RESEARCH ARTICLE

Awareness of leprosy in East Seram District community: A cross-sectional study from Maluku Province, Indonesia

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A B S T R A C T

Background and Aim: Leprosy, caused by *Mycobacterium leprae*, remains a significant public health challenge in Indonesia, especially in provinces like Maluku where elimination targets have not been met. Low community awareness and stigma surrounding the disease contribute to delayed diagnosis and hinder effective control efforts. This study assessed the level of awareness about leprosy and its associated factors among residents of East Seram District, Maluku Province.

Materials and Methods: A cross-sectional household health survey was conducted between September and December 2023, covering 253 respondents aged 18–65 years residing on the mainland of East Seram Island. Data were collected using structured interviews adapted from validated health surveys. The main outcome variable was awareness of leprosy, measured through knowledge-based questions. Respondents were categorized as having high awareness if their score exceeded 76%. Logistic regression analyses were employed to identify factors associated with high awareness.

Results: Only 10.3% of respondents demonstrated a high level of awareness about leprosy. Higher odds of awareness were significantly associated with university education (odds ratio [OR] = 57.86; 95% confidence interval [CI]: 5.75–582.24; p = 0.001), being unmarried (OR = 6.33; 95% CI: 1.56–25.71; p = 0.010), and previous contact with health workers (OR = 6.38; 95% CI: 1.04–39.00; p = 0.045). Respondents with lower educational attainment, those who were married, and those who had never accessed health services were more likely to have low awareness levels.

Conclusion: Community awareness of leprosy in East Seram District is alarmingly low. Targeted health education campaigns are imperative, especially among populations with limited formal education, those who are married, and those without prior exposure to healthcare services. Expanding health promotion efforts through community-based strategies and improving access to health workers are essential for enhancing awareness and advancing leprosy control initiatives in Maluku Province.

Keywords: awareness, cross-sectional study, health education, Indonesia, leprosy, Maluku, stigma.

INTRODUCTION

Leprosy is a chronic skin infection caused by *Mycobacterium leprae*, which invades the mucosal tissues of the skin and peripheral nerves, leading to a loss of skin sensation with or without visible dermatological lesions [1]. The primary clinical manifestations of leprosy include loss of skin sensation, visible hypopigmented patches, hyperpigmented anesthetic lesions, and hypoesthetic skin lesions. These cutaneous lesions most frequently appear on the face, arms, and legs, while the buttocks are the least affected.

Neurological symptoms are characterized by nerve tenderness and enlargement, with the ulnar nerve being the most commonly involved [2]. If left untreated, the disease progressively impairs an individual's functional abilities. In addition to nerve damage, leprosy can also affect other organs due to its impact on the peripheral nervous system [3, 4].

The World Health Organization (WHO) categorizes leprosy as a neglected tropical disease, with more than 200,000 new cases reported annually across 127 countries [1]. The WHO South-East Asia Region accounts

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for 71% of the global burden, with India (120,334 cases) and Indonesia (17,017 cases) contributing 92% of the regional total. Collectively, Brazil, India, and Indonesia accounted for 79.6% of all newly detected cases worldwide [5]. In 2020, each of these countries reported over 10,000 new cases, representing 78.1% of global new case detections [1]. According to the Indonesian Ministry of Health, the country continued to make progress toward the national-level elimination of leprosy, with a prevalence rate of 0.45/10,000 population in 2021 [6]. By 2023, Indonesia had recorded 12,230 registered cases [7]. However, six provinces – North Sulawesi, Gorontalo, Maluku, North Maluku, Papua, and West Papua – had not yet achieved elimination. In Maluku Province, the prevalence of leprosy in 2022 was 2.68/10,000 population, totaling 484 cases, including 23 cases reported in East Seram District [8].

The high prevalence of leprosy is a major public health concern, as it is an infectious disease with the potential to cause not only medical complications but also social, economic, and cultural challenges. Leprosy continues to be stigmatized by both the general public and health workers [9], often due to limited knowledge and awareness about the disease [10]. Studies by Salamung *et al.* [11] and Nafi'a *et al.* [12] in various provinces of Indonesia have consistently reported low levels of awareness regarding leprosy. For instance, research in Central Sulawesi Province in 2023 indicated that 81.4% of respondents exhibited poor awareness [11], while a 2024 study in East Java found that only 34% had adequate knowledge of the disease [12]. Another 2024 investigation linked poor public understanding of leprosy to lower educational attainment. Many individuals perceive leprosy as a common ailment, leading to refusal of treatment and neglect of personal hygiene, which further contributes to the spread of the disease [13].

