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Navigating Poverty and Health Literacy in Protected Communities: Net-Map strategies

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Abstract
This study investigates barriers to health literacy among communities in Taman Negara Pahang, Malaysia. Data was collected using Focus Group Discussions, in-depth interviews, and the Net-Map tool from 16 stakeholders, including government bodies, healthcare providers, and non-governmental organizations. The Social Network Analysis revealed cohesiveness (density: 0.47), highlighting individuals sharing health-related information. The thematic analysis highlighted four obstacles: barriers, lack of infrastructure, fiscal limitations, and restrictive regulations. Suggested interventions include awareness campaigns, multilingual outreach, and policy reforms. The results highlight the importance of multi-sectoral promoting health opportunities and shaping policies for underserved communities in protected areas.

Keywords: Health Literacy, Protected Areas, Stakeholder Networks, Poverty

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1.0 Introduction

Health literacy is increasingly recognized as a key determinant of health equity, influencing individuals' ability to access, understand, evaluate, and apply health-related information to make informed decisions (Sørensen et al., 2012). Globally, low health literacy is associated with poor health outcomes, reduced healthcare utilization, and heightened health disparities, particularly among marginalized populations. The World Health Organization (2022) highlights that populations in rural, underserved, and indigenous areas often face systemic barriers such as limited education, low income, and poor access to health care that hinder the development of adequate health literacy skills. For example, studies from Latin America, sub-Saharan Africa, and Southeast Asia have shown that communities living in remote and ecologically sensitive areas frequently experience a dual burden of poverty and inadequate health information, compounded by geographical isolation and insufficient infrastructure (Kansiime et al., 2024).

In Malaysia, similar patterns are evident. Protected areas like Taman Negara Pahang (TNP) are home to rural and indigenous populations who face challenges and experience limited access to infrastructure, formal education, and health services (Ahmad et al.,

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2024). These structural constraints reduce opportunities to develop and apply health literacy, ultimately widening the gap in health equity between urban and remote populations. While Malaysia has made progress in expanding public health programs, a national survey found that many adults, especially those in rural and low-income communities, still have inadequate levels of health literacy (Jaafar et al., 2021).

Addressing such complex challenges requires context-specific and participatory strategies. The Net-Map method, an innovative tool combining stakeholder mapping, social network analysis, and power mapping, identifies key actors, relationships, and flows of information and resources within a community. By applying the Net-Map approach in the context of TNP, this study explores how social structures and power dynamics shape the relationship between poverty and health literacy in protected communities. Understanding these interconnections is essential for designing targeted, community-driven interventions to enhance empowerment, improve access to health information, and reduce health inequities.

2.0 Literature Review

Globally, rural and indigenous communities face many obstacles that prevent them from achieving adequate health literacy, such as poverty, geographic isolation, and limited access to education and healthcare services (Pailaha, 2023). These are further exacerbated by the challenges of language and culture barriers in effective communication with healthcare providers (Wang et al., 2020). For example, studies in both Australia and Canada have demonstrated significant gaps in health outcomes for Indigenous peoples, where poor health literacy limits their capacity to either practice preventive care or manage chronic illnesses (Smylie et al., 2021; Nutbeam & Lloyd, 2021). Moreover, the rural and indigenous populations in Southeast Asia face comparable barriers, including low levels of literacy, lack of infrastructure for health care, and poverty. For instance, in Indonesia, communities living in remote areas have limited access to health education and basic health services; hence, most of them rely on traditional medicine, either because they do not trust the modern health system available or because they cannot understand it (Laksono et al., 2024). Similarly, in this line, interventions in the Philippines and Thailand that aimed at improving health literacy through community health workers and digital health tools showed some success, though there is persistence in the challenge of engaging the marginalized communities (Jongdeepaisal et al., 2024; Kosowicz et al., 2024). These regional examples clearly show the significant need for tailored interventions to rural and indigenous populations' unique needs.

The challenges faced in Malaysia, particularly in protected areas like Taman Negara Pahang (TNP), highlight broader systemic health literacy issues. These areas are home to Indigenous communities, who encounter significant barriers to accessing and understanding health information. Their struggles are shaped by socio-economic limitations, geographic isolation, and policy constraints, underscoring the urgent need for targeted interventions to bridge health literacy gaps and promote equitable healthcare access. The systemic barriers surrounding the Orang Asli and other local communities are poverty and inadequate infrastructure (Chin, 2024). These problems usually limit their access to healthcare and educational opportunities and hinder their ability to acquire and utilize health information. Though necessary for preserving of the environment, conservation policies in protected areas often limit the development of basic infrastructure and services, further isolating these communities (Rahim et al., 2022).

