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LYMPHATIC FILARIASIS DRUG TREATMENT POLICIES IN EASTERN INDONESIA: WHAT TARGET CHARACTERISTICS MATTER?

Kebijakan Pengobatan Filariasis di Kawasan Timur Indonesia: Target Karakteristik Apa yang Berpengaruh?

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Abstract

Background: Lymphatic filariasis (LF) drug treatment compliance remains a challenge in Eastern Indonesia.
Aims: The study sought to determine which aspects of Eastern Indonesia's LF drug treatment compliance policies were most pertinent.
Methods: The 2018 Indonesian Basic Health Survey data was employed. The analysis units were adults (≥ 15 years) who had received LF drug treatment. LF drug treatment compliance was analyzed based on respondent characteristics (age, gender, marital status, education, occupation, wealth and comorbidities) using binary logistic regression.
Results: The proportion of adherence to LF treatment in Eastern Indonesia was 73.1%. Respondent characteristics that influenced LF treatment compliance were age group > 24 (AOR = 1.374, 95% CI: 1.305-1.447), female (AOR = 1.307, 95% CI: 1.263-1.353), all educated respondent status (AOR = 2.152, 95% CI: 2.043-2.268), and all employed respondents (AOR = 1.437, 95% CI: 1.365 - 1.512). Married respondents and those with all levels of wealth status were less likely to take LF drug treatment
Conclusion: Policy focus on improving LF treatment compliance among the younger male, the less educated, the unemployed, and those with lower social economic status.

Keywords: compliance, Eastern Indonesia, lymphatic filariasis, public health

Abstrak

Latar Belakang: *Kepatuhan terhadap pengobatan filariasis limfatik (LF) masih menjadi tantangan di wilayah Indonesia Timur.*
Tujuan: *Menganalisis karakteristik yang paling sesuai untuk kebijakan kepatuhan pengobatan LF wilayah Indonesia Timur.*
Metode: *Studi ini memanfaatkan data hasil Survei Kesehatan Dasar Indonesia 2018. Unit analisis adalah orang dewasa (≥ 15 tahun) yang mendapat terapi obat LF setelah didiagnosis. Kepatuhan pengobatan LF dianalisis berdasarkan karakteristik responden (usia, jenis kelamin, perkawinan, pendidikan, pekerjaan, kekayaan, dan penyakit penyerta). menggunakan regresi logistik biner.*
Hasil: *Proporsi kepatuhan terhadap pengobatan LF di wilayah timur Indonesia sebesar 73.1%. Karakteristik responden yang berpengaruh terhadap kepatuhan pengobatan LF adalah kelompok usia > 24 (AOR= 1,374, 95% CI : 1,305-1,447), perempuan (AOR= 1,307, 95% CI : 1,263-1,353), semua status responden yang berpendidikan (AOR=2,152, 95% CI : 2,043-2.268), dan semua responden yang bekerja (AOR=1.437, 95% CI : 1.365 – 1.512). Responden yang menikah dan dari semua tingkat kekayaan memiliki kemungkinan lebih rendah untuk mengkonsumsi obat LF.*
Kesimpulan: *Fokus kebijakan peningkatan kepatuhan pengobatan LF kepada golongan muda, laki-laki, berpendidikan rendah, dan tingkat sosial ekonomi rendah.*

Kata kunci*: filariasis limfatik, Indonesia bagian timur, kepatuhan, kesehatan masyarakat*

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Introduction

The neglected tropical disease lymphatic filariasis (LF) is caused by roundworms of the family Filariodidea carried by such mosquitoes as Aedes, Culex, Mansonia, and Anopheles. LF is not a fatal disease, but it can cause permanent disability (Lourens and Ferrell, 2019; Sungpradit and Sanprasert, 2020). In 2020, there were 72 LF endemic countries, and 863 million individuals in 47 of these countries needed prophylactic chemotherapy to prevent LF. The disease is distributed in tropical and sub-tropical regions such as Africa, the South Pacific Islands, Southeast Asia, Latin America, and the Caribbean (Sungpradit and Sanprasert, 2020). In 2000, the distribution of the highest prevalence of LF in the world was in Southeast Asia, with a 52% prevalence of LF worldwide. It was estimated that the majority of LF cases in 2018 would remain in Southeast Asia, including Indonesia, with the provinces of East Nusa Tenggara and Papua having the highest numbers of LF cases (NIHRD, 2019; Deshpande *et al.*, 2020).

