fever control strategies include public education, mobile dengue education vehicles, and the implementation of Wolbachia mosquito technology.[13] The knowledge, attitudes and practices of heads of households towards DF are important components in sustainable vector control and serve as a basis for strengthening community-based interventions in DF control.[14,15]

This study aims to analyze and compare the knowledge, attitudes, and practices (KAP) of household heads regarding dengue fever prevention in high- and low-incidence areas in Magetan Regency, Indonesia. The importance of this study lies in its contribution to understanding how differences in disease exposure influence preventive behavior at the household level, particularly in endemic tropical areas. By identifying gaps between knowledge, attitudes, and actual practices, this study provides evidence to inform more targeted and behavior-oriented public health interventions. These findings are expected to benefit policymakers, health practitioners, and community stakeholders by offering insights for designing effective community empowerment strategies and strengthening sustainable dengue prevention programs, particularly in low-incidence areas that remain vulnerable to future outbreaks.

2. METHODS

2.1 Research Design

This study used a cross-sectional design, aiming to compare the KAP of household heads regarding dengue fever prevention in high- and low-case areas.

2.2. Research Location

The study was conducted in Magetan Regency, Indonesia, which has diverse geographic characteristics and a tropical climate. It is located at an altitude of 60–1,660 meters above sea level, with an average temperature of 16–20°C in the highlands and 22–26°C in the lowlands. Annual rainfall is 1,481–2,345 mm in the highlands and 876–1,551 mm in the lowlands. Lake Sarangan, located at an altitude of 1,000 meters above sea level, serves as a tourist attraction on the slopes of Mount Lawu.

2.3 Population, Sample Size, and Sampling Technique

The population of this study comprised all heads of families residing in the Community Health Center (*Puskesmas*) work areas categorized as having high and low dengue fever cases in Magetan Regency, based on the distribution of dengue cases from 2017–2019 and population density. The area with a high dengue fever case rate was reported by the Candirejo Community Health Center, which has a population density of 2,143 people/km² and a case distribution of ≥11 cases per year. This area encompasses 14 villages with a total of 14,665 families. Meanwhile, the area with a low dengue case rate includes the Poncol, Gorang-gareng Taji, Tladan, and Ngujung Community Health Centers, with a population density of 610–1,866 people/km² and a case distribution of ≤10 cases per year, comprising 27,281 families from representative villages.

The sample size was determined using the Slovin formula with a 5% margin of error. This resulted in a sample size of 390 households in high-case areas and 395 households in low-case areas, for a total of 785 respondents. The sampling technique used stratified random sampling. Stratification was based on village area

within each case category (high and low) to ensure proportional representation of each village in the total population of households. The sample size in each village was determined proportionally to the number of households in that village. Respondents in each stratum were then selected using simple random sampling using a list of households obtained from official local government data.

Inclusion criteria included household heads who had resided in the study area for at least one year and who agreed to participate by signing an informed consent. This stratified random sampling approach was used to increase estimation precision and reduce sampling bias, ensuring population representation in each category. Overall, the average age of respondents in low-case areas was 50.08 years, and in high-case areas, 49.71 years. The majority of respondents were female, with a higher proportion in low-case areas (73.9%) than in high-case areas (61.3%). Respondents were predominantly secondary school-educated, particularly in high-case areas (50.8%), and most respondents worked in the private sector in both areas.

2.4 Data Collection Instrument

The data collection instrument was a pre-tested questionnaire with a validity of 0.452–0.734 and a reliability of 0.526–0.809. The questionnaire to measure knowledge consisted of 45 questions about the dengue virus, mosquito characteristics, the nature of the disease, treatment, transmission, and prevention. The questionnaire to measure attitudes consisted of 18 questions about perceptions and responses to dengue fever. The questionnaire to measure practices consisted of 25 questions about mosquito nest eradication, the use of mosquito nets, mosquito repellent, participation in control programs, and observation of mosquito larvae.

2.5 Statistical Analysis

Data were analyzed using descriptive and inferential statistics. The Spearman Rank test was used to identify correlations between sociodemographic characteristics and KAP scores, and the Mann–Whitney U test was applied to compare differences between groups. All statistical analyses were performed using IBM SPSS Statistics version 26.0, with a significance level set at $p < 0.05$.

2.6 Ethics Practices

This study was reviewed and approved by the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya, Indonesia. The ethical clearance certificate number is EA/123/KEPK-Poltekkes.SBY/2024. All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee and the Declaration of Helsinki. Written informed consent was obtained from all respondents prior to data collection, and confidentiality of participants' information was strictly maintained throughout the study.