Low health literacy in rural and protected communities, such as Taman Negara Pahang (TNP), contributes to significant public health challenges. Individuals with limited health literacy are less likely to engage in preventive health behaviors, often delay seeking medical attention, and struggle to manage chronic conditions effectively (Mohamed-Yassin et al., 2023). These health behaviors result in poorer health outcomes, increased healthcare costs, and widening health disparities. While stakeholders such as local health clinics, government agencies, NGOs, and traditional leaders—are involved in delivering health services and education, their efforts are often fragmented and uncoordinated (Chang et al., 2021). This lack of synergy reduces the overall impact of interventions and leads to overlapping responsibilities or missed opportunities for targeted outreach.

Moreover, there is a limited understanding of how these stakeholders interact, who holds influence within the network, and how resources and information flow across the system. Without this insight, it is difficult to develop effective, community-specific strategies that are both inclusive and sustainable. As a result, marginalized populations remain underserved, and existing health inequities persist or worsen. This study addresses this critical gap using the Net-Map method to uncover the underlying stakeholder dynamics and propose coordinated strategies to strengthen health literacy in protected and underserved communities.

Hence, this study will explore stakeholders' perceptions of the barriers to health literacy and seek the identification of strategies to improve health outcomes among the communities living in TNP. Specifically, the objective is to identify major stakeholders involved in health literacy initiatives, review the barriers to health literacy faced by the local communities, and propose actionable strategies using stakeholder input to increase health literacy and improve equitable health access for these marginalized community groups. Discussing these objectives enables the research concerned with health literacy within marginalized communities to serve a broader need and provide further practical implications and considerations for protected and rural-serving policymakers and service practitioners in Malaysia.

3.0 Methodology

The study adopted a qualitative research design to explore the stakeholders' perceptions about barriers to health literacy and identify strategies for improving health literacy among communities living in TNP. A qualitative approach was used to delve into the difficult socio-economic and infrastructural dynamics that shape health literacy within these marginalized communities.

3.1 Study Design and Participants

A purposive sampling technique was used to select the stakeholders engaged in the development of TNP policies or influenced by these policies on health literacy development. The stakeholders identified were representatives from government agencies, local community leaders, healthcare providers, civil society organizations, and NGOs in that area. Sixteen stakeholders were identified according to their roles and influence in health-related decision-making, as determined through preliminary consultations and nominations by other stakeholders.

3.2 Data Collection

The study used two primary data collection methods: focus group discussions (FGDs) and in-depth interviews. The FGDs allow participants to share views on health literacy challenges and strategies through group discussion. In-depth interviews with key stakeholders complement this to get detailed narratives and insights that might not be possible to be shared in a group setting. Semi-structured interviews were used to explore the three questions: (1) Identify stakeholders in PNP who would be involved with health literacy issues. (2) Identify potential barriers to health literacy faced by local communities. (3) Identify the strategies to overcome the barrier.

The Net-Map tool was used during the FGDs to depict visually the relationships between and influence of these actors in the health literacy network. The use of the Net-Map methodology in health literacy research is underpinned by social network theory, which emphasizes the role of social relationships and information flows in shaping individual behaviors and access to resources (Borgatti et al., 2024; Scott, 1991).

Stakeholder selection was conducted using purposive and snowball sampling. Participants were chosen based on their health, education, community development, or policymaking roles in Taman Negara Pahang (TNP). Initial informants were asked to nominate other relevant and influential actors, ensuring a diverse and representative group. During Focus Group Discussions (FGDs) and in-depth interviews, participants:

1. Identified key actors involved in health literacy efforts.
2. Mapped the relationships and flows of resources or information between actors.
3. Assigned influence levels using “influence towers” to visualize power and authority.
4. Discussed the barriers faced by communities and proposed strategies to improve health literacy in TNP.

The resulting maps and qualitative data were analyzed using UCINET for network metrics and thematic analysis to extract key insights.

3.3 Data Analysis

The data analysis process was conducted through two complementary methods: Social Network Analysis (SNA) and thematic analysis. These methods provided quantitative insights into the relationships of stakeholders under study, and qualitative insights into the underlying barriers and strategies related to health literacy.