Despite ongoing national efforts to eliminate leprosy in Indonesia, the disease continues to pose significant public health challenges, particularly in geographically isolated regions such as Maluku Province. While national and provincial surveillance data provide insights into case counts and prevalence rates, there remains a paucity of empirical research on the community's awareness of leprosy in these high-burden areas. Previous studies conducted in other provinces have documented low levels of public knowledge and stigma related to leprosy; however, few have specifically investigated the determinants of awareness in remote and island communities. In addition, limited information is available regarding how sociodemographic factors and interactions with health systems influence awareness levels in archipelagic regions like East Seram District. This lack of localized evidence hinders the development of contextually appropriate and targeted health promotion interventions.

This study aims to assess the level of community awareness regarding leprosy and identify sociodemographic and health service-related factors associated with higher awareness among residents of East Seram District, Maluku Province, Indonesia. By analyzing data from a household survey conducted in 2023, this study seeks to generate context-specific evidence that can inform the design of more effective public health strategies and educational interventions to support leprosy control and elimination efforts in remote island regions.

MATERIALS AND METHODS

Ethical approval for this study was granted by the Ethics Committee of the Faculty of Medicine, Pattimura University, Ambon (Approval No. 143/FK-KOM.ETIK/VIII/2023, dated 3 October 2023). Before data collection, the research team obtained permission from the relevant local administrative authority.

Study period and location

This study utilized data from a cross-sectional household health survey conducted in East Seram District by the Faculty of Medicine, Pattimura University, between September and December 2023. East Seram District comprises three main regions: East Seram Island, the Gorom Islands, and the Wakate Islands (Figure 1). The district is a maritime region encompassing 14,877.771 km^2 of sea area and 5,779.123 km^2 of land, divided into 15 sub-districts and 50 islands. It is bordered by the Seram Sea, the Banda Sea, Central Maluku Regency, and the Arafura Sea. As of the second semester of 2023, the population of East Seram Regency was 138,580, with the majority engaged in agriculture, manufacturing, and services [14].

Sampling design, population, and sample

A modified version of the Expanded Program on Immunization Coverage Survey design (WHO, 2008) was employed, using a 30 × 15 cluster sampling method. Unlike the standard 30 × 7 design, this approach increased the number of respondents per cluster to 15 to enhance the representativeness of community awareness. This modification also accounted for the difficulties in accessing remote regions beyond Seram Island. Based on a design effect of two, the targeted sample size was 420 respondents.

Villages and the number of hamlets within them were selected using probability proportional to size (Figure 2). Within each selected hamlet, households were identified through a systematic process: an initial direction was determined, house locations were mapped, and the first house was selected randomly. Subsequent households were chosen based on proximity, with the next house being the one whose front door was closest to the previous one. This process continued until 15 households were surveyed in each hamlet. From each household, one eligible respondent

Figure 1: East Seram District of Maluku Province, Indonesia [Source: https://sipulau.big.go.id/map].
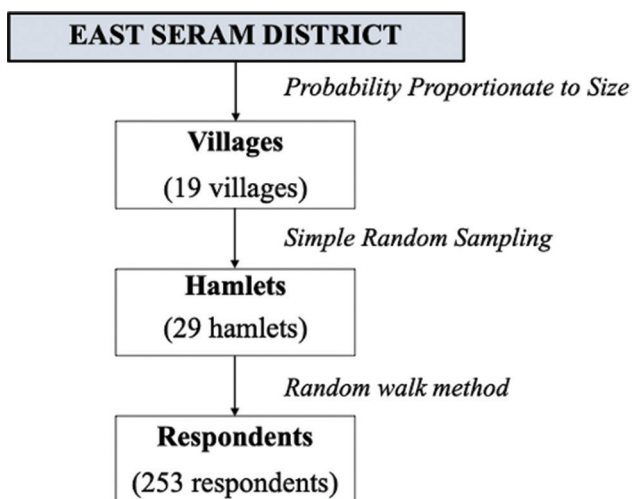

Figure 2: Sampling process.

(aged 18–65 years and willing to participate) was randomly selected. If multiple eligible individuals were present, only one was chosen at random.

Due to unfavorable sea conditions during data collection, areas outside Seram Island were inaccessible. As a result, data were collected from 253 respondents residing in 17 clusters on the Seram Island mainland.