Efforts to prevent LF require the involvement of all sectors and stakeholders, with health promotion and knowledge improvement for the public being essential to LF risk reduction (Maryen, Kusnanto and Indriani, 2018). In addition, to break the chain of transmission, the government implements a mass drug administration (MDA) program in LF endemic areas. The procedure for MDA typically involves the distribution of medications. The use of community drug distributors, known as cadres in Indonesia, who collaborate with village health personnel to deliver LF medications, is one of the main elements of mass treatment programs in Indonesia (Titaley *et al.*, 2018). MDA coverage necessitates the population's willingness to take the drug as prescribed. Several places with limited resources have struggled to sustain MDA coverage over time (Won *et al.*, 2009; Burgert-Brucker et al., 2020). A number of prior studies have found that low MDA compliance for the elimination of LF is one of the variables determining the incidence of re-transmission of LF in locations that have completed MDA (Widjanarko, Saraswati and Ginandjar, 2018; Biritwum *et al.*, 2019; Burgert-Brucker *et al.*, 2020).

Some obstacles to MDA adherence for the elimination of LF are related to individual influences and program implementation (Silumbwe *et al.*, 2017). Individual influences include fear of adverse events (Mathieu *et al.*, 2004; Widiastuti *et al.*, 2021), education level (Kasturiratne *et al.*, 2001), occupation, knowledge (Krentel *et al.*, 2016) and wealth (Gunawardena, Ismail, and Bradley, 2007). One of the impacts of the program is increased participants' exposure to advertisements on the media as well as local drug distributors and health worker visits (Krentel *et al.*, 2016). Indonesia is an archipelago of approximately 260 million inhabitants (World Bank, 2020). The dispersion of the population, the vast distances involved, and the geography of the region are obstacles for the population to receive expeditious treatment (Meireles *et al.*, 2020) and it is also true for Indonesia (Suharmiati, Laksono and Astuti, 2013; Laksono, Rukmini and Wulandari, 2020). Based on the preceding information, this study aimed to identify the most suitable characteristics for LF drug treatment compliance policies in the eastern region of Indonesia. The findings of this research can be considered in the development of appropriate policies regarding targets related to MDA coverage to accelerate the elimination of LF in eastern Indonesia, including whether intensive socialization or involvement of key stakeholders is needed.

Method

Data Source

For this study, secondary data were taken from the 2018 Indonesian Basic Health Survey, carried out by the National Institute of Health Research and Development (NIHRD). Indonesia also conducted a community-based cross-sectional survey in 2018 as part of its Basic Health Survey. This survey's sample structure was derived from the results of the 2018 National Socio-economic Survey, which was carried out by the Central

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(Jurnal Administrasi Kesehatan Indonesia)
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Statistics Agency in March of 2018. The 2018 Indonesian Basic Health Survey targeted 300,000 households from 30,000 census blocks, and the 2018 Indonesian Socio-economic Survey targeted 300,000 families from 30,000 census blocks.

The 2018 Indonesian Basic Health Survey adopted Probability Proportional to Size (PPS), a two-stage systematic linear sampling method. The first stage constituted implicit stratification based on the 2010 Population Census' determination of the welfare strata of each census unit. As many as 180,000 census blocks (or 25%) of the total 720,000 census blocks from the 2010 Population Census were chosen by PPS as the sampling frame from the sample survey. The survey counted census blocks in each urban/rural stratum per regency/city using the PPS method to create a census block sample list, resulting in 30,000 census blocks being surveyed. The second phase used systematic sampling to identify the ten homes in each census block with the highest implicit stratification of education completed by the head of household. Members of randomly chosen households in Indonesia were questioned for the 2018 Basic Health Survey (NIHRD, 2019).

Specifically, 295,720 houses in 34 provinces with 1,091,528 household members were surveyed for the 2018 Indonesia Basic Health Survey. A sample of data from five chosen provinces was studied. We limited our analysis to people aged 15 years and above (n = 790) living in five provinces (Papua (n = 274), West Papua (n = 99), Maluku (n = 177), North Maluku (n = 50), and East Nusa Tenggara (n = 160)) who had been diagnosed with LF and had received LF medication treatment. The sample consisted of 760 respondents selected using multistage cluster sampling.

