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Community Perceptions of Forest-Based Ecosystem Services in Protected Forests under the Social Forestry Program in Kulon Progo

Persepsi Masyarakat terhadap Jasa Lingkungan Berbasis Ekosistem Hutan pada Hutan Lindung dalam Skema Perhutanan Sosial di Kulon Progo

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ABSTRACT

Social forestry programs offered a substantial opportunity to enhance local livelihoods and foster sustainable forest governance. However, empirical insights into the specific forest-based ecosystem services (FbES) most valued by adjacent communities remained limited. Therefore, this research aimed to investigate community perceptions of FbES across three social forestry groups located within protected areas in Kulon Progo, Indonesia. Based on 306 completed survey responses, perceptions across three FbES categories, including provisioning, regulating, supporting, and cultural services, were assessed. The results showed distinct patterns in service valuation, with provisioning services consistently rated as the lowest. This outcome might have reflected the restrictive regulatory environment in protected forests, which limited extractive use and shaped community interactions with forest resources. In contrast, regulating, supporting, and cultural services were consistently perceived as more valuable, suggesting an appreciation for the ecological stability and cultural identity forests provide. Variation among groups also pointed to the influence of local customs and differential access to forest benefits. These results outlined the inherent trade-offs between conservation imperatives and livelihood needs, and the importance of adaptive, locally responsive forest management. The present research advanced current understanding of socio-ecological dynamics in social forestry and strategies to strengthen community participation and equitable benefit-sharing frameworks.

KATA KUNCI
perhutanan sosial,
jasa lingkungan,
konservasi hutan,
partisipasi masyarakat

INTISARI

Meskipun program perhutanan sosial memiliki potensi besar dalam meningkatkan penghidupan masyarakat lokal dan mendorong tata kelola hutan berkelanjutan, kajian empiris mengenai jenis jasa ekosistem hutan (jaslinghut) yang paling dihargai oleh masyarakat sekitar masih terbatas. Penelitian ini menelaah persepsi masyarakat terhadap jaslinghut pada tiga kelompok perhutanan sosial yang berada di kawasan hutan lindung di Kulon Progo, Indonesia. Berdasarkan 306 kuesioner yang terkumpul, persepsi dianalisis terhadap tiga kategori jaslinghut, yaitu jasa penyediaan, pengaturan dan pendukung, serta jasa kultural. Hasil menunjukkan pola penilaian yang berbeda, di mana jasa penyediaan secara konsisten memperoleh skor terendah. Kondisi ini mencerminkan ketatnya regulasi kawasan hutan lindung yang membatasi pemanfaatan ekstraktif dan membentuk pola interaksi masyarakat dengan sumber daya hutan. Sebaliknya, jasa pengaturan, pendukung, dan kultural dinilai lebih tinggi, menunjukkan adanya penghargaan terhadap stabilitas ekologi dan identitas budaya yang diberikan oleh hutan. Perbedaan antar kelompok juga mengindikasikan pengaruh tradisi lokal serta variasi akses terhadap manfaat hutan. Temuan ini menyoroti adanya trade-off *antara kepentingan konservasi dan kebutuhan penghidupan, serta menekankan pentingnya pengelolaan hutan yang adaptif dan responsif terhadap konteks lokal. Studi ini memperkaya pemahaman tentang dinamika sosio-ekologis dalam perhutanan sosial sekaligus memberikan masukan strategis bagi penguatan partisipasi masyarakat dan mekanisme pembagian manfaat yang berkeadilan.*

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Introduction

Forests are essential natural resources, providing a variety of ecosystem services crucial for environmental sustainability and human well-being (Brockerhoff et al. 2017; Kim et al. 2018; Jiang et al. 2021). These services comprise concrete advantages, including food, drinking water, timber, climate regulation, biodiversity improvements, and cultural enrichment (Kim et al. 2018; Acharya et al. 2019). Forests are widely recognized for their essential role in mitigating environmental issues such as climate change, biodiversity loss, and water scarcity. Despite their significance, Indonesian forests face substantial risks from deforestation, conflicts, and degradation (Tsujino et al. 2016; Higginbottom et al. 2019; Nordhaus et al. 2019), endangering their capacity to provide essential ecosystem services.

