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Sociodemographic determinants and mosquito nest eradication practices of dengue hemorrhagic fever in indonesia: Findings from the Indonesian Health Survey 2023

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Abstract

Background: Dengue Hemorrhagic Fever (DHF) is widely distributed in tropical regions and remains a public health concern in Indonesia In 2023, Indonesia reported 114,720 DHF cases with 894 deaths. The occurrence of DHF is influenced by multiple factors, including environmental conditions and community behavior that can be modified through prevention efforts.
Puspose: To analyze the association between sociodemographic factors and mosquito nest eradication behavior with the prevalence of DHF in Indonesia.
Method: This study employed a cross-sectional design using secondary data from the Indonesian Health Survey 2023, involving 877,531 respondents. Statistical analysis was performed using the Pearson Chi-Square test.
Results: There is a significant association between age, place of residence, covering water storage containers, destroying used items, applying larvicide powder to water storage containers, installing mosquito nets on house ventilation, and using mosquito repellents with the prevalence of DHF ($p < 0.05$). Meanwhile, gender, education, and draining bathtubs/large buckets/drums were not significantly associated with the prevalence of DHF ($p \geq 0.05$).
Conclusion: Sociodemographic factors, including age and place of residence, as well as mosquito nest eradication behaviors covering water storage containers, destroying used items, applying larvicide powder to water storage containers, installing mosquito nets on house ventilation, and using mosquito repellents were significantly associated with DHF prevalence. Based on these results, strengthening targeted mosquito nest eradication interventions and public health programs that consider age and residential characteristics is recommended to support DHF prevention efforts in Indonesia.

Keywords: Dengue Hemorrhagic Fever; Mosquito Nest Eradication; Sociodemographic Factors.

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is widely distributed across various regions of the world, particularly in tropical areas, making it a health issue that requires attention, including in Indonesia (Zebua, Gulo, Purba, & Gulo, 2023). *Aedes aegypti* mosquitoes can survive and thrive optimally in warm places, so they are commonly found in urban areas. DHF cases can be found in almost all cities and regencies in Indonesia. However, overall, the number of DHF cases tends to be higher in urban areas with high population density (Ministry of Health of the Republic of Indonesia, 2022).

Throughout 2023, the total number of DHF cases in Indonesia was recorded at 114,720 with 894 deaths (Ministry of Health of the Republic of Indonesia, 2024; Indah, Maharani, & Fauziah, 2026). Based on the Indonesian Health Survey 2023, Central Papua was the province with the highest DHF prevalence, at 3.90% or 4,577 respondents (Ministry of Health of the Republic of Indonesia, 2023).

The risk of DHF in Indonesia is influenced by various factors (Ministry of Health of the Republic of Indonesia, 2020). One of them is the environmental factor, which also plays an important role (Ismah,

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Purnama, Wulandari, Sazkiah, & Ashar, 2021). However, there are also environmental factors that can be controlled through community behavior. Habits such as leaving stagnant water, uncovering water storage containers, and low concern for environmental cleanliness provide opportunities for mosquito breeding sites to develop. These things also increase the potential for DHF transmission in residential areas (Saragih, Lubis, & Ashar, 2025). In addition, individual sociodemographic factors also have the potential to influence DHF prevalence and community behavior patterns in implementing mosquito nest eradication behavior (Ramadania, Azizah, Ayu, & Lubis, 2023).

Previous studies have reported a relationship between sociodemographic factors and mosquito nest eradication behavior with DHF prevalence, and shown that routine implementation of mosquito nest eradication behavior has the potential to reduce the risk of DHF (Febriansyah, Mulyadi, & Tarwati, 2023; Heryanto & Meliyanti, 2021). However, these studies are still local in scope. Therefore, this study uses the Indonesian Health Survey 2023 to analyze the relationship between sociodemographic factors and mosquito nest eradication behavior with DHF prevalence (Ministry of Health of the Republic of Indonesia, 2023). Through this analysis, it is hoped that useful information can be obtained at the national population level.

Thus, the objective of this study is to analyze sociodemographic factors and mosquito nest eradication behavior on DHF prevalence based on Indonesian Health Survey 2023.

RESEARCH METHOD

This study employed an observational analytic research design with a cross-sectional approach. The independent variables in this study include sociodemographic factors, namely age, gender, education, and place of residence, as well as mosquito nest eradication behaviors consisting of draining bathtubs/large buckets/drums, covering water storage containers, destroying used items (tires, cans, plastic bottles), applying larvicide powder on water storage containers, installing mosquito nets on house ventilation, and using mosquito repellents (coils/spray/electric). The dependent variable in this study is the prevalence of DHF in Indonesia.