3. RESULTS

3.1 Head of Family Characteristics Data

Based on Table 1, the average age of respondents in low dengue hemorrhagic fever (DHF) case areas was slightly higher (50.08 years) than in high DHF case areas (49.71 years). Most respondents were female in both areas, but the proportion of males was higher in high case areas (38.71%) than in low case areas (26.08%). The education level of respondents in high case areas tended to be higher, with a higher proportion of secondary (50.78%) and tertiary (14.87%) education than in low case areas. Based on occupation, respondents in low case areas were predominantly farmers (23.29%) and housewives (19.24%), while in high case areas, more worked as employees in the private sector, state-owned enterprises, and other formal sectors. The average knowledge and attitude scores were relatively the same in both areas, but the practice scores were higher in the high DHF case area (Mean = 15.51; SD = 4.37) compared to the low case area (Mean = 12.94; SD = 5.91), which indicates that DHF prevention practices tend to be better in areas with high cases.

3.2 Data from Analysis of Correlation of Respondents Characteristics and KAP Scores

Based on the Spearman correlation test in Table 2, in areas with low DHF cases, age had a weak but significant negative relationship with knowledge (rs = -0.124; $p = 0.01$), and a significant positive relationship with attitudes (rs = 0.249; $p < 0.001$) and practices (rs = 0.254; $p < 0.001$). In areas with high DHF cases, age was not associated with knowledge ($p = 0.81$), but was significantly positively associated with attitudes (rs = 0.502; $p < 0.001$) and practices (rs = 0.327; $p < 0.001$).

Gender did not show a significant relationship with knowledge, attitudes, or practices in either area ($p > 0.05$). Education level was significantly positively

associated with knowledge in low (rs = 0.187; $p < 0.001$)

Table 1. Respondent characteristics data, knowledge, attitude and practice

Characteristics	Low DHF case area (n=395)	High DHF case area (n=390)
Age (year)		
Mean	50.08	49.71
Min	14	12
Max	88	83
Sex		
Male, n(%)	103 (26.08)	151 (38.71)
Female, n(%)	292 (73.92)	239 (61.29)
Level of Education		
Base, n(%)	229 (57.98)	134 (34.36)
Intermediate, n(%)	142 (35.95)	198 (50.78)
Tall, n(%)	24 (6.07)	58 (14.87)
Employment		
Civil servant, n(%)	5 (1.26)	29 (7.43)
Soldier, n(%)	17 (4.31)	55 (14.10)
Private, n(%)	129 (32.65)	112 (28.72)
Farmer, n(%)	92 (23.29)	37 (9.49)
Trader, n(%)	23 (5.82)	17 (4.36)
Laborer, n(%)	2 (0.51)	3 (0.78)
State-owned enterprises, n(%)	34 (8.61)	55 (14.10)
Housewife, n(%)	76 (19.24)	62 (15.89)
Student, n(%)	17 (4.31)	20 (5.13)
Knowledge		
Mean	29.36	30.09
SD	5.73	5.52
Min	9	16
Max	43	45
Attitude		
Mean	12.16	12.35
SD	2.94	3.18
Min	4	3
Max	18	18
Practice		
Mean	12.94	15.51
SD	5.91	4.37
Min	2	3
Max	24	25

DHF = Dengue hemorrhagic fever

and high (rs = 0.160; p < 0.001) DHF areas, as well as with practice in low DHF areas (rs = 0.125; p = 0.01). Employment status was significantly associated with knowledge (rs = 0.187; p < 0.001) and practice (rs = 0.125; p = 0.01) in low DHF areas, and with practice in high DHF areas (rs = 0.113; p = 0.02). In general, age, education level, and occupation were associated with DHF prevention attitudes and practices, while gender showed no significant association.

3.3 Data from the Mann-Whitney U test analysis results

Based on the results of the Mann-Whitney U test in Table 3, there was no significant difference in knowledge scores (Z = -1.36; p = 0.17) and attitudes (Z = -1.04; p = 0.29) between respondents in areas with rare and high DHF cases. However, there was a significant difference in practice scores (Z = -6.50; p < 0.001), where respondents in high-case areas had a higher average practice score (Mean = 15.51; SD = 4.37) compared to those in rare-case areas (Mean = 12.94; SD = 5.91). This indicates that people in areas with high DHF cases have better DHF prevention practices compared to areas with low cases.