Variables

The study used compliance with LF drug treatment as an outcome variable. If a household member had taken the LF drug, the variable would have a "Yes" value, indicating that the individual had taken the LF medication after being diagnosed with positive laboratory-confirmed LF within the preceding 24 months by local healthcare professionals/physicians and a "No" value otherwise. LF is typically confirmed in health facilities by microscopic examination of stained blood smears. The interviewer for this study did not conduct any screening tests. The study developed variables according to respondents' self-reported use of LF medications following a laboratory diagnosis of LF within the previous twenty-four months.

In the study, the characteristics of each respondent were used as independent variables. Factors such as age, gender, occupation, degree of education, marital status, wealth and the presence or absence of co-occurring disorders were considered. The last birthday was used to calculate age in the study. Ages 15–24 and older made up the demographics of the respondents, who were categorized as either male or female. There were three distinct occupational groups, namely, the unemployed, farmers and those in other professions. Four tiers of schooling were used, namely, no education, elementary, secondary and tertiary. There were two possible marital statuses, namely, unmarried and married. Finally, the study looked at the most recent diploma to assess education level.

In 2018, the Indonesian Basic Health Survey calculated wealth using a wealth index. A weighted average of a family's total outlays was used to calculate the wealth index (NIHRD, 2019; Sartirano *et al.*, 2023). Polling was conducted using responses on basic household expenditures such as healthcare, food, and housing to calculate the wealth index. The poll segmented the income index into lowest, middle, high, and highest income groups. Control variables, including province and category of residence, were evaluated along with respondent characteristics. There were five provinces investigated in total. Cities and rural areas offered different types of living situations.

Data Analysis

Initially, the investigation used a chi-square test to compare two variables. A collinearity test was also conducted to ensure that the independent variables in the final regression model were not

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interrelated. The final analysis employed binary logistic regression. The survey assessed the multivariate connection between all independent factors and primary healthcare use using the prior test. The statistical analysis used IBM SPSS 26.

Result and Discussion

The analysis results informed that the proportion of lymphatic filariasis drug treatment compliance in eastern Indonesia, which was the study's object of analysis, was 73.1%. Table 1 provides a statistical description of this. According to Table 1, individuals aged above 24 dominated both groups of LF drug therapy compliance. As for the gender-based proportion, females outnumbered males in both groups of LF drug therapy compliance. In terms of marital status, married individuals were dominant in both LF drug therapy compliance groups.

Table 1 indicates that people with secondary education dominated the non-compliance group, while those with primary education did the compliance group. Based on occupation, unemployed individuals were superior in number in both LF drug therapy compliance groups. Regarding wealth status, the richest individuals dominated both groups of LF drug therapy compliance. In terms of comorbidities, those without any comorbidities dominated both LF drug therapy compliance groups. Based on the province, residents of Maluku dominated the non-compliance group, while residents of Papua did the compliance group. Moreover, those living in rural areas surpassed their urban counterparts in number in both groups of LF drug therapy compliance.

Table 2 presents the binary logistic regression results used to analyze the association between characteristics and lymphatic filariasis (LF) drug treatment compliance in Eastern Indonesia. The study used the "lymphatic filariasis drug treatment compliance = No" category as a reference in this analysis.

According to Table 2, individuals over 24 years of age were 1.374 times more likely than those ages 15–24 years to have taken LF drug treatment (AOR 1.374; 95% CI 1.305-1.447), indicating that younger people in Eastern Indonesia were less compliant to the LF drug treatment. Regarding gender, females were 1.307 times more likely than males to have taken LF drug treatment (AOR 1.307; 95% CI 1.263-1.353), indicating that males in Eastern Indonesia were less compliant with LF drug treatment in Eastern Indonesia. In terms of to marital status, married individuals had 0.793 the likelihood of single individuals to have taken LF drug treatment (AOR 0.793; 95% CI 0.757-0.831), indicating that married individuals in Eastern Indonesia were less compliant with the LF drug treatment.