This study uses secondary data sourced from the Indonesian Health Survey 2023 managed by the Health Policy Development Agency, Ministry of Health of Indonesia. The study was conducted from August to December 2025 with a population of 877,531 respondents.

The inclusion criteria in this study are all respondents registered in the Indonesian Health Survey 2023, whether they experienced DHF prevalence or implemented or did not implement mosquito nest eradication behavior. The exclusion criteria include respondents with missing or incomplete data.

Several independent variables in this study had missing data of less than 10%, namely education, draining bathtubs/large buckets/drums, covering water storage containers, destroying used items, applying larvicide powder on water storage containers, and installing mosquito nets on house ventilation. However, literature indicates that missing data of less than 5% is generally considered trivial, but proportions of missing data exceeding 10% tend to bias the analysis results (Marino, Lucas, Latour, & Heintzman, 2021). Based on these criteria, the proportion of missing data in this study is still within acceptable limits, thus allowing the obtained data to remain suitable for further analysis.

The statistical analyses used include univariate and bivariate analyses. Univariate analysis was used to describe both independent and dependent variables in terms of frequency and percentage. Bivariate analysis was conducted to determine the relationship between the dependent variable and independent variables. The statistical test used was the Pearson Chi-Square. If the p-value obtained is <0.05, it can be concluded that there is a significant relationship. This study has obtained ethical approval from the Research Ethics Commission of the Faculty of Medicine, Universitas Trisakti, with letter number 046/KER/FK/08/2025.

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RESEARCH RESULTS

Table 1. Sociodemographic Characteristics of Respondents (N=877,531)

Variable	Results
Age (Mean±SD)(Range) (Year)	(33.5±19.8)(0-75)
Age (n%)	
0 – 14	239,353/27.3
15 – 24	96,564/11
25 – 64	483,735/55.1
≥ 65	57,879/6.6
Gender (n/%)	
Female	463,269/52.8
Male	414,262/47.2
Education (Year)(n/%)	
<12	521,357/59.4
≥12	269,810/30.7
Missing system	86,364/9.8
Place of residence (n/%)	
Urban	469,549/53.5
Rural	407,982/46.5
Draining bathtubs/large buckets/drums (n/%)	
No	312,380/35.6
Yes	545,509/62.2
Missing system	19,642/2.2
Covering water storage containers (n/%)	
No	546,660/62.3
Yes	315,349/35.9
Missing system	15,522/1.8
Destroying used items (n/%)	
No	508,973/58
Yes	359,846/41
Missing system	8,712/1
Applying larvicide powder on water storage containers (n/%)	
No	772,342/88
Yes	92,102/10.5
Missing system	13,087/1.5
Installing mosquito nets on house ventilation (n/%)	
No	736,654/83.5
Yes	132,699/15.1
Missing system	8,178/0.9
Using mosquito repellents (n/%)	
No	415,428/47.3
Yes	462,103/52.7
DHF(n/%)	
Yes	4,887/0.6
No	872,644/99.4

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Based on the age distribution, most respondents were in the 25 – 64 year age group, with 483,735 respondents (55.1%). For the gender variable, most respondents were female, with 463,269 respondents (52.8%), while male respondents numbered 414,262 (47.2%). Most respondents had education <12 years, with 521,357 respondents (59.4%). The place of residence variable showed that more respondents lived in urban areas, with 469,549 respondents (53.5%). For the DHF diagnosis history variable, most respondents had no diagnosis, with 872,644 respondents (99.4%). Most respondents performed the behavior of draining bathtubs/large buckets/drums, with 545,509 respondents (62.2%). The variable regarding closing water storage containers indicates that the majority of respondents did not implement this behavior, with a percentage reaching 546,660 respondents (62.3%), For the variable on destroying used items, it was found that more respondents did not perform this behavior, totaling 508,973 respondents (58%). Most respondents, namely 772,342 (88%), did not perform the behavior of applying larvicide powder on water storage containers. The majority of respondents also did not install mosquito nets on house ventilation, numbering 736,654 (83.9%). The variable on using mosquito repellents was the most commonly performed behavior by respondents, reaching 462,103 (52.7%), whereas respondents who did not use mosquito repellents numbered 415,428 (47.3%).