Ecosystem services (ESs) refer to the benefits humans obtain directly or indirectly from ecosystems, relating ecological functions to human well-being (Brogna et al. 2017; Brockerhoff et al. 2017; Jiang et al. 2021). Inter-national frameworks, such as the Millennium Ecosystem Assessment (MEA), have been established to categorize and highlight the benefits to civilization. MEA classifies ecosystem services into four principal categories, namely provisioning (e.g., food, water, and raw materials), regulating (e.g., climate and water regulation), sustaining (e.g., nutrient cycling and soil formation), and cultural services (e.g., recreational and spiritual benefits). These categories offer a systematic framework for comprehending the diverse values of forests. However, implementation requires localized evaluations to pinpoint and address specific community needs and priorities (Riechers et al. 2016; Susanto et al. 2024).

In Indonesia, numerous people reside near areas where forests significantly enhance livelihoods and quality of life by providing tangible benefits, revenue opportunities, and non-material qualities that bolster cultural identity and social cohesiveness (Maryudi et al. 2016; Yusran et al. 2017; Pudyatmoko et al. 2018; Nugroho & Numata 2022; Susanto et al. 2024). Forests provide important supplies, economic opportunities, and intangible values that greatly contribute to cultural identity and social cohesion (Nugroho et al. 2021; Susanto et al. 2024), collectively referred to as forest-based ecosystem services (FbES). However, local community perceptions of forest management strongly shape attitudes and influence the benefits received from forest ecosystems. Positive attitudes toward management are strongly associated with greater willingness to actively participate in conservation activities (Sirivongs & Tsuchiya 2012). To improve human well-being through ecological services (Cruz-Garcia et al. 2017; Kim et al. 2018), understanding community perceptions, values, and benefits related to multiple FbES is crucial. Understanding the community-specific viewpoints of FbES is essential for matching conservation programs with local needs. Forests provide numerous benefits, but living close to the ecosystem also presents considerable obstacles, such as agricultural damage, landslides, and exposure to other natural dangers (Aditian et al. 2018; Gross et al. 2019). Community who lives near forests frequently have complicated, dualistic perspectives toward their surroundings, both positive and negative (Muhamad et al. 2014). According to Martín-López et al. (2012), identifying highly valued FbES signified socio-cultural characte-ristics in these services. Therefore, investigating local perceptions of FbES given by forest areas is essential. This understanding improves the effectiveness of forest management strategies and ensures relevance to the communities served.

This research analyzed three community forest sites (*hutan kemasyarakatan*, HKm) in a protected area under the social forestry program in Kulon Progo, Indonesia, to examine local perspectives on FBeS. In the Indonesian forest management system, protected forests (*hutan lindung*) are established largely to preserve environmental protection functions. These include regulating hydrological systems, preventing erosion and landslides, and maintaining soil fertility. Due to the primary focus on preservation, extractive activities, specifically timber harvesting, are more limited. This designation governs the implementation of the social forestry system by determining access regulations, permissible uses, and the benefits local communities may derive. The present research defined perceived FbES as the values and benefits that local communities or individuals attribute to forests. The manner in which individuals perceive and engage with forest ecosystems influences these perspectives

on a daily basis (Muhamad et al. 2014). Furthermore, the social forestry program presents a viable framework for reconciling conservation with community development. Restricted access to protected forests frequently undermines traditional practices and income streams. This underscores the necessity for more inclusive management that harmonizes conservation objectives with local welfare (Erbaugh 2019; Rakatama & Pandit 2020; Wong et al. 2020). Recognizing the most valued FbES enables policymakers and forest managers to align conser-vation goals with local priorities, thereby enhancing the effectiveness of conservation efforts. This research utilizes the MEA framework to analyze community views and comprehend the local importance of FbES. The result offers essential insights for formulating environmentally sustainable, socially inclusive forest management policies.

Methods

Research Area

The research examined three community forest farmer groups (*kelompok tani hutan kemasyarakatan*, KTHKm), namely KTHKm Mandiri, KTHKm Sukomakmur, and KTHKm Menggerejo. These groups operated under the social forestry program in protected areas of Kulon Progo Regency and were located in Hargowilis and Sendangsari Villages in Menoreh Hills, Special Region of Yogyakarta (Figure 1). Menoreh Hills were characterized by steep slopes and high biodiversity, which supported important ecological functions and contributed to landscape aesthetics (Reinhart et al. 2023). The areas managed by the groups formed part of the Indonesian Social Forestry Program, which integrated environmental conservation with community welfare by granting local communities access to resource management. This approach supported sustainable land management while contributing to local socio-economic development.