People with education of all levels had more possibility of taking LF drug treatment than non-educated people in Eastern Indonesia. Similarly, working individuals engaged in any profession had a higher probability of taking LF drug treatment than those who were unemployed in Eastern Indonesia. Furthermore, people of all wealth statuses had low likelihood of taking LF drug treatment in Eastern Indonesia. Several factors, such as feeling healthy, fearing side effects, and concerns about safety due to health conditions, can contribute to this issue (Sindhu *et al.*, 2023). One control variable, province, in addition to exposure, was also related to LF drug treatment compliance. People of East Nusa Tenggara was second to Papuans to have the highest likelihood of taking LF drug treatment in Eastern Indonesia.

In the present investigation, a significant majority of participants diagnosed with LF (≥ 70%) said that they adhered to a prescribed regimen of LF medication subsequent to receiving confirmation from a medical professional. The outcome of anti-filarial therapy in individuals with lymphatic filariasis (LF) was found to be correlated with many demographic characteristics, including age, gender, marital status, level of educational attainment, occupation, and socio-economic status.

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Table 1. Descriptive statistics of lymphatic filariasis drug treatment compliance in Eastern Indonesia (n = 760)

Variables	LF Drug Therapy Compliance		p-value
	No (n = 191)	Yes (n = 569)	
Age			*< 0.001
15–24	29.9%	24.4%	
> 24	70.1%	75.6%	
Gender			*< 0.001
Male	48.7%	46.1%	
Female	51.3%	53.9%	
Marital status			*< 0.001
Single	34.8%	31.5%	
Married	65.2%	68.5%	
Education			*< 0.001
No education	16.3%	14.3%	
Primary	34.5%	40.3%	
Secondary	37.3%	31.8%	
Higher	11.8%	13.6%	
Occupation Type			*< 0.001
No work	46.7%	40.1%	
Farmer	26.1%	32.0%	
Non-farmer	27.2%	27.9%	
Wealth Status			*< 0.001
Poorest	14.3%	20.0%	
Tend to be poor	13.6%	16.0%	
Middle	16.6%	16.4%	
Tend to be rich	25.6%	21.7%	
Richest	29.9%	25.9%	
Comorbidities			0.066
No	90.9%	90.5%	
Yes	9.1%	9.5%	
Province			*< 0.001
East Nusa Tenggara	20.2%	24.3%	
Maluku	30.1%	20.3%	
North Maluku	7.5%	3.4%	
West Papua	16.2%	8.7%	
Papua	25.9%	43.2%	
Type of residence			*< 0.001
Urban	42.2%	36.3%	
Rural	57.8%	63.7%	

Note: ∗p < 0.001.

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Table 2. Binary logistic regression results of lymphatic filariasis drug treatment compliance in Eastern Indonesia (n = 760)

Predictors	LF Drug Therapy Compliance			
	p-value	AOR	95% CI	
			Lower Bound	Upper Bound
Age: 15–24	-	-	-	-
Age: > 24	**<0.001	1.374	1.305	1.447
Gender: Male	-	-	-	-
Gender: Female	**<0.001	1.307	1.263	1.353
Marital Status: Single	-	-	-	-
Marital Status: Married	**<0.001	0.793	0.757	0.831
Education: No education	-	-	-	-
Education: Primary	**<0.001	2.152	2.043	2.268
Education: Secondary	**<0.001	1.836	1.737	1.941
Education: Higher	**<0.001	2.120	1.976	2.274
Occupation: No work	-	-	-	-
Occupation: Farmer	**<0.001	1.437	1.365	1.512
Occupation: Non-farmer	**<0.001	1.401	1.337	1.469
Wealth: Poorest	-	-	-	-
Wealth: Tend to be poor	*0.006	0.921	0.869	0.977
Wealth: Middle	**<0.001	0.816	0.771	0.864
Wealth: Tend to be rich	**<0.001	0.689	0.651	0.730
Wealth: Richest	**<0.001	0.571	0.537	0.606
Province: East Nusa Tenggara	-	-	-	-
Province: Maluku	**<0.001	0.655	0.625	0.687
Province: North Maluku	**<0.001	0.377	0.350	0.406
Province: West Papua	**<0.001	0.606	0.572	0.643
Province: Papua	**<0.001	1.839	1.755	1.928
Residence: Urban	-	-	-	-
Residence: Rural	0.927	0.998	0.958	1.040

Note: AOR: Adjusted Odds Ratio; CI: Confidence Interval; *p < 0.010; **p < 0.001.