3.3.1 Social Network Analysis (SNA)

SNA was conducted to understand the structural relationships among stakeholders in the health literacy network. Three key metrics used for analysis are the (1) Density which is the ratio of actual ties in a network to the total possible ties. The higher the density, the more cohesive the network is. (2) Centrality involves a betweenness centrality, in which a stakeholder acts as a bridge between others. The closeness centrality calculates how fast a node can reach all the others, and how good it is at spreading information. The in-degree centrality is the number of ties received by a stakeholder, and the out-degree centrality is the number of ties a stakeholder sends. (3) Connectivity refers to the extent of interconnectivity amongst stakeholders that shows how information and resources flow through the network. These measures gave a very comprehensive stakeholder and stake analysis of these stakeholders and the stakes in health literacy within this region, with government agencies and local leaders being at the core.

3.3.2 Thematic Analysis

Thematic analysis was conducted using Clarke and Braun’s (2013) six-phase framework. This involved familiarizing with the data, coding relevant content, identifying and refining themes, and constructing a coherent narrative. Four key barriers to health literacy emerged: education, infrastructure, financial constraints, and policy limitations. Sub-themes such as health awareness, language barriers, and inadequate healthcare facilities provided deeper insight into the specific challenges faced by the community.

4.0 Findings

4.1 Stakeholder Networks in Health Literacy

Table 1 reveals the summary of the SNA data. There were 16 key nodes representing the stakeholders involved, such as government agencies, local leaders, NGOs, and healthcare providers. The density of the network was 0.47, which shows moderate cohesion and collaboration among the stakeholders. The density, defined as the proportion of 106 actual ties out of a possible 225 ties [(16-1) x (16-1)], or 0.47, indicates that the actors established 47% of all potential ties within the network. This reflects a moderate level of connectivity, where stakeholders are somewhat engaged with one another but not fully integrated (Borgatti et al., 2024; Scott, 1991, 2012). A higher density would suggest stronger and more frequent interactions, enabling faster and more consistent information flow across the network.

The current density shows that collaboration exists particularly among key actors like local health clinics, JAKOA, and community leaders. There is still space to strengthen partnerships and improve coordination, especially with peripheral actors like NGOs and federal agencies. With an average degree of 6.625, the typical node in this network is connected to six others, signifying a high potential for communication or resource exchange across the network. The standard deviation in the number of ties (0.5) indicates uniformity in connectivity across nodes, with no node being significantly more or less connected than others within the network.

Table 1. Summary of SNA data

Network Indices	Value
Density	0.47
Number of nodes	16
Number of ties	106
Standard deviation	0.5
Average degree	6.625

Fig. 1 reveals a dense web of connections among a set of nodes labeled within TNP. There are 16 nodes, each representing distinct entities such as offices, positions, or organizations, that are intricately linked, as evidenced by the numerous edges that denote the relationships between the stakeholders.