All three KTHKm organizations operated within the confines of protected forests, regulated by national laws that limited heavy resource exploitation, particularly timber products. These restrictions aim to preserve biodiversity but restrict access to forest resources. The community groups were adjusted by advocating for non-extractive practices, such as ecotourism and agroforestry. These activities corresponded with the primary objectives of social

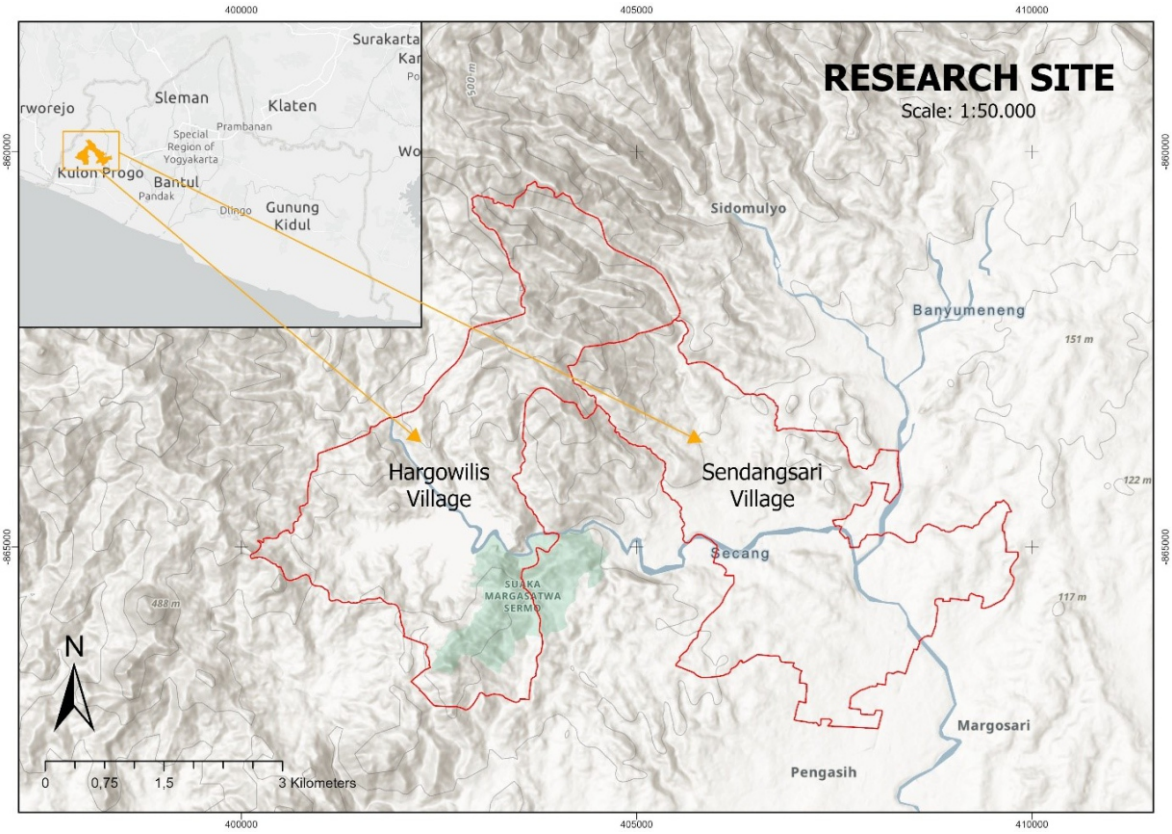

Figure 1. Research area

forestry by improving community welfare and safeguarding long-term ecological integrity. KTHKm organizations utilize integrated approaches to conserve the biodiversity of Menoreh Hills, sustainably manage protected forest areas, and offer livelihood options that diminish reliance on resource exploitation.

