

Socioeconomic and Cultural Influences on Antenatal Care Utilization: A Multilevel Analysis

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Abstract

Antenatal care (ANC) is critical to reducing maternal and neonatal morbidity and mortality. Despite the global promotion of ANC, disparities in utilization persist, especially in low- and middle-income countries (LMICs), where socioeconomic and cultural dynamics profoundly shape health behaviors. This study employs a multilevel analysis to explore how individual and community-level socioeconomic and cultural factors influence ANC utilization across selected LMICs. Data from the most recent Demographic and Health Surveys (DHS) of five Sub-Saharan African countries were analyzed, involving 67,842 women aged 15–49 who had a live birth within five years preceding the survey. Multilevel logistic regression models assessed the effects of maternal education, household wealth, employment status, community literacy, and cultural norms on ANC uptake. The results indicate that both individual-level factors and community-level factors significantly predict ANC use. Women in communities with high female literacy and gender-equitable norms were more likely to utilize ANC services adequately, regardless of their personal socioeconomic status. These findings underscore the importance of addressing broader structural and cultural inequalities to enhance maternal healthcare access. Policies that integrate socioeconomic empowerment and culturally sensitive health promotion are crucial to improving ANC coverage in LMICs.

Keywords: Antenatal care; Maternal health; Socioeconomic factors; Cultural norms; Multilevel analysis; Low- and middle-income countries

1. Introduction

1.1. Background and Global Relevance of Antenatal Care

Antenatal care (ANC) is a cornerstone of maternal health services, offering critical opportunities to monitor pregnancy, manage complications, provide health education, and prepare for childbirth. It is well-established that timely and adequate ANC visits are associated with improved maternal and neonatal outcomes, including reduced risk of preterm birth, low birth weight, and maternal mortality [1,2]. The World Health Organization (WHO) recommends a minimum of eight ANC contacts for pregnant women to maximize health benefits [3].

Despite these global guidelines, ANC utilization remains suboptimal in many parts of the world, particularly in low- and middle-income countries (LMICs). According to the WHO, nearly 50% of women in LMICs do not receive the recommended number of ANC visits, with some receiving no care at all during pregnancy [4]. Sub-Saharan Africa and South Asia bear the brunt of these disparities, with significant consequences for maternal and infant health outcomes.

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The determinants of ANC utilization are multifaceted and extend beyond mere availability of services. Previous studies have identified a range of individual-level predictors such as maternal age, education, parity, and household wealth [5,6]. However, growing attention is being directed toward the role of community and cultural contexts in shaping healthcare-seeking behaviors. These contextual factors ranging from social norms to gender roles can either facilitate or hinder women's access to antenatal services.

1.2. Socioeconomic and Cultural Barriers to ANC

Socioeconomic status (SES) remains a fundamental determinant of health service utilization. Women from wealthier households are more likely to access ANC services compared to those from poorer backgrounds, even in settings where such services are offered free of charge [7]. Educational attainment, particularly maternal education, has also been linked to greater ANC use, likely due to increased health awareness and autonomy in decision-making [8].

However, socioeconomic factors are often intertwined with cultural norms and expectations that may constrain or facilitate ANC uptake. For instance, in many patriarchal societies, men control household decisions including those related to healthcare. Cultural beliefs that perceive pregnancy as a natural state not requiring medical attention further reduce ANC demand [9]. Moreover, stigma, religious interpretations, and traditional birth practices can discourage women from seeking care at formal health facilities.

Community-level cultural influences are especially important in LMICs where extended families and communal decision-making structures play a prominent role. A woman's behavior may be shaped not only by her beliefs but also by the dominant norms in her social environment. In this context, exploring the joint effect of individual and community-level socioeconomic and cultural determinants offers a more comprehensive understanding of ANC utilization.

1.3. Rationale for a Multilevel Analytical Approach

Traditional analytical methods focusing solely on individual-level characteristics may overlook the broader context in which healthcare decisions are made. Multilevel modeling provides a robust statistical framework to disentangle the effects of individual and contextual variables, accounting for the nested structure of population data (i.e., individuals within households, and households within communities) [10].

This study applies a multilevel logistic regression model to analyze nationally representative data from five Sub-Saharan African countries. The aim is to assess the influence of both individual and community-level socioeconomic and cultural factors on ANC utilization. By identifying the interplay between these levels of influence, the study seeks to inform targeted interventions and policy reforms that address both personal and structural barriers to maternal healthcare.

1.4. Objectives of the Study

The primary objective of this research is to investigate the socioeconomic and cultural factors that influence ANC utilization using a multilevel analytical framework. Specifically, the study seeks to; Determine the association between individual-level socioeconomic indicators (education, wealth, employment) and ANC use.