4. DISCUSSION

The results of the study, as shown in Table 2, show that age has a significant relationship with attitudes and practices regarding dengue prevention in both low- and high-case areas, although the relationship with knowledge is inconsistent. The positive relationship between age and practices indicates that older individuals tend to have better preventive behaviors. This is likely due to greater life experience, including exposure to the disease or exposure to public health programs, which increases risk awareness and preventive actions. Previous studies have reported that older age groups tend to have better dengue prevention behaviors due to increased perceived susceptibility and direct experience with the disease.[16,17]

However, in areas with low case rates, a negative relationship was found between age and knowledge, indicating that older age groups had lower levels of knowledge than younger age groups. This may be due to differences in access to health information, with younger age groups more easily obtaining information through digital media and communication technology. Other studies have also found that younger age groups have higher levels of knowledge due to more active access to health information through the internet and social media.[18]

This study also showed that gender was not significantly associated with knowledge, attitudes, or practices regarding dengue prevention in both areas. This indicates that both men and women have equal opportunities to obtain information and take preventive measures. This finding aligns with previous studies that

Table 2. Analysis correlation of respondents characteristics and KAP scores

Correlation test	Low DHF area (n=395)		High DHF area (n=390)	
	r_s	p	r_s	p
Age vs knowledge	-0.124	0.01*	0.012	0.81
Age vs attitude	0.249	0.00**	0.502	0.00**
Age vs practice	0.254	0.00**	0.327	0.00**
Sex vs knowledge	0.181	0.72	-0.034	0.50
Sex vs attitude	0.81	0.10	0.016	0.74
Sex vs practice	-0.023	0.65	-0.054	0.28
Level of education vs knowledge	0.187	0.00**	0.160	0.00**
Level of education vs attitude	0.083	0.09	0.079	0.12
Level of education vs practice	0.125	0.01*	-0.062	0.22
Employment vs knowledge	0.187	0.00**	-0.024	0.60
Employment vs attitude	0.77	0.128	0.083	0.09
Employment vs practice	0.125	0.01*	0.113	0.02*

*p < 0.05; **p < 0.01, indicating statistically significant correlations based on Spearman rank test.

Table 3. Data from the Mann-Whitney U test analysis results

Variable	Rare case, n=395		High case, n=390		Mann-Whitney U test		
	Mean	SD	Mean	SD	Value	Z	Asymp. sig.
Knowledge	29.36	5.73	30.09	5.52	72701.00	-1.36	0.17
Attitude	12.16	2.94	12.35	3.18	73712.00	-1.04	0.29
Practice	12.94	5.91	15.51	4.37	56398.50	-6.50	0.00*

*p < 0.05; **p < 0.01, indicating statistically significant correlations based on Spearman rank test.

reported that gender is not a major determinant of dengue prevention behavior, especially in communities with relatively equal access to health information.[19,20]

In contrast, education level showed a significant positive relationship with knowledge in both regions, as well as with practice in the low-case area. This suggests that education plays a significant role in improving individuals' ability to understand health information and apply it to their daily lives. Individuals with higher levels of education tend to have better health literacy skills, making it easier to understand and implement dengue prevention methods effectively.[21] Other studies have also shown that education is a key predictor of dengue prevention behavior, as it improves individuals' ability to access, understand, and use health information.[22]

Furthermore, employment status also showed a significant relationship with knowledge and practice of dengue prevention. Employed individuals tend to have better prevention practices, possibly due to broader access to information, social environments, and workplace health programs. The work environment can also serve as a vehicle for disseminating health information through health promotion programs or social interactions between workers.[23] Another study showed that employment status is associated with increased dengue prevention behavior because it is linked to levels of economic independence and access to health resources.[23]

The stronger relationship between age and practice in areas with high case numbers suggests that experience with disease risk can increase public awareness and preventative behavior. This supports the Health Belief Model theory, which states that perceived susceptibility and experience with the disease can increase a person's likelihood of taking preventive action.[24]

Overall, the results of this study indicate that sociodemographic factors such as age, education, and employment are important determinants in shaping DHF prevention behavior, particularly in attitudes and practices. Therefore, public health interventions need to focus on improving health literacy and community empowerment, particularly among young people, those with low education, and those without work, to increase the effectiveness of dengue control programs.