Data collection team

Twelve teams conducted the data collection, each composed of five members. Each team included one physician, responsible for conducting physical examinations, blood tests (cholesterol, blood sugar, and uric acid), and anthropometric assessments, and four trained enumerators who were medical students from Pattimura University. Data collection was completed in approximately 1 week.

Before fieldwork, all team members underwent training on sampling procedures, questionnaire administration, and interview techniques, provided by the research team at the Faculty of Medicine, Pattimura University. Each team collected data from one cluster per day. Interviews were conducted face-to-face in the

Indonesian language. A data manager oversaw the daily inflow of data to ensure accuracy and completeness.

Instruments

The survey instrument was adapted from several standardized household survey tools, including the Basic Health Research (RISKESDAS) [15], the Indonesia Demographic and Health Survey [16], and other previously validated studies by Tesema and Beriso [17] and Gunawan *et al.* [18]. The instrument was pre-tested to ensure clarity and appropriateness for data collection.

The questionnaire included items to assess various risk factors associated with leprosy awareness, such as prior contact with health workers, food security, and household wealth. The enumerators collected data digitally using the Android-based CommCare application, (Dimagi Inc., USA).

Dependent variable

The primary outcome variable was the level of awareness about leprosy, defined as the extent to which individuals understand key features of the disease. Awareness was assessed using questions covering signs, symptoms, transmission, effects, treatment, prognosis, and complications of leprosy. Each correct answer was awarded one point, while incorrect responses scored zero. A composite score was computed for each respondent. Individuals scoring above 76% were classified as having high awareness, while those scoring 76% or below were considered to have low awareness [19].

Independent variables

Independent variables were grouped into three categories: Individual characteristics, household characteristics, and exposure to healthcare providers (categorized as never vs. ever visited a provider). Individual variables included (1) age (<31 years, 31–60 years, >60 years); (2) gender (male/female); (3) marital status (married/divorced or unmarried); (4) educational attainment (no schooling, primary, secondary, college/university); (5) employment status (not working/formal/informal); and (6) household income (below, at or above the regional minimum wage of Indonesian Rupiah [IDR] 2,812,827 [20], or not reported). Household variables included wealth index (poor/middle/rich) and food security status (food secure, food insecure without hunger, food insecure with hunger). The wealth index was constructed from household assets such as ownership of bicycles, motorcycles, televisions, refrigerators, latrines, fuel type, drinking water source, and housing materials. Food security was measured using the U.S. Household Food Security/Hunger Survey Module [21, 22].

Statistical analysis

Univariate analyses were conducted to describe the distribution of each variable, presented as frequencies (n) and percentages (%). Bivariate analyses were performed using contingency tables to assess

the relationship between variables and cholesterol levels. Logistic regression was conducted to calculate odds ratios (OR) for associations without adjusting for confounders. Subsequently, multivariate logistic regression was applied to determine the adjusted OR, controlling for all other variables, using a significance level set at 0.05. Only variables with a p-value < 0.25 in the bivariate logistic regression analysis were included in the multivariate model. All analyses were conducted using the Statistical Package for the Social Sciences version 24 (IBM Corp., NY, USA).

RESULTS

The results indicated that among the 253 respondents included in the study, 227 (89.7%) demonstrated a low level of awareness about leprosy (Figure 3). The highest proportion of incorrect responses (94.5%) pertained to the mode of leprosy transmission. In contrast, the highest rates of correct responses were observed for questions regarding prior awareness of leprosy (31.6%) and knowledge of where patients could seek treatment (26.5%) (Figure 4).

The frequency distribution of respondent characteristics is presented in Table 1. The majority of respondents were female (61.3%) and reported household incomes below the regional minimum wage of IDR 2,812,827 (60.5%). Approximately 43.9% of respondents had no formal education or had not completed primary schooling, and 49% were unemployed. Notably, over 23% of respondents had never visited a healthcare provider. Higher levels of leprosy awareness were more commonly observed among male respondents, those who were unmarried, formally employed, university-educated, earning equal to or above the regional minimum wage, and those residing in food-secure households.

Table 2 summarizes the factors significantly associated with high awareness of leprosy. Respondents

with a college or university education had significantly greater odds of high awareness compared to those with no education or only primary schooling (OR = 57.86; 95% confidence interval [CI]: 5.75–582.24; p = 0.001). Similarly, unmarried individuals exhibited higher odds of awareness compared to their married counterparts (OR = 6.33; 95% CI: 1.56–25.71; p = 0.010). Moreover, individuals who had previously visited a healthcare provider were significantly more likely to have high awareness of leprosy (OR = 6.38; 95% CI: 1.04–39.00; p = 0.045).

