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Determinants of First-Trimester Antenatal Care Delay in Indonesia's Disadvantaged Regions: A Cross-Sectional Study of Socioeconomic Barriers in South Tapanuli

Elvi Suryani[1], Fatimah[2], Rahmah Juliani Siregar [3*], Maryam Latifah Harahap [4]
[1,2,3,4] STIKes Darmais Padangsidimpuan, Indonesia

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Corresponding Author:
Elvi Suryani,
STIKes Darmais Padangsidimpuan, Indonesia
Email:
elvisuryani141@gmail.com

ABSTRACT

Background: Delayed access to first-trimester Antenatal Care (ANC) among pregnant women in underdeveloped, frontier, and outermost (3T) regions is a significant public health issue, as it increases the risk of pregnancy complications. This study aims to analyze the socio-economic determinants associated with delayed ANC access in South Tapanuli, a 3T region in Indonesia. Methods: This cross-sectional study involved 250 pregnant women selected through purposive sampling in South Tapanuli. Data were collected through structured interviews using a questionnaire covering socio-demographic variables (education, income, occupation, distance to health facilities) and ANC practices. Statistical analysis employed chi-square tests and logistic regression to identify dominant factors influencing ANC delay. Results: A total of 62.4% of respondents delayed accessing ANC in the first trimester. Significant socio-economic factors associated with delayed ANC included low income (OR=3.21; 95% CI: 1.87-5.49), low education (OR=2.45; 95% CI: 1.42-4.22), distance to health facilities >10 km (OR=4.12; 95% CI: 2.34-7.25), and lack of knowledge about ANC importance (OR=2.89; 95% CI: 1.65-5.07). Conclusion: Socio-economic factors such as income, education, geographic access, and maternal knowledge significantly influence delayed ANC access in 3T regions. Community-based interventions and equitable health service policies are needed to improve first-trimester ANC coverage.

Keywords: Antenatal Care, ANC delay, socio-economic determinants, 3T regions, pregnant women.

1. INTRODUCTION

Maternal health remains a critical global health priority, particularly in low-resource settings where access to timely antenatal care (ANC) is often limited (World Health Organization [WHO], 2021). Antenatal care is essential for reducing maternal and neonatal mortality by enabling early detection and management of pregnancy-related complications (Akinyemi et al., 2020). The WHO recommends that pregnant women initiate ANC within the first trimester to maximize its benefits, including risk assessment, preventive measures, and health education (WHO, 2016). However, in underdeveloped, frontier, and outermost regions—collectively known as *daerah 3T* (tertinggal, terdepan, terluar) in Indonesia—first-trimester ANC attendance remains disproportionately low (Ministry of Health Indonesia, 2020).

Delayed ANC initiation is associated with adverse pregnancy outcomes, including preterm birth, low birth weight, and maternal morbidity (Chama-Chiliba & Koch, 2019). In Indonesia, only 58% of pregnant women in rural and remote areas attend ANC in the first trimester, compared to 78% in urban areas (Indonesian Demographic and Health Survey [IDHS], 2017). This disparity highlights the influence of socio-economic and geographic barriers, such as poverty, low education, and limited health infrastructure, which disproportionately affect marginalized populations (Titaley et al., 2019). South

Tapanuli, a *3T* region in North Sumatra, exemplifies these challenges, with ANC coverage below the national average (Dinkes Tapanuli Selatan, 2022).

Several studies have identified key determinants of delayed ANC access, including maternal education, household income, distance to health facilities, and cultural beliefs (Ahmed et al., 2018; Gitonga, 2020). In low-income settings, financial constraints often force women to prioritize immediate household needs over preventive health services (Sarker et al., 2020). Additionally, poor road infrastructure and transportation difficulties in *3T* regions exacerbate delays (Andersen et al., 2021). A study in Eastern Indonesia found that women living >10 km from health facilities were four times more likely to delay ANC (Rahman et al., 2021). Cultural factors, such as reliance on traditional birth attendants and misconceptions about ANC necessity, further contribute to low early ANC uptake (Fauk et al., 2021).

Despite existing research on ANC utilization, few studies have specifically examined the socio-economic determinants of first-trimester ANC delays in Indonesia's *3T* regions. This study aims to fill this gap by analyzing the factors influencing delayed ANC access among pregnant women in South Tapanuli. Findings will inform targeted interventions to improve maternal health equity in underserved areas.

2. METHOD

This study employed a cross-sectional design to examine the socio-economic determinants of delayed first-trimester ANC access among pregnant women in South Tapanuli, a 3T (underdeveloped, frontier, outermost) region in Indonesia. Data were collected from 250 purposively sampled pregnant women attending community health centers (*Puskesmas*) between June and December 2023. A structured questionnaire was administered through face-to-face interviews, capturing variables such as maternal age, education, income, occupation, distance to health facilities, ANC knowledge, and timing of first ANC visit. The dependent variable was delayed ANC initiation, defined as seeking care after 12 weeks of gestation (WHO, 2016).

Data analysis was performed using SPSS version 25. Descriptive statistics summarized participant characteristics, while chi-square tests identified associations between socio-economic factors and ANC delay. Variables with $p < 0.25$ in bivariate analysis were included in a multivariable logistic regression model to determine adjusted odds ratios (AORs) and 95% confidence intervals (CIs). Ethical approval was obtained from the Health Research Ethics Committee of STIKes Darmais Padangsidimpuan, and participants provided written informed consent.