Age is one of the attributes that is firmly connected with many elements. It additionally has close connections with work, marriage, and reproduction. This study showed that age correlated with LF drug treatment compliance. Older individuals were found to pay more attention to their health and be more compliant with the filarial drug treatment. Additionally, the results also showed that parents of children under five were most likely to be non-adherent due to concerns about treatment side effects (Boyd *et al.*, 2010). Conversely, an earlier Subang study found no correlation between age and anti-filariasis medication compliance (Widawati *et al.*, 2020). In contrast, a study conducted in Pondicherry, South India, found that treatment adherence was significantly poorer among participants aged 61 and older (Nandha *et al.*, 2007).

The current study revealed that males were less compliant with the LF drug treatment than females in Eastern Indonesia. This result is consistent with a study conducted in Pondicherry, southern region of India and Mandalay Region, Myanmar (Nandha *et al.*, 2007; Dickson *et al.*, 2021), but different from a study in Subang and Depok, Western Indonesia, which reported that gender did not have any impact on adherence to anti-filarial medication (Santhi, 2011; Widawati *et al.*, 2020). This discrepancy may be attributed

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to the fact that men in Eastern Indonesia often do more work because they play an essential role in the family economy. Men tend not to take filarial drugs because the MDA side effects can interfere with their daily work. Therefore, outreach to the entire community is essential before implementing the program. Information sharing is one of the keys to successful program implementation (Ikawati *et al.*, 2019). According to this finding, we can develop flexible treatment delivery by exploring options to accommodate the needs and preferences of males in Eastern Indonesia. According to the LF elimination program guidelines, individuals must take filariasis medication under the supervision of health cadres.

The analysis results further indicated that married individuals were less compliant with the LF drug treatment than single individuals in Eastern Indonesia. In other words, unmarried individuals paid more attention to their health and were more compliant with the filarial drug treatment. The potential side effects of the medication might have discouraged married individuals from complying with the filarial drug treatment. They might assume that adverse reactions to therapy, including lightheadedness, nausea and dizziness, could interfere with their daily activities. Different results were reported by the Subang-based study, according to which the percentage of respondents who were unmarried and did not take filarial drugs was higher (37.6%) than that of those who were married (25.1%) or divorced (23.1%). It was also reported that there was no correlation between marital status and medication adherence (Widawati *et al.*, 2020). Similar results were found in previous studies in Nigeria (Ogbonnaya and Okeibunor, 2004) and Myanmar (Koyadun and Bhumiratana, 2005), indicated that there was no statistically significant association between marital status and the behavior of using filariasis drugs. Based on these results, it is necessary to strengthen the awareness among married individuals using a family-centered approach. This may involve promoting open communication within families and encouraging mutual support for health-seeking behaviors.

People with all levels of education had more possibility of taking the LF drug treatment than those non-educated in Eastern Indonesia. According to this study, education demonstrated the potential of affecting community compliance when taking filarial drugs. Studies have shown that education can lead to better knowledge and a better understanding of filariasis, leading to more compliance in taking medications. For instance, a study in Bandung identified the knowledge about diseases and the active involvement of medical professionals were among the catalysts for expanding the scope of filarial drugs (Ipa *et al.*, 2016). A schistosomiasis study conducted in the Philippines demonstrated mass drug administration compliance. The study noted that respondents who knew the disease and how the disease was transmitted were more obedient to taking the drug than those who did not (Inobaya *et al.*, 2018). Numerous studies have also reported that understanding the causes of lymphatic filariasis and how to prevent the illness could affect community compliance (Krentel, Fischer and Weil, 2013; Kouassi *et al.*, 2018). A study in Sri Lanka found that the failure to take the drug was due to the lack of information on taking filarial drugs (Gunawardena *et al.*, 2007). Meanwhile, a study in Ambon showed no relationship between education and filariasis drug-taking behaviour (Kerjapy, Titaley and Sanaky, 2019).