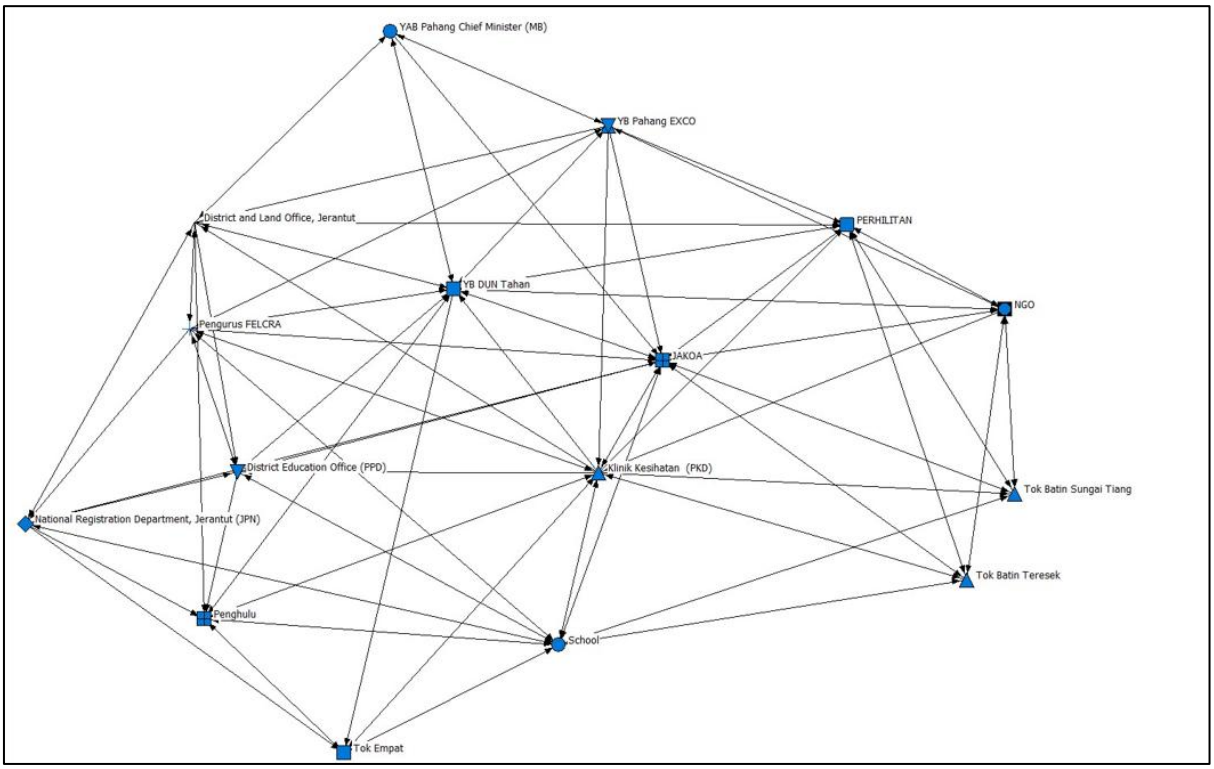

Fig.1 Social Network of Stakeholders of Health Literacy in TNP.

Table 2 shows the result of the individual network of each stakeholder in the SNA.

Table 2. The Results of Individual Network of SNA

Stakeholder	Out-Degree	In-degree	Closeness	Betweenness
YB DUN Tahan	9	10	20	27.85
JAKOA	9	12	18	24.50
Klinik Kesihatan (PKD)	11	9	21	23.25
School	9	9	21	16.75
Penghulu	5	7	23	5.38
Tok Empat	3	5	25	0.67
Tok Batin Sungai Tiang	5	5	25	1.84
Tok Batin Teresek	5	5	25	1.84
NGO	7	5	26	5.76
PERHILITAN	5	8	22	5.88
Pengurus FELCRA	8	6	24	7.53
District and Land Office, Jerantut	7	7	23	10.63
YAB Pahang Chief Minister (MB)	4	3	31	0.61
National Registration Department, Jerantut (JPN)	6	5	25	2.80
District Education Office (PPD)	6	6	24	2.33
YB Pahang EXCO	7	4	28	3.39

The Social Network Analysis identified key actors influencing health literacy in Taman Negara Pahang. The State Legislative Assembly Representative (YB DUN Tahan) served as the most critical connector, while JAKOA emerged as the most frequently engaged stakeholder. Klinik Kesihatan played a central role in disseminating health information. Schools, with balanced connections and high closeness, showed strong potential for promoting health literacy among youth. However, limited involvement from peripheral actors like JPN and the Chief Minister's Office indicates opportunities to strengthen network integration and collaboration.

4.2 Barriers to Health Literacy

The results from the FGD revealed the barriers faced by the community and the strategies to improve the situation. Table 3 presents the key barriers and strategies and their respective themes and sub-themes.

Table 3. Theme and Sub-theme of Health Literacy Barriers Faced by the Community in PNP and Strategies to Improve

Health Literacy Barriers	Sub-theme of Health Literacy Barriers	Strategies to Improve Health Literacy
Education	Health awareness	Health Talk, Seminar, regular health check-ups
	Health education	Health Training courses (CPR), in-house treatment
	Language and communication	Promotion and Outreach Programs
Infrastructure	Network facilities	Upgrade the facilities and the network
	Public Transportation	Provide public transport
	Healthcare facilities	Provide new facilities (clinics and staff)
Financial	poverty	Small business
	employment status	Provide career opportunities
PNP Policy	conservation policy	Eco-friendly environment

The FGD results revealed four main themes of barriers: education, infrastructure, finances, and the TNP's policy.

4.2.1 Education

Lack of health awareness amongst the community, with delayed healthcare-seeking behavior and a lack of understanding about preventive care. There are challenges in health awareness, health education, and Language and communication barriers, particularly among Indigenous communities, due to cultural differences and low literacy levels. Stakeholder 1 talked about the fear and anxiety among senior citizens and Indigenous to do health screening "The problem for villagers is a lack of awareness about health screenings. Some are afraid to visit the clinic, possibly due to age and education level". Moreover, stakeholder 1 added that "their understanding of health status varies for each person. I usually use the simplest language and speak in their dialect. For the Indigenous community, I need to draw pictures of the moon and the sun to indicate taking medicine at night and during the day".

The suggested strategies for improving health literacy were introducing health awareness campaigns and seminars targeting local communities, providing health training programs, such as CPR and first aid, to build local capacity for handling minor health issues, and multilingual outreach programs using culturally sensitive communication materials.