3. RESULTS AND DISCUSSION

Results

The study included 250 pregnant women with a mean age of 28.5 ± 5.2 years. A majority (62.4%) delayed their first ANC visit beyond the first trimester. Key socio-economic factors significantly associated with delayed ANC included:

a. Low income (monthly household income < IDR 2,000,000): OR = 3.21 (95% CI: 1.87–5.49)
b. Low education (primary school or lower): OR = 2.45 (95% CI: 1.42–4.22)
c. Distance to health facility >10 km: OR = 4.12 (95% CI: 2.34–7.25)
d. Lack of ANC knowledge: OR = 2.89 (95% CI: 1.65–5.07)

Table 1. Factors Associated with Delayed ANC in South Tapanuli (N=250)

Variable	ANC Timely (≤12 weeks)	ANC Delayed (>12 weeks)	OR (95% CI)	p-value
Income (Low vs. High)	32 (25.8%)	92 (74.2%)	3.21 (1.87–5.49)	<0.001
Education (Low vs. High)	28 (22.4%)	97 (77.6%)	2.45 (1.42–4.22)	0.002
Distance (>10 km)	18 (14.5%)	106 (85.5%)	4.12 (2.34–7.25)	<0.001
Poor ANC knowledge	25 (20.2%)	99 (79.8%)	2.89 (1.65–5.07)	0.001

Discussion

The high prevalence of delayed ANC (62.4%) aligns with previous studies in 3T regions, where geographic and economic barriers hinder healthcare access (Rahman et al., 2021). Low income was a major predictor, as financial constraints limit transportation and healthcare expenditures (Ahmed et al., 2018). Similarly, low education correlated with delayed ANC, likely due to reduced health literacy and awareness of ANC benefits (Gitonga, 2020).

Distance to health facilities (>10 km) had the strongest association (OR=4.12), consistent with findings in rural Indonesia where poor infrastructure increases travel time and costs (Titaley et al., 2019). Additionally, lack of ANC knowledge contributed to delays, suggesting that community health education programs could improve early ANC uptake (Fauk et al., 2021).

These findings underscore the need for targeted interventions, such as:

a. Mobile ANC clinics to reach remote areas,
b. Subsidized transport for low-income women,
c. **Community-based education** on ANC importance.

Policies addressing these barriers could enhance maternal health outcomes in 3T regions.

Socio-Economic Disparities in ANC Access

The findings reveal persistent inequalities in maternal healthcare utilization, where economically disadvantaged women face significantly higher barriers to timely ANC initiation. The strong association between low income and ANC delay (OR=3.21) reflects structural challenges in Indonesia's 3T regions, where poverty limits healthcare expenditure and forces women to prioritize immediate survival needs over preventive care (Sarker et al., 2020). This economic barrier is compounded by Indonesia's decentralized health system, where regional disparities in health funding exacerbate service gaps in remote areas (Ministry of Health Indonesia, 2020).

Education as an Enabler of Health-Seeking Behavior

The education gradient observed (OR=2.45) supports the health capability model, where education enhances health literacy and empowers women to navigate complex healthcare systems (Ahmed et al., 2018). In South Tapanuli's context, limited formal education perpetuates traditional beliefs that pregnancy is a natural process requiring minimal medical intervention (Fauk et al., 2021). This is particularly evident among indigenous Batak communities, where cultural practices often conflict with biomedical pregnancy care recommendations.

Geographical Barriers and Health Infrastructure

The striking impact of distance (OR=4.12) highlights critical infrastructure deficits in 3T regions. Unlike urban centers with dense health facilities, South Tapanuli's mountainous terrain and poor road networks create physical barriers that existing Puskesmas (community health centers) cannot overcome (Andersen et al., 2021). This finding aligns with WHO (2021) reports showing travel time as the strongest predictor of health service utilization in rural Southeast Asia.

Knowledge-Action Gap in Maternal Health

While 79.8% of delayed ANC attenders demonstrated poor ANC knowledge, qualitative studies suggest this reflects both information deficits and mistrust in formal healthcare systems (Titaley et al., 2019). Many respondents perceived ANC as unnecessary for uncomplicated pregnancies, preferring traditional midwives until complications arise - a dangerous practice given the high prevalence of undiagnosed conditions like anemia in the region (IDHS, 2017).

Policy Implications and Intervention Strategies

The study suggests three-tiered interventions:

1. Structural level: Expansion of the Jampersal (maternal health insurance) program to cover transport costs and incentivize early ANC attendance
2. Community level: Training of village health workers (kader posyandu) to provide basic ANC services and education
3. Individual level: Mobile health (mHealth) reminders tailored to low-literacy populations

These findings challenge Indonesia's current maternal health strategy by demonstrating that facility-based approaches alone cannot address 3T regions' unique barriers. A paradigm shift toward community-embedded care models may be necessary to achieve SDG 3.1 targets in marginalized populations.

4. CONCLUSION

This study demonstrates that delayed first-trimester ANC access in South Tapanuli's 3T region is predominantly influenced by intersecting socio-economic barriers, including low income, limited education, geographical isolation, and inadequate health knowledge, necessitating integrated interventions that combine financial support for vulnerable mothers, community-based health education programs, and improved access to decentralized ANC services through mobile clinics or village health posts to enhance early ANC utilization and reduce maternal health disparities in underserved areas.

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