The current study's results further indicated that the unemployed were less compliant with the LF drug treatment than working individuals, regardless of their type of occupation. Employed individuals tend to exhibit a heightened level of concern for their well-being and possess a heightened awareness of their physical condition. This is mostly due to the recognition that maintaining good health is a crucial determinant of achieving success in the workplace. This study showed that working individuals of any occupation type were more likely to comply with medication than those who were not working. LF can lead to lifelong disability through the enlargement

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10.20473/jaki.v12i1.2024.108-119

of the legs, arms, and genitals. Another finding elsewhere also showed that working individuals were more compliant in taking the filarial drug (Purwantyastuti, 2010; Agustini and Indrawati, 2018; Sari, Ginandjar and Saraswati, 2020). Different results were reported by previous studies in South Sumatra, Ambon, and Subang, Indonesia, that there was no link between occupation and filariasis drug-taking behavior (Oktarina, 2010; Kerjapy, Titaley and Sanaky, 2019).

People of the poorest wealth status were the most likely to take LF drug treatment in Eastern Indonesia, showing that they had better lymphatic filariasis drug treatment compliance than people of other wealth statuses. This is most likely related to the large number of LF cases in regions with low socio-economic conditions, resulting in a poor environment that encourages mosquito vector breeding. Studies showed that 94% of endemic LF cases took place in areas with a low human development index (Durrheim *et al.*, 2004).

Moreover, people living in Papua had the highest likelihood of taking the LF drug treatment in Eastern Indonesia (Indonesia Ministry of Health, 2020). The policy of reducing LF cases in endemic areas through the implementation of MDA annually for five years or more for all eligible populations, until the adult worms die or stop producing microfilariae, may have caused LF drug compliance in Papua Province to be better than other provinces. This is in line with a Pekalongan-based study, which states that LF drug compliance is higher in LF endemic areas (Widjanarko, Saraswati and Ginandjar, 2018).

Only variables from the 2018 Indonesian Basic Health Survey were included in the analysis. The analysis results could not explain a number of other variables known to influence LF drug treatment compliance mentioned in previous studies: knowledge of lymphatic filariasis, the procedure of MDA, and adverse drug reactions (Manyeh *et al.*, 2020, 2021). Quantitative methodological studies failed to comprehensively explain the lasting impacts of cultural elements as identified in previous studies. Several previous studies, including those on stigma and self-esteem, produced relevant findings (Kulkarni *et al.*, 2020; Taylor *et al.*, 2022).

Conclusion

The study found that factors like age, gender, marital status, occupation, level of education and income were associated to LF drug treatment plans in Eastern Indonesia. Younger males and those with lower socio-economic status and less education or employment stability were the primary focus of programs designed to improve LF drug treatment compliance.

Compliance of LF treatment can be improved through health promotion programs with specific targets, and involvement of all community components including families, community leaders, peers, and local leaders. In addition, flexible drug distribution options can be implemented based on regional characteristics and the integration of LF treatment services with existing programs.

It is critical to acknowledge the limitations of this study: The data was gathered through self-reporting, which may cause response bias and alter the accuracy of the results. The study's cross-sectional design limited our ability to demonstrate causal links between the identified characteristics and treatment compliance. Furthermore, the study was conducted in a specific geographic region; therefore, the results may cannot be applied to other people or contexts. Despite these limitations, the results provide valuable insights into the determinants of adherence to LF medication in eastern Indonesia and highlight the importance of targeted interventions to address the barriers faced by susceptible groups.

Abbreviations

AOR: adjusted odds ratio; CI: confidence interval; LF: lymphatic filariasis; MDA: mass drugs administration; NIHRD: National Institute of Health Research and Development.

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Declarations

Ethics Approval and Participant Consent
The 2018 Indonesian Basic Health Survey is authorized by the National Ethics Committee. All survey respondents' names were erased from the database.

Conflict of Interest
The authors have stated that they have no conflict of interest to disclose.

Availability of Data and Materials
NIHRD provides access to a wide range of data and resources for conducting research and analysis. A third party prohibits the writers from disclosing the data.

Authors' Contribution
Study concept development: MI, LH and ADL. Methods: MI, ADL, APK and TW. Formal analysis: MI and RM. Validation: ADL, MI and APK. Data visualization: ADL, TW and RM. Writing (first draft): MI and LH. The entirety of the authors made contributions to the composition, review and editing of the manuscript.

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