4.2.2 Infrastructure

There was poor network and transportation facilities. Some villages have no road access or reliable internet. Moreover, the number of healthcare facilities and medical staff is also limited. Stakeholder 5 mentioned that "the internet in Kuala Tembeling area is stable because it is a tourist area. However, clean water is a problem. We must use hill water. In the Hulu Tembeling area, there are issues with roads and internet access". Therefore, stakeholders ensured that the local government should upgrade the transportation and network facilities, create new healthcare facilities, and recruit more staff to address medical needs in the community.

4.2.3 Financial Constraints

High levels of poverty curtailed the community's potential to access health services. Therefore, it contributes to unstable employment opportunities, reducing access to health insurance and services. Stakeholder 7 mentioned their hardship in earning an income "Most residents struggle with unstable income. It is difficult even to get RM500". To overcome this issue, stakeholders suggest that the government and local authorities assist by providing aid and incentives to small businesses and vocational training among young local communities to relieve poverty and improve their employment status.

4.2.4 Policy Challenges

Conservation policies in protected areas restrict infrastructure and economic development, limiting access to basic services and healthcare. As noted by a stakeholder, "permanent settlements are prohibited, only solar power, hill water, and shelters are allowed." To address this, eco-friendly development policies are needed to balance the conservation with community needs through renewable energy, green infrastructure, and sustainable land use planning.

5.0 Discussion

The findings reflect how barriers to health literacy in Taman Negara Pahang are rooted in broader social determinants of health (SDH), such as poverty, limited education, poor infrastructure, and restrictive policies. These structural factors shape the community's ability to access and use health information. By applying Network Theory through Social Network Analysis (SNA), the study highlights how

stakeholder relationships and influence affect information flow and coordination. (Borgatti et al., 2024). The moderate network density (0.47) suggests partial collaboration, while centrality measures identified influential stakeholders such as local health leaders, government representatives, and schools. However, the presence of peripheral actors and uneven distribution underscores a need for better integration and coordinated efforts across sectors.

The findings show that barriers to health literacy in Taman Negara Pahang (TNP) are shaped by broader social determinants of health (SDH), including poverty, limited education, poor infrastructure, and restrictive policies. These structural factors significantly impact the community's ability to access and utilize health information.

Using Network Theory through Social Network Analysis (SNA), the study reveals how stakeholder relationships influence information flow and coordination. The moderate network density (0.47) suggests partial collaboration among actors, with key roles played by local leaders, JAKOA, and healthcare providers. However, peripheral actors and an uneven influence distribution indicate a need for stronger integration and cross-sector coordination.

Schools, identified as having high betweenness centrality, emerged as vital yet underutilized actors. Given the community's limited infrastructure and socio-economic constraints, schools are uniquely positioned to deliver health literacy through education, outreach, and practical learning activities. As Komolafe et al. (2020) and Tomokawa et al. (2020) highlight, schools and teachers can act as trusted health communicators, bridging gaps in language, access, and awareness, especially in underserved communities.

While improving infrastructure and revising policy require long-term efforts, empowering schools to integrate health education into their curriculum offers an immediate and sustainable strategy. This also reduces over-reliance on a few central actors, helping to prevent bottlenecks in information flow.

In summary, integrating SNA findings with the socio-economic context of TNP underscores the importance of schools and inter-agency collaboration in improving health literacy. Understanding stakeholder roles and relationships is critical for designing targeted interventions and strengthening network resilience in protected communities.

6.0 Conclusion and Recommendation

The findings from this study reveal the significant barriers to health literacy in TNP and the central role of stakeholders in addressing these challenges. While education, infrastructure, financial constraints, and policy restrictions present formidable barriers, targeted strategies such as health awareness campaigns, improved healthcare access, and policy reforms may improve health literacy. However, this study limits TNP only, which may affect the generalizability of findings to other protected communities with different socio-economic contexts such as Smylie et al. (2021) found that Indigenous communities in remote Canada faced similar barriers due to systemic neglect, while Laksono et al. (2024) reported limited health literacy in remote Indonesian villages, mainly due to language, poverty, and cultural preferences for traditional medicine. These parallels reinforce the need for context-specific yet scalable interventions. This study underscores the urgent need for multi-sectoral interventions that address the root causes of poor health literacy, particularly poverty, in protected communities. By doing so, Malaysia can ensure that marginalized populations are not left behind in health equity.

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Paper Contribution to Related Field of Study

This paper contributes to the field by identifying crucial barriers to health literacy in protected communities through innovative stakeholder mapping methods. It proposes practical, multi-sectoral strategies to address health equity and community well-being and provides policymakers with actionable recommendations to balance conservation policies with communities' health development.

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