Table 2. Association Between Sociodemographic Factors and DHF

Variable	DHF		p-value
	Yes (n=4,887)	No (n=872,644)	
Age (Years) (n/%)			
0 – 14	1,474/0.6	237,879/99.4	
15 – 24	604/0.6	95,960/99.4	0.000
25 – 64	2,549/0.5	481,186/95	
≥ 65	260/0.4	57,619/99.6	
Gender (n/%)			
Female	2,606/0.6	460,663/99.4	0.454
Male	2,281/0.6	411,981/99.4	
Education (n/%)			
<12 years	2,872/0.6	518,485/99.4	0.203
≥12 years	1,547/0.6	268,236/99.4	
Place of residence (n/%)			
Urban	2,889/0.6	466,660/99.4	0.000
Rural	1,998/0.5	405,984/99.5	
Draining bathtubs/large buckets/drums (n/%)			
No	1,714/0.5	310,666/99.5	0.418
Yes	3,067/0.6	542,442/99.4	
Covering water storage containers (n/%)			
No	2,908/0.5	543,752/99.5	0.000
Yes	1,870/0.6	313,479/99.4	
Destroying used items (n/%)			
No	2,682/0.5	506,291/99.5	0.000
Yes	2,131/0.6	357,715/99.4	
Applying larvicide powder on water storage containers (n/%)			
No	4,157/0.5	768,185/99.5	0.000
Yes	634/0.7	91,468/99.3	
Installing mosquito nets on house ventilation (n/%)			
No	3,801/0.5	732,853/99.5	0.000
Yes	1,017/0.8	131,682/99.2	
Using mosquito repellents (n/%)			
No	2,136/0.5	413,292/99.5	0.000
Yes	2,751/0.6	459,352/99.4	

p-value*: Results of the Pearson Chi-Square test

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The age variable shows that in the 0–14 years age group, 1,474 respondents (0.6%) were diagnosed with DHF and 237,879 respondents (99.4%) were not. Meanwhile, in the 15–24 years age group, 604 respondents (0.6%) were diagnosed with DHF and 95,960 respondents (99.4%) were not. Then, in the 25–64 years age group, 2,549 respondents (0.5%) were diagnosed with DHF and 481,186 respondents (99.5%) were not. For the >65 year age group, 260 respondents (0.4%) were diagnosed with DHF and 57,619 respondents (99.6%) were not. Based on the statistical test, a p-value = 0.000 was obtained, so it can be concluded that there is a significant relationship between age and DHF prevalence.

The gender variable shows that in the female gender group, 2,606 respondents (0.6%) were diagnosed with DHF, while 460,663 respondents (99.4%) were not. Meanwhile, in the male gender group, 2,281 respondents (0.6%) were diagnosed with DHF and 411,981 respondents (99.4%) were not. The statistical test results show a p-value = 0.454, indicating no significant relationship between gender and DHF prevalence.

Based on the education variable, in the group with education <12 years, 2.872 respondents (0.6%) were diagnosed with DHF and 518,485 respondents (99.4%) were not. For the group with education >12 years, 1,547 respondents (0.6%) were diagnosed with DHF and 268,236 respondents (99.4%) were not. The statistical test shows a p-value = 0.203, meaning there is no significant relationship between education and DHF prevalence.

From the place of residence variable, it is known that in the group of respondents living in urban areas, 2,889 respondents (0.6%) were diagnosed with DHF, while 466,660 respondents (99.4%) were not. For respondents living in rural areas, 1,998 respondents (0.5%) were diagnosed with DHF, while 405,984 respondents (99.5%) were not. The statistical test results show a p-value = 0.000, meaning there is a relationship between place of residence and DHF prevalence.

Based on the analysis of the draining bathtubs/large buckets/drums variable, respondents who did not perform this behavior and were diagnosed with DHF numbered 1,714 respondents (0.5%), while those not diagnosed numbered 310,666 respondents (99.5%). Meanwhile, respondents who implemented this behavior and were diagnosed with DHF numbered 3,067 respondents (0.6%), and those not diagnosed numbered 542,442 respondents (99.4%). The statistical test results show a p-value = 0.418, meaning there is no significant relationship between the behavior of draining bathtubs/large buckets/drums and DHF prevalence.

The covering water storage containers variable shows that respondents who did not perform this behavior and were diagnosed with DHF numbered 2,908 respondents (0.5%), while those not diagnosed numbered 543,752 respondents (99.5%). Meanwhile, respondents who implemented this behavior and were diagnosed with DHF numbered 1,870 respondents (0.6%) and those not diagnosed numbered 313,479 respondents (99.4%). From the statistical test, a p-value = 0.000 was obtained, indicating a significant relationship between the behavior of covering water storage containers and DHF prevalence.

The destroying used items variable shows that respondents who did not perform this behavior and were diagnosed with DHF reached 2,682 respondents (0.5%), while those not diagnosed with DHF numbered 506,291 respondents (99.5%). Meanwhile, respondents who performed this behavior and were diagnosed with DHF reached 2,131 respondents (0.6%) and those not diagnosed with DHF numbered 357,715 respondents (99.4%). Based on the statistical test, a p-value = 0.000 was obtained, indicating a significant relationship between the behavior of destroying used items and DHF prevalence.