KTHKm Mandiri had effectively established Kalibiru, a nature-based tourism region that served as a substantial source of income for the community. The group oversees the forest by fostering ecotourism while safeguarding the adjacent protected areas. It also harmonized forest conservation with economic benefits through activities such as trekking and canopy hikes, generating cash while promoting environmental education. KTHKm Sukomakmur, situated in Sendangsari Village, emphasized agroforestry by integrating agriculture with forest management through the cultivation of crops with tree planting. This approach preserved soil fertility and regulated water, thereby enhancing agricultural productivity and forest vitality. KTHKm Menggerejo utilized comparable agroforestry methods, focusing mostly on coffee cultivation beneath the forest canopy. The group promoted forest biodiversity and established a sustainable livelihood for its members through the cultivation of shade-grown coffee.

Data Collection

The research started by gathering key information regarding the availability, management approaches, and potential of FbES through structured, comprehensive interviews with forest managers. This phase was predicated on the premise that managers play a crucial role in shaping forest governance in line with social policies. The insights from the interviews provided the basis for developing the subsequent household survey instrument. Subsequently, field observations were conducted to corroborate and enhance the interview data and to evaluate on-site ecological conditions. The observations comprised the mapping of the spatial distribution and potential of FbES in the specified research area. This triangulation method facilitated a more comprehensive knowledge of the biophysical and socio-institutional aspects of forest ecosystem services.

The third step comprised a direct questionnaire survey executed from August to September 2024. Perceived FbES were evaluated using a 21-item scale derived from MEA classification. This included 7 items for provisioning, 3 for regulating, 4 for supporting, and 7 for cultural services. The items were derived from prior research (Nugroho et al. 2020) and contextually modified to guarantee relevance and intelligibility for participants in the research area. The survey focused on community living in adjacent community forest areas to gather perspectives and experiences about localized FbES. Face-to-face administration was selected for its ability to promote respondent engagement and improve response rates, as evidenced by prior research (Sperber et al. 2023).

Respondents were selected through convenience sampling, determined by availability, accessibility, and a desire to engage in the fieldwork. Interviews were performed both on-site and through door-to-door visits in the designated village. Participants were instructed to assess the perceived presence of distinct FbES using a five-point Likert scale, with 1 indicating "strongly disagree" and 5 indicating "strongly agree." This method allowed the systematic quantification of the community's acknowledgment of ecosystem benefits.

Data Analysis

Quantitative descriptive statistical methods were adopted to thoroughly characterize the diversity and frequency distribution of FbES identified in the research area. This method enabled the identification of prevalent service categories as considered by local communities and for the evaluation of heterogeneity among respondent profiles. Descriptive statistics, such as means, percentages, and frequency distributions, were used to summarize community responses to the existence and significance of provisioning, regulating, supporting, and cultural services provided by the forest environment. Alongside mapping the diversity of FbES, descriptive analysis was used to investigate potential manage-ment methods to improve the provision and sustainability of these services in the context of social forestry. This included determining the ecological services most valued by the community and evaluating the consequences for future forest governance and participatory management strategies. All statistical analyses were conduc-

ted using Microsoft Excel for initial tabulations and visualiza-tions, and RStudio for more comprehensive statistical computations and data management.

Result and Discussion

General Findings

A total of 306 complete questionnaires were collected, and sociodemographic characteristics of the respondents are presented in Table 1. In terms of gender, the sample was relatively balanced, with 51.31% male and 48.69% female. Age distribution showed a predominance of older adults, with 47.39% of respondents aged 55 years and above. This was followed by 19.61% in the 45-55 age range and a smaller percentage in younger groups, particularly 6.21% in the 17-25 age range. In terms of education, a large proportion of respondents had only completed elementary school (30.07%) or high school (34.64%), while a smaller proportion (4.25%) had attained higher education. The frequency of forest visits varied: 31.37% of respondents visited the forest less than once a year, and 27.12% visited it more than 10 times annually.