- Examine the influence of community-level factors such as female literacy rate and prevailing gender norms.
- Identify variations in ANC utilization across different communities and countries.

2. Methods

2.1. Study Design and Setting

This study adopted a cross-sectional analytical design utilizing secondary data from the Demographic and Health Surveys (DHS) conducted between 2015 and 2022 across five Sub-Saharan African countries: Nigeria, Kenya, Ethiopia, Ghana, and Tanzania. These countries were selected based on their geographic diversity, data completeness, and varying maternal health outcomes. The DHS is a nationally representative household survey that collects data on health indicators, reproductive behavior, and service utilization in LMICs using a standardized methodology across countries [11].

2.2. Study Population and Sampling

The study population comprised women aged 15–49 years who had at least one live birth within the five years preceding the survey. From the pooled data of the five countries, a weighted sample of 67,842 women was analyzed. The DHS

employs a stratified two-stage cluster sampling technique. In the first stage, enumeration areas (EAs) are selected using probability proportional to size. In the second stage, households are systematically selected within each EA, and eligible women are interviewed using a standardized questionnaire [12].

2.3. Inclusion and Exclusion Criteria

Only women with complete information on antenatal care attendance and key socioeconomic and cultural variables were included. Women whose last pregnancy did not result in a live birth or who had missing data on ANC utilization were excluded. This was to ensure the internal validity and comparability of the dataset across countries.

2.4. Outcome Variable

The primary outcome variable was **adequate antenatal care utilization**, defined according to WHO's revised guidelines recommending at least eight ANC visits during pregnancy [3]. However, due to data limitations and comparability across countries, this study operationalized ANC adequacy as attending at least four ANC visits, which aligns with the earlier WHO standard still used in many LMICs [13]. The variable was dichotomized as follows:

1 = Adequate ANC use (≥ 4 visits)

0 = Inadequate ANC use (< 4 visits)

2.5. Independent Variables

2.5.1. Individual-Level Variables

Individual-level predictors included:

- **Maternal education** (no education, primary, secondary, higher)
- **Household wealth index** (poorest, poorer, middle, richer, richest), derived through principal component analysis of household assets [14]
- **Employment status** (employed vs unemployed)
- **Age at last birth** (categorized as 15–24, 25–34, and 35–49 years)
- **Marital status** (currently married, formerly married, never married)
- **Parity** (number of previous live births)

2.5.2. Community-Level Variables

Community-level variables were aggregated at the cluster level, based on the average characteristics of women in each enumeration area. These included:

- Community female literacy rate (proportion of women with at least secondary education);
- Community wealth (proportion of households in the richest two wealth quintiles);
- Cultural gender norms (proxied by the proportion of women in the cluster who agreed that a husband is justified in beating his wife under any circumstance);
- Urban vs rural residence.

Community norms were calculated using empirical Bayes estimation to reduce sampling variability in smaller clusters [15].

2.6. Ethical Considerations

The study was based on publicly available DHS data, which are anonymized and accessible upon formal request. Ethical clearance for each country's DHS was obtained by local authorities and ICF International. No additional ethical approval was required for this secondary analysis [16].

2.7. Statistical Analysis

A multilevel logistic regression model was used to account for the hierarchical structure of the data individuals nested within communities, and clusters nested within countries. Four models were estimated:

- Model 0 (Null model): Contained no predictors, used to estimate intra-class correlation (ICC)

- Model 1: Included individual-level variables
- Model 2: Included community-level variables
- Model 3 (Full model): Included both individual and community-level variables

Random intercepts were specified for clusters and countries to account for unobserved heterogeneity. Fixed effects were reported as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Variance inflation factor (VIF) was used to assess multicollinearity, and Akaike Information Criterion (AIC) was used to compare model fit [17].

All analyses were conducted using Stata version 17.0 (StataCorp, College Station, TX, USA). Sampling weights were applied to adjust for the complex survey design and non-response.

3. Results

3.1. Descriptive Characteristics of the Study Population

Table 1 summarizes the sociodemographic characteristics of the 67,842 women included in the study. The mean age is 28.7 years (SD $\pm$ 6.4), with the majority (52.3%) aged between 25 and 34 years. Approximately 38.6% of the respondents has no formal education, while 25.1% has completed secondary education or higher. Nearly 46.8% of the women resides in rural areas, and 61.5% are currently employed.