DISCUSSION

Our analysis revealed that a relatively small proportion of the population in East Seram District

Table 1: Frequency distribution of all respondents (n = 253) based on the analyzed variables.

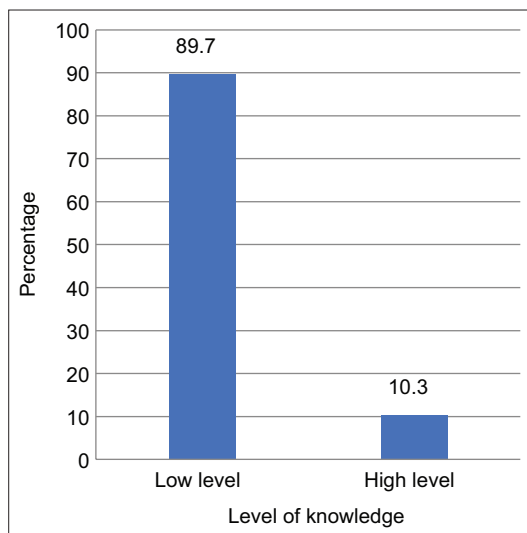| Variables	n	%	Awareness of leprosy			
			High		Low	
			n	%	n	%
Individual characteristics						
Gender						
Male	98	38.7	12	12.2	86	87.8
Female	155	61.3	14	9.0	141	91.0
Age						
<30 years	42	16.6	6	14.3	36	85.7
31–60 years	181	71.5	18	9.9	163	90.1
>60 years	30	11.9	2	6.7	28	93.3
Marital status						
Married/divorced	234	92.5	17	7.3	217	92.7
Not married	19	7.5	9	47.4	10	52.6
Highest educational attainment						
Not in school/not graduated from elementary school/not graduated from elementary school	111	43.9	1	0.9	110	99.1
Junior high school	36	14.2	2	5.6	34	94.4
High school	59	23.3	5	8.5	54	91.5
University	47	18.6	18	38.3	29	61.7
Occupation						
Not working	125	49.4	5	4.0	120	96.0
Formal employment	28	11.1	7	25.0	21	75.0
Informal employment	100	39.5	14	14.0	86	86.0
Household income						
Less than minimum monthly wage	153	60.5	13	8.5	140	91.5
No mention	44	17.4	1	2.3	43	97.7
More than the minimum monthly wage	56	22.1	12	21.4	44	78.6
Household characteristics						
Household wealth index						
Poor	103	40.7	4	3.9	99	96.1
Middle	49	19.4	7	14.3	42	85.7
Rich	101	39.9	15	14.9	86	85.1
Food security						
Food secured	142	56.1	17	12	125	88.0
Food insecurity without hunger	72	28.5	7	9.7	65	90.3
Food insecurity due to hunger	39	15.4	2	5.1	37	94.9
Visit to a healthcare provider						
Never	59	23.3	3	5.1	56	94.9
Ever	194	76.7	23	11.9	171	88.1

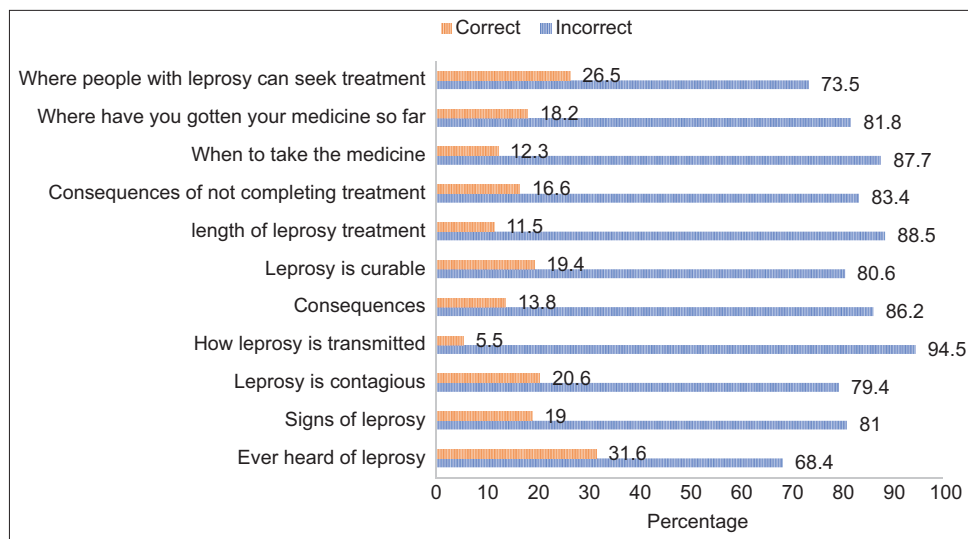**Figure 3:** Distribution of respondents' level of awareness about leprosy (n = 253).