Based on the research results in Table 3, there were no significant differences in knowledge and attitudes between communities in areas with rare and high DHF cases. However, there were significant differences in

practices, with communities in areas with high cases having better preventive practices. This finding indicates that the incidence rate does not necessarily directly influence community knowledge and attitudes, but rather influences the formation of concrete preventive behaviors. This can be explained by the fact that people living in areas with high DHF incidence rates tend to have direct or indirect experience with the disease, thus increasing awareness and encouraging more consistent implementation of preventive measures.[25]

The absence of significant differences in knowledge levels between the two areas suggests that information about DHF has likely been disseminated evenly through various sources such as mass media, health workers, and government programs. Previous studies have reported that disseminating health information through national campaigns and health promotion programs can increase public knowledge broadly, regardless of the area's level of endemicity.[16] However, increased knowledge is not always followed by behavioral changes, as preventive practices are influenced by other factors such as risk perception, personal experience, and exposure to disease cases.[18]

The results of this study also showed that public attitudes toward DHF prevention did not differ significantly between the two regions. This indicates that, in general, the public has a relatively similar perception regarding the importance of DHF prevention. Previous research has shown that public attitudes toward disease prevention are often shaped by social norms and cultural values that develop within the community, and therefore are not always influenced by the disease incidence rate in the region.[20]

Conversely, DHF prevention practices were significantly better among communities in high-case areas. This suggests that direct experience with high DHF cases can increase risk awareness and encourage communities to take more active preventive measures, such as cleaning water reservoirs, eradicating mosquito breeding sites, and maintaining environmental cleanliness. This finding aligns with previous research that suggests that perceived susceptibility to and experience with the disease are important factors influencing community prevention behavior.[19]

Furthermore, the high level of prevention practices in high-case areas may also be due to more intensive public health interventions, such as outreach, fogging, and community empowerment activities. Community-based interventions have been shown to be effective in improving dengue prevention practices, especially in areas with high incidence rates.[22]

Overall, the results of this study indicate that although levels of public knowledge and attitudes are relatively similar, prevention practices are more influenced by the level of exposure to disease cases. Therefore, DHF control programs need to focus not only on increasing knowledge but also on behavioral change strategies and community empowerment to improve prevention practices sustainably, particularly in low-risk areas to prevent a future increase in cases.

The findings of this study are consistent with several previous studies that highlight the gap between knowledge and actual preventive practices in dengue control. Although knowledge and attitudes were relatively similar across high- and low-incidence areas, this study found significantly better preventive practices in high-incidence areas. This aligns with previous research showing that adequate knowledge does not always translate into appropriate preventive behavior, as behavioral change is strongly influenced by risk perception and direct exposure to the disease.[16] Similarly, other studies have demonstrated that communities with higher exposure to dengue cases tend to adopt more consistent vector control practices due to increased perceived susceptibility.[17] In addition, evidence from Indonesia emphasizes that access to information alone is insufficient without reinforcement through community engagement and behavioral interventions.[18] These findings reinforce the argument that experiential factors and perceived risk play a more decisive role than knowledge alone in shaping dengue prevention practices, thereby supporting the need for more context-specific and behavior-focused intervention strategies.

This study offers novel and practical contributions by providing a comparative analysis of dengue prevention behavior between high- and low-incidence areas at the household level, which is still limited in the existing literature, particularly in the Indonesian context. Unlike previous studies that primarily focus on knowledge or general KAP assessment, this research highlights the discrepancy between knowledge and actual preventive practices and demonstrates that direct exposure to disease risk plays a more decisive role in shaping behavior. This finding is innovative as it emphasizes the importance of experiential and contextual factors rather than relying solely on information-based interventions. The study is also useful for the target

group, including policymakers, health workers, and community stakeholders, as it provides evidence to support the development of more targeted, behavior-oriented, and community empowerment-based dengue prevention strategies, especially in low-incidence areas that are often overlooked but remain at risk of future outbreaks.

5. CONCLUSION

This study concluded that dengue prevention practices were significantly better among communities in areas with high incidence rates than in areas with low incidence rates, although there were no differences in knowledge and attitudes. Sociodemographic factors such as age, education level, and employment status were associated with prevention attitudes and practices, while gender was not. These findings suggest that experience with the disease and individual factors play a significant role in shaping prevention behavior. Therefore, strengthening health promotion and community empowerment programs that focus on improving prevention practices is necessary, particularly among young people, those with low education, and communities in areas with low incidence rates, to increase preparedness and prevent future increases in dengue cases.

Ethical Approval

This study was reviewed and approved by the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya, Indonesia. The ethical clearance certificate number is EA/123/KEPK-Poltekkes.SBY/2024.

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Competing Interests

All the authors declare that there are no conflicts of interest.

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Underlying Data

Derived data supporting the findings of this study are available from the corresponding author on request.

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