Regarding household wealth, 21.3% of respondents belong to the poorest wealth quintile, and only 17.5% are in the richest quintile. Across the five countries, the proportion of women who received at least four ANC visits during their last pregnancy ranged from 42.6% in Ethiopia to 74.1% in Ghana.

Table 1 Descriptive characteristics of women aged 15–49 with a recent live birth (N = 67,842)

Characteristic	Frequency	Percentage (%)
Age group (years)		
15–24	16,302	24.0
25–34	35,471	52.3
35–49	16,069	23.7
Education level		
No education	26,233	38.6
Primary	24,486	36.1
Secondary or higher	17,123	25.3
Household wealth index		
Poorest	14,448	21.3
Richest	11,879	17.5
Place of residence		
Urban	36,132	53.2
Rural	31,710	46.8
ANC visits ($\geq$ 4 visits)	43,198	63.7

3.2. Bivariate Analysis

Bivariate analysis using chi-square tests indicated significant associations between adequate ANC utilization and several individual-level factors, including maternal education, household wealth, and employment status ($p < 0.001$ for all). Higher rates of ANC utilization were also observed in urban communities and among women from clusters with higher female literacy and more gender-equitable norms.

3.3. Multilevel Logistic Regression Results

Table 2 presents the adjusted odds ratios (AORs) from the multilevel logistic regression models.

3.3.1. Model 1 (Individual-Level Factors Only):

- Women with secondary education or higher were 2.21 times more likely to have adequate ANC visits than those with no education (AOR: 2.21; 95% CI: 2.09–2.34).
- Employment was positively associated with ANC utilization (AOR: 1.28; 95% CI: 1.19–1.38).
- Belonging to the richest wealth quintile significantly increased the odds of ANC use (AOR: 2.45; 95% CI: 2.32–2.59).

3.3.2. Model 2 (Community-Level Factors Only):

- Residing in a community with a high female literacy rate significantly predicted ANC utilization (AOR: 1.77; 95% CI: 1.62–1.93).
- Living in communities with patriarchal gender norms reduced the likelihood of ANC use (AOR: 0.68; 95% CI: 0.60–0.76).
- Urban residence increased odds of adequate ANC use (AOR: 1.55; 95% CI: 1.43–1.68).

3.3.3. Model 3 (Full Model – Individual and Community Factors):

- After controlling for all variables:
- Education and wealth retained strong associations.
- Community gender norms remained a significant barrier (AOR: 0.71; 95% CI: 0.63–0.79).
- Intra-class correlation (ICC) reduced from 15.2% in the null model to 6.3% in the full model, indicating that observed variables explained much of the between-cluster variance.

Table 2 Multilevel logistic regression of factors associated with adequate ANC utilization

Variable	AOR (95% CI)	p-value
Individual-Level Factors		
Secondary or higher education	2.21 (2.09–2.34)	<0.001
Employment status (employed)	1.28 (1.19–1.38)	<0.001
Richest wealth quintile	2.45 (2.32–2.59)	<0.001
Age 25–34 years	1.13 (1.06–1.20)	<0.001
Community-Level Factors		
High community female literacy	1.77 (1.62–1.93)	<0.001
Patriarchal community norms	0.71 (0.63–0.79)	<0.001
Urban residence	1.42 (1.31–1.54)	<0.001
Random Effects		
Intra-class correlation (ICC)	6.3%	–
Model AIC (Model 3)	103,458	–

3.4. Summary of Key Findings

- Maternal education and household wealth were strong predictors of ANC use.
- Community-level cultural norms and literacy levels significantly shaped ANC behavior, even after adjusting for individual characteristics.
- The multilevel model demonstrated that contextual factors explain a substantial proportion of the variation in ANC utilization across communities and countries.

4. Discussion

4.1. Principal Findings

This study provides robust evidence that both individual- and community-level socioeconomic and cultural factors significantly influence antenatal care (ANC) utilization in Sub-Saharan Africa. The multilevel analysis showed that while individual determinants such as maternal education, employment, and wealth status were positively associated with ANC uptake, contextual characteristics particularly community literacy levels and prevailing gender norms also exerted a significant impact.

The findings highlight that ANC utilization is not merely a function of personal characteristics but is deeply embedded in the socioeconomic and cultural fabric of the community. Women residing in communities with low female literacy and entrenched patriarchal norms were significantly less likely to access adequate ANC, regardless of their individual education or income level.

4.2. Comparison with Previous Literature

The positive association between maternal education and ANC utilization has been widely documented in previous studies. Educated women are more likely to be informed about the benefits of ANC, possess greater autonomy in household decision-making, and better navigate health systems [18,19]. Similarly, wealthier women are more likely to overcome financial and logistical barriers to accessing health facilities, a trend corroborated by findings from other LMICs [20].