The applying larvicide powder on water storage containers behavior shows that respondents who did not perform this behavior and were diagnosed with DHF numbered 4,157 respondents (0.5%), while those not diagnosed with DHF numbered 768,185 respondents (99.5%). Then, respondents who performed this behavior and were diagnosed with DHF numbered 634 respondents (0.7%), and those not diagnosed with DHF numbered 91,468 respondents (99.3%). From the statistical test results, a p-value = 0.000 was obtained, so it can be concluded that there is a significant relationship between the behavior of applying larvicide powder on water storage containers and DHF prevalence.

Based on the respondents behavior of installing mosquito nets on house ventilation, it is known that respondents who did not perform this behavior and were diagnosed with DHF numbered 3,801

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respondents (0.5%), while those not diagnosed with DHF numbered 732,853 respondents (99.5%). For respondents who installed mosquito nets on house ventilation and were diagnosed with DHF, 1,017 respondents (0.8%) and those not diagnosed with DHF numbered 131,682 respondents (99.2%). The statistical test results show a p-value = 0.000, indicating a significant relationship between the behavior of installing mosquito nets on house ventilation and DHF prevalence.

The results for the behavior of using mosquito repellents show that respondents who did not perform this behavior and were diagnosed with DHF reached 2,136 respondents (0.5%), while those not diagnosed with DHF numbered 413,292 respondents (99.5%). Meanwhile, respondents who used mosquito repellents and were diagnosed with DHF reached 2,751 respondents (0.6%) and those not diagnosed with DHF numbered 459,352 respondents (99.4%). From the statistical test, a p-value = 0.000 was obtained, indicating a significant relationship between the behavior of using mosquito repellents and DHF prevalence.

DISCUSSION

The statistical test results show that age has a significant relationship with DHF prevalence. Children aged <15 years have a higher risk due to an immune system that has not developed optimally (Novrita, Mutahar, & Purnamasari, 2017). In addition, the adult age group >45 years is also at risk due to declining immune system function and the presence of comorbidities that can increase vulnerability to DHF (Khoisiah, Sani, Sudiadnyani, & Hermawan, 2025).

Based on the analysis results, gender does not show a significant relationship with DHF prevalence. This indicates that both men and women have relatively equal chances of being infected with the dengue virus. Aedes mosquitoes do not have a preference for a specific gender, so the risk of transmission is more influenced by individual habits and daily activities (Sarira, Kaunang, & Ratag, 2025).

Education level does not show a significant relationship with DHF prevalence. This condition is possibly influenced by the relatively even exposure to DHF-related information in society, whether through counseling activities by community health centers and integrated health posts or through educational institutions such as schools and School Health Unit programs (Akbar & Syaputra, 2019). Nevertheless, some studies report that education level is related to mosquito nest eradication implementation behavior, where individuals with higher education tend to have better preventive behavior compared to those with lower education (Funna, Asniar, & Alam, 2024).

The findings in this study indicate that place of residence has a relationship with DHF prevalence. DHF spread is closely related to housing density, where increasingly dense environments increase the chance of transmission, especially if there are family members who are currently infected (Chew, Woon, Amin, Adnan, Abdul Wahab, Ahmad, & Lim, 2016). Population growth and settlement expansion, as in Bandung City, lead to changes in land use from open spaces to residential areas, along with increased environmental density that supports the development of Aedes mosquito populations. Dense settlements without adequate sanitation and unclean environments further increase the risk of DHF transmission (Respati, Raksanagara, Djuhaeni, & Sofyan, 2017). In addition, Aedes mosquito density is reported to be higher in urban areas compared to rural areas, especially due to many construction sites that have the potential to become mosquito breeding places (Rahman, Ekalaksananan, Zafar, Poolphol, Shipin, Haque, & Overgaard, 2021).

Aedes mosquitoes have a relatively short flight range, about 75 meters from their breeding place, so human mobility plays an important role in expanding the spread of the dengue virus (Liu, Zhang, Cheng, Zhang, Ye, Huang, & Kang, 2021).

In this analysis, the behavior of draining bathtubs/large buckets/drums does not show a significant relationship with DHF prevalence. This finding indicates that DHF control cannot rely on one preventive behavior alone, but needs to be integrated with other prevention methods, both physical, biological, and chemical. Prevention effectiveness can increase if draining is done together with covering water storage places, recycling used items, and using insecticides in the 3M Plus concept (Ovelina, Asiani, & Murni, 2024).