Figure 4: Distribution of research questionnaire answers (n = 253).

Table 2: Factors associated with high awareness of leprosy in East Seram District, Maluku Province, Indonesia, 2023.

Variables	Bivariate				Multivariate			
	OR	95% CI		p-value	OR	95% CI		p-value
Individual characteristics								
Gender								
Male	1.00				**			
Female	0.71	0.31	1.61	0.414	**	**	**	**
Age								
<30 years	1.00				**			
31–60 years	0.66	0.24	1.78	0.416	**	**	**	**
>60 years	0.42	0.08	2.28	0.321	**	**	**	**
Marital status								
Married/divorced	1.00				1.00			
Not married	11.48	4.11	32.08	0.000	6.33	1.56	25.71	0.010
Highest education attainment								
Not in school/not graduated from elementary school/not graduated from elementary school	1.00				1.00			
Junior high school	6.47	0.56	73.57	0.132	6.82	0.55	84.04	0.134
High school	10.18	1.16	89.34	0.036	7.10	0.68	74.17	0.101
University	68.27	8.74	532.91	<0.001	57.86	5.75	582.24	0.001
Occupation								
Not working	1.00				1.00			
Formal employment	8.00	2.32	27.58	0.001	1.44	0.30	6.93	0.643
Informal employment	3.90	1.35	11.25	0.012	2.76	0.71	10.65	0.140
Household income								
Less than minimum monthly wage	1.00				1.00			
No mention	0.25	0.03	1.97	0.188	0.26	0.20	3.63	0.322
More than the minimum monthly wage	2.93	1.25	6.90	0.013	0.92	0.22	3.74	0.908
Household characteristics								
Household wealth index								
Poor	1.00				1.00			
Middle	4.12	1.14	14.84	0.030	1.21	0.45	10.78	0.326
Rich	4.31	1.38	13.50	0.012	0.85	0.24	2.98	0.812
Food security								
Food secured	1.00				1.00			
Food insecurity without hunger	0.79	0.31	2.00	0.623	1.63	0.51	5.21	0.403
Food insecurity due to hunger	0.39	0.08	1.80	0.231	0.48	0.15	1.56	0.228
Visit to a healthcare provider								
Never	1.00				1.00			
Ever	2.51	0.72	8.67	0.146	6.38	1.04	39.00	0.045

OR=Odds ratio, CI=Confidence interval, ** = These variables were not included in the multivariate models because their p-values in the bivariate analysis exceeded 0.25

exhibited a high level of awareness about leprosy. Respondents who had attained a university education were unmarried, and had previously interacted with healthcare providers were more likely to possess a greater awareness of the disease. These findings have important implications for policymakers and program managers in developing targeted interventions aimed at improving community knowledge and understanding of leprosy. Enhancing public awareness is essential to bolstering leprosy control initiatives both in East Seram District and throughout Maluku Province.

Formal education and level of awareness about leprosy

Our findings emphasize the pivotal role of formal education in increasing knowledge and awareness of health-related conditions, including leprosy. Respondents with a college or university education were significantly more likely to have higher awareness levels than those with no formal education or only incomplete primary schooling. This observation aligns with previous research by Damayanti and Sofyan [23], which highlighted a strong association between educational attainment and disease-related knowledge. A study conducted in Nigeria [24] similarly found that individuals with higher education levels were more inclined to adopt health-promoting behaviors and demonstrated a better capacity to comprehend and apply health information. Such individuals were also more likely to recognize the broader public health impact of their actions.

Research from Eastern Ethiopia [25] further supports these findings, indicating that individuals with higher education levels were more knowledgeable about the transmission, symptoms, and treatment of leprosy. Another study among individuals affected by leprosy found that those with at least a secondary education were more likely to monitor their family members for signs of the disease compared to those without formal education [26]. These results suggest that formal education not only improves individual awareness but also fosters critical thinking and informed decision-making, both of which are crucial for the effective implementation of public health programs.