Employment status, often a proxy for economic empowerment, was also positively associated with ANC use, aligning with studies suggesting that women with independent income sources have enhanced bargaining power and mobility [21].

Importantly, our findings affirm that community characteristics have independent and substantial effects on ANC utilization. Higher community female literacy was a strong predictor of increased ANC use. This may reflect the diffusion of health-related knowledge, positive peer influence, and collective empowerment within communities where women are more educated [22].

In contrast, patriarchal norms at the community level significantly decreased the likelihood of ANC use, supporting qualitative studies that have shown how cultural beliefs and male-dominated decision-making structures restrict women's health-seeking behavior [23,24]. These findings emphasize that health behaviors are socially conditioned and that interventions targeting individual behavior alone may fall short if they neglect the wider social and cultural context.

4.3. Policy and Programmatic Implications

The results of this study underscore the need for multifaceted interventions that simultaneously target individual empowerment and community-level transformation. From a policy perspective, increasing female education remains a critical strategy, not only for improving health literacy but also for fostering social environments that support women's healthcare utilization.

Economic empowerment programs such as conditional cash transfers or community savings schemes may directly improve household resources and indirectly challenge patriarchal power dynamics by increasing women's decision-making authority [25].

At the community level, engaging local leaders, men, and religious figures in health promotion campaigns can help reshape cultural norms around maternal health. Community dialogues and participatory learning approaches have been effective in transforming harmful gender attitudes in similar settings [26].

Health systems should also prioritize the decentralization and cultural adaptation of services. For example, providing mobile ANC clinics in remote or conservative communities, or training female healthcare providers, can reduce access barriers related to geography and gender sensitivity [27].

Finally, integrating community-level data into health monitoring and planning can improve the targeting of resources to underserved populations. Programs that combine spatial mapping with multilevel indicators may help identify high-risk clusters where women are most likely to underutilize ANC services [28].

4.4. Strengths and Limitations

This study has several strengths. It uses large, nationally representative DHS datasets from multiple countries and applies a multilevel analytical framework that accounts for clustering and contextual variation. The consistent pattern of findings across diverse settings strengthens the validity and generalizability of the results.

However, the study also has limitations. The cross-sectional nature of DHS data precludes causal inference. There is also potential for recall bias, as ANC use was self-reported. Furthermore, the proxy indicators used for community norms may not capture the full complexity of cultural attitudes toward maternal health. Additionally, some relevant factors such as quality of care, facility proximity, and partner involvement were not included due to data constraints.

Despite these limitations, the findings provide compelling evidence of the need to address both individual and community-level determinants in order to achieve universal ANC coverage in Sub-Saharan Africa.

4.5. Directions for Future Research

Future studies should explore longitudinal designs to better understand the causal pathways linking socioeconomic and cultural contexts to ANC utilization. Qualitative and mixed-methods research can also provide deeper insights into how women navigate community norms and institutional barriers.

Moreover, future research should assess the role of health system variables such as provider availability, quality of care, and facility-level gender responsiveness. Integrating geospatial data and social network analysis may further elucidate how local environments shape maternal health behaviors.

5. Conclusion

This study provides critical evidence that antenatal care (ANC) utilization in Sub-Saharan Africa is shaped by a complex interplay of individual and community-level socioeconomic and cultural factors. While maternal education, wealth, and employment significantly predict ANC attendance, the influence of broader community dynamics such as female literacy rates and entrenched gender norms remains substantial even after adjusting for personal characteristics.

The multilevel analytical approach used in this study reveals that healthcare behavior, particularly in relation to maternal services, cannot be adequately understood without accounting for the contextual environment in which women live. The persistence of poor ANC uptake in certain communities reflects deeper structural and cultural inequities that cannot be addressed solely through health-sector interventions.

These findings call for a paradigmatic shift in how health systems, policymakers, and development agencies conceptualize and address maternal health. Programs that emphasize only individual-level behavior change without acknowledging the broader sociocultural milieu risk missing a substantial portion of the problem. Effective interventions must therefore be holistic, addressing both the structural enablers and the social norms that condition women's health choices.

Improving ANC utilization requires an equity-centered approach one that goes beyond improving access to also dismantling the societal barriers that disproportionately affect vulnerable and marginalized groups. Education, gender equality, and community empowerment must become integral components of maternal health strategies in LMICs.

5.1. Recommendations

Based on the study's findings, the following recommendations are proposed:

- Governments and stakeholders must prioritize the expansion of universal education, particularly for girls. Educational attainment not only enhances knowledge about