Table 1. Sociodemographic characteristics of respondents

No.	Demographic characteristics	Frequency	Percentage (%)
1	Community forest groups		
	Mandiri	101	33.01%
	Menggerejo	99	32.35%
	Sukomakmur	106	134.64%
2	Gender		
	Male	157	51.31%
	Female	149	48.69%
3	Age (years old)		
	17–25	19	6.21%
	>25–35	39	12.75%
	>35–45	43	14.05%
	> 45–55	60	19.61%
	>55	145	47.39%
4	Formal educational attainment		
	No formal education	36	11.76%
	Elementary school	92	30.07%
	Junior high school	59	19.28%
	Senior high school	106	34.64%
	University	13	4.25%
5	How often do you visit a forest area (times in one month)?		
	Never	96	31.37%
	≤4	69	22.55%
	5–7	29	9.48%
	8–10	29	9.48%
	>10	83	27.12%

Perceived Forest-based Ecosystem Services

Table 2 indicates that provisioning services received the lowest mean scores among all FbES categories across the three groups, with Mandiri (mean=3.00) and Menggerejo (mean=3.15) scoring lower than Sukomakmur (mean=3.83). Conversely, regulating and supporting services were consistently valued the highest across all groups, with Mandiri scoring the highest mean (4.38), followed by Sukomakmur (4.12) and Menggerejo (4.08). Cultural services, which represented the non-material benefits derived from forests, also scored highly, with Mandiri (mean=3.87) and Menggerejo (mean=3.84) slightly outperforming Sukomakmur (mean=3.71). Figure 2 shows the variation of perceived FbES across community forest groups.

Figure 2 demonstrates distinct patterns in community valuation of FbES across the three social forestry groups. Provisioning services consistently received the lowest mean scores. This might be attributed to the regulatory framework governing

Table 2. Perceived forest-based ecosystem services

Forest-based ecosystem services	Value	Community forest group		
		Mandiri	Menggerejo	Sukomakmur
Provisioning services	min	1.71	1.57	2.57
	max	4.29	4.57	4.86
	mean	3.00	3.15	3.83
	SD	0.51	0.65	0.53
Regulating & supporting services	min	3.00	2.00	2.29
	max	5.00	5.00	5.00
	mean	4.38	4.08	4.12
	SD	0.55	0.74	0.68
Cultural services	min	2.50	2.67	2.50
	max	5.00	4.83	5.00
	mean	3.87	3.84	3.71
	SD	0.52	0.58	0.68