Marital status and level of awareness about leprosy

Marital status also emerged as a significant predictor of leprosy awareness. Unmarried individuals demonstrated a higher level of knowledge and understanding of leprosy compared to those who were married or divorced. This association may partly be attributed to age, as younger individuals generally have greater access to information and tend to be more engaged with health-related content. Prior studies have shown that younger populations are more capable of seeking and processing health information than older individuals, who may face age-related barriers such as declining vision or cognitive capacity [27].

Furthermore, younger and unmarried individuals are often more involved in educational and social activities, which enhance their cognitive abilities and exposure to health information [28]. Lim *et al.* [29] have also indicated that this demographic is more likely to utilize digital platforms and social networks where health information is widely disseminated [29]. A qualitative study involving married individuals affected by leprosy revealed that some chose to conceal their condition due to fear of abandonment by their spouses, which may further suppress awareness and facilitate disease transmission [30]. These insights highlight the need for targeted health education efforts that address different age and marital groups to promote comprehensive and inclusive dissemination of leprosy-related knowledge.

Exposure to the health system and awareness of leprosy

Respondents who had engaged with healthcare providers exhibited a greater understanding of leprosy compared to those who had never accessed such services. This finding underscores the critical role of healthcare exposure in improving disease awareness. A similar relationship was observed in a study from Indonesia, where individuals utilizing services at comm-unity health centers demonstrated higher levels of awareness [31]. Dasappa *et al.* [32] reported that communities with prior contact with primary health facilities showed greater general health awareness.

However, research from India revealed that most individuals received information about leprosy through informal channels such as family and friends, rather than from healthcare professionals [33]. This underscores the need to strengthen health promotion initiatives led by healthcare workers. Misconceptions about leprosy – such as beliefs that it is a curse or an incurable condition – persist and contribute to stigma and psychological distress [34]. Stigma, discrimination, and prejudice continue to be significant barriers to leprosy elimination [35].

Therefore, health education efforts should extend beyond individuals diagnosed with leprosy to include their families, local communities, and stakeholders. Educational campaigns should focus on accurate information regarding transmission, treatment adherence, and the consequences of delayed or incomplete treatment. A study conducted in Ambon demonstrated that utilizing diverse communication strategies – such as posters, leaflets, counseling, and social media – can significantly enhance public awareness [36]. Sustained community engagement and increased interaction with healthcare professionals are essential for fostering informed health decisions and improving outcomes.

These strategies are integral to reinforcing leprosy control programs in East Seram District and the wider Maluku Province.

CONCLUSION

This study highlights a critically low level of awareness about leprosy among the adult population in East Seram District, Maluku Province, with only 10.3% of respondents demonstrating a high level of knowledge regarding the disease. The analysis revealed that individuals with university-level education, those who were unmarried, and those who had previously interacted with healthcare providers were significantly more likely to possess higher awareness. Specifically, the odds of high awareness were markedly elevated among university-educated respondents (OR = 57.86; 95% CI: 5.75–582.24), unmarried individuals (OR = 6.33; 95% CI: 1.56–25.71), and those who had visited health workers (OR = 6.38; 95% CI: 1.04–39.00). These findings underscore the urgent need for targeted, context-specific health promotion strategies that address sociodemographic disparities in awareness and access to healthcare.

A major strength of this study is its use of a modified and statistically robust cluster sampling design (30 × 15), which enhanced the representativeness of the sample while accommodating the logistical challenges posed by the region's archipelagic geography. The inclusion of a diverse set of individual, household, and health service exposure variables also permitted a comprehensive analysis of the determinants of leprosy awareness.

Nevertheless, several limitations should be acknowledged. First, due to unfavorable sea conditions during data collection, respondents from the smaller outlying islands within East Seram District could not be included, potentially limiting the generalizability of findings to all sub-regions. Second, the cross-sectional nature of the study precludes causal inferences regarding the relationships between predictor variables and awareness outcomes. Third, because the data were derived from a general health survey rather than a disease-specific instrument, variables such as prior contact with leprosy patients or history of stigma experiences were not captured.

Despite these limitations, this study provides critical baseline evidence on the awareness landscape of leprosy in a remote and underserved setting. Future research should aim to include island communities not covered in this study and consider longitudinal designs to examine changes in awareness over time following public health interventions. Furthermore, incorporating qualitative approaches could enrich the understanding of the sociocultural barriers to leprosy knowledge and care-seeking behavior. Programmatically, there is a clear imperative for the government and health institutions to develop and deploy multifaceted health promotion strategies – leveraging schools, digital media, community health workers, and local leaders – to improve knowledge, reduce stigma, and ultimately support the national goal of leprosy elimination.

AUTHORS' CONTRIBUTIONS

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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