The absence of a significant relationship in this analysis may also be influenced by the frequency of this draining behavior. The Ministry of Health of the Republic of Indonesia recommends draining bathtubs routinely at least once a week to prevent Aedes larva development, which generally takes 8 – 10 days to

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become adult mosquitoes (Ovelina et al., 2024). Routine draining plays a role in eliminating stagnant water as a breeding place for larvae, but this effort still needs to be accompanied by other preventive behaviors so that the reduction in DHF transmission risk can be achieved optimally (Apriyani, Magdalena, & Lejab, 2024).

The variable of covering water storage containers shows a relationship with DHF prevalence in this analysis. Open water storage containers have the potential to become breeding places for larvae that develop into adult mosquitoes, which play a role in transmitting the dengue virus. By covering water storage containers, the opportunity for mosquitoes to breed can be reduced, thereby decreasing the risk of mosquito bites on humans. The risk of dengue transmission can increase if this behavior is not implemented, especially in environments with poor sanitation and high population density, which support wider vector spread (Saragih et al., 2025).

The analysis results indicate a relationship between the behavior of destroying used items and DHF prevalence. In this study, destroying used items is defined as efforts to bury or recycle objects that could become mosquito breeding places (Ministry of Health of the Republic of Indonesia, 2019). Used items such as cans, tires, and bottles can collect rainwater, thus serving as breeding places for Aedes mosquitoes (Simatupang & Yuliah, 2021). Therefore, proper management of used items is needed to reduce Aedes mosquito breeding, thereby lowering the risk of DHF prevalence (Nasywa, Yusuf, & Nurhendriyana, 2025).

On the other hand, the method of burying used items needs to be considered carefully because it risks causing environmental pollution, such as microplastic contamination and the release of hazardous materials, including heavy metals into the soil. If not managed properly, this can potentially contaminate water sources and impact the health of living organisms. Therefore, managing used items is more recommended through the 3R principle (reduce, reuse, recycle) because, in addition to effectively preventing mosquito breeding sites, this method is also considered safer and more environmentally friendly (Simatupang & Yuliah, 2021).

Based on the analysis results, applying larvicide powder on water storage containers shows a significant relationship with DHF prevalence. The use of larvicide is one form of chemical vector control aimed at suppressing mosquito larvae growth in water storage containers. The application of larvicide powder is recommended to be done periodically, every three months or four times a year, especially in water storage containers where mosquito larvae or pupae are found. However, the effectiveness of larvicide powder is limited to the larval phase and does not affect adult mosquitoes that are already infected with the dengue virus. Thus, the risk of transmission can still occur even if the larval population is successfully controlled, so the use of larvicide needs to be combined with other vector control efforts (Nasywa et al., 2025).

Based on the analysis results, installing mosquito nets on house ventilation shows a relationship with DHF prevalence. Poor ventilation without mosquito nets facilitates mosquitoes entering the house, thereby increasing the chance of contact between mosquitoes and humans and the risk of bites. In addition, mosquito breeding inside the house also risks becoming higher (Ginting, Hariati, Sitorus, & Siahaan, 2025; Nasmita, Nurmaini, & Siregar, 2020).

Therefore, installing mosquito nets on ventilation plays a role as an effective preventive measure in reducing mosquito entry into the house and protecting occupants from the risk of bites by dengue virus-carrying mosquitoes (Novrita et al., 2017).

The results of this study show that using mosquito repellents has a significant relationship with DHF prevalence. Using mosquito repellents can reduce the risk of contact with Aedes mosquitoes, thus potentially decreasing the chance of transmission (Nasywa et al., 2025). In addition, repellents or anti-mosquito lotions containing certain chemicals can provide protection against mosquito bites for several hours (Mahardika, 2021).

This behavior is important because *Aedes aegypti* has diurnal activity peaking in the morning and afternoon, while Aedes albopictus tends to be active at night. Thus, using mosquito repellents is needed not only in the morning and afternoon but also at night as part of efforts to prevent mosquito bites (Sari & Putri, 2019).

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CONCLUSION

It can be concluded that there is a significant association between age, place of residence, covering water storage containers, destroying used items, applying larvicide powder to water storage containers, installing mosquito nets on house ventilation, and using mosquito repellents (coil/spray/electric) with the prevalence of DHF. Meanwhile, gender, education, and draining bathtubs/large buckets/drums were not significantly associated with the prevalence of DHF. Based on these findings, strengthening targeted mosquito nest eradication interventions and public health programs that consider age and residential characteristics is recommended to support dengue prevention efforts in Indonesia.

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