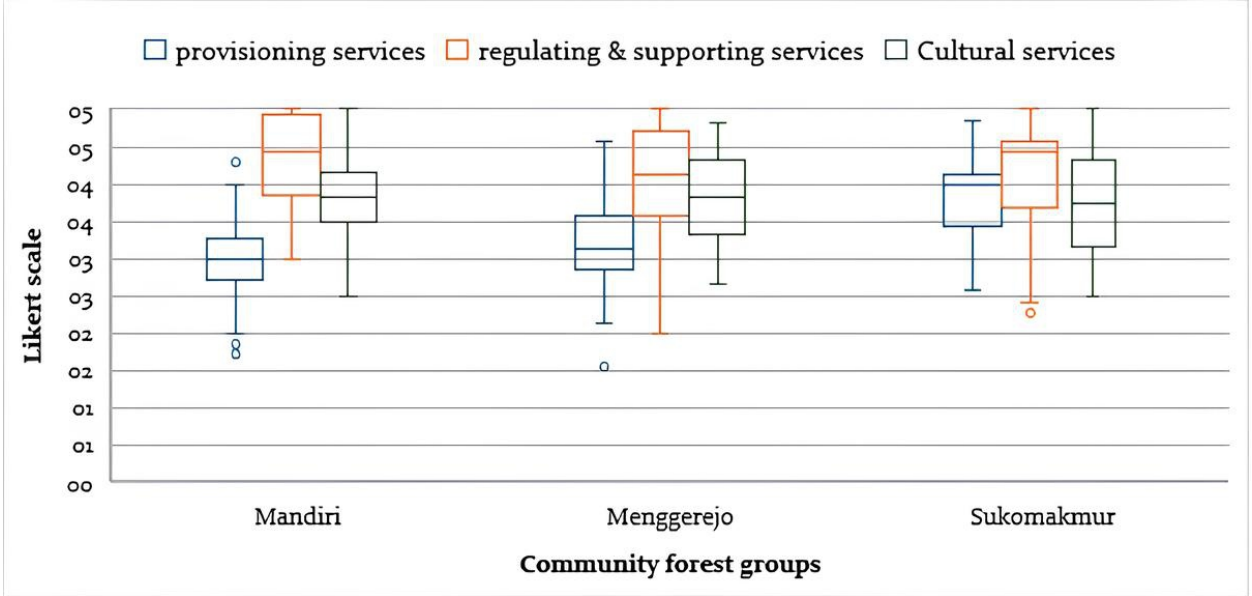

Figure 2. Perceived FbES across community forest groups

protected forests in Indonesia. The result is consistent with existing research on the regulatory impacts of forest governance, which often restricts local community access to resources. These limitations significantly influenced community perception and engagement with forest areas, shaping attitudes toward conservation and resource management. Previous research has emphasized how governance frameworks, particularly those prioritizing conserva-tion goals, often limit resource extraction. This led to reduced local benefits and altered perceptions of forest value (Erbaugh 2019; Rakatama & Pandit 2020; Gunawan et al. 2022). The government's regulations, such as Indonesian Forestry Law No. 41/1999, prioritized biodiversity conservation and sustainability by restricting timber harvesting and the collection of non-timber products. These regulations often limit local community access to provisioning services, including timber, non-timber products, and other forest-based resources, thereby directly influencing community perceptions of the availability and utility of these services. The restrictions on resource extraction reduced local communities' capacity to derive tangible benefits from the forest, diminishing the perceived value of provisioning services. In contrast, regulating and cultural services, which were less affected by these limitations, may be viewed more favorably, underscoring the potential trade-offs between conservation-oriented policies and local livelihoods, and underscoring the importance of adaptive strategies to balance ecological protection with sustainable community benefits. Therefore, policies to enhance resource accessibility alongside maintaining conservation priorities were indispensable. Strategies such as agroforestry helped communities meet livelihood needs while preserving forest ecosystems.

Regulating and supporting services were consistently valued as the highest across all groups. This reflected the community's recognition of the forest's crucial role in maintaining ecological stability, including soil fertility, water regulation, and disaster mitigation. The results corroborated and extended previous research that underscored the crucial role of forests in sustaining water availability (Nugroho et al. 2013; Marhaento et al. 2021), mitigating the risks of water-related disasters (Marhaento et al. 2021), and enhancing soil fertility (Octavia et al. 2023). This evidence further outlined the essential ecosystem services provided by forests, which were integral to maintaining ecological balance and supporting sustainable land and water management practices. Given its reliance on agriculture, the community might consider these services essential for sustaining livelihoods. The relatively low standard deviations across groups suggested broad consensus regarding the importance of the services, underscoring the ecological value of protected areas in ensuring long-

term community resilience.

Cultural services, which represented the non-material benefits derived from forests, were highly valued by locals. These results showed the deep socio-cultural connection between communities and their forested landscapes, including the use of forests for spiritual activities, recreation, and community identity. The variability observed across groups (SD=0.52-0.68) indicated significant differences in individuals' or subgroups' engagement with these services, which might be influenced by cultural diversity, forest access, or local traditions. Cultural services were crucial for fostering community cohesion and engagement. Programs celebrating local traditions, eco-tourism initiatives, and knowledge-sharing platforms amplified the cultural value of forests and generated alternative income sources for locals. These initiatives should be tailored to each community forest group's unique cultural context to maximize impact.

The variation in FbES valuation across the three groups highlighted the need for context-sensitive, participatory forest management strategies. Incorporating diverse community perspectives into decision-making processes was essential to correlate management interventions with local priorities, mitigate social disparities, and ensure equitable benefit-sharing. By recognizing and integrating the ecological and cultural values held by forest-dependent communities, social initiatives can more effectively achieve the dual objectives of environmental conservation and sustainable community development.

Conclusion

This research showed that the individuals engaged in social forestry in protected areas had varying perceptions of FbES across different service categories. Provisioning services consistently received the lowest value, perhaps due to regulatory limits on extractive use. Meanwhile, regulating, supporting, and cultural services had high valuations across all populations. Divergences among groups showed that local customs, access conditions, and socioeconomic settings influenced the prioritization of FbES. The results underscored the necessity for adaptive, locally responsive governance that harmonized conservation goals with community welfare. This incorporated participatory management and context-specific strategies such as agroforestry and eco-cultural initiatives to enhance engagement and equitable benefit-sharing.

The results offered valuable insights into the valuation of FbES by communities near protected areas, but should be considered in the context of the research's sampling methodology. Because convenience sampling was used for respondent recruitment, the sample may not fully reflect the community. This necessitated cautious interpretation of the results when generalizing to other populations or areas. Future research should utilize probability-based or stratified sampling to enhance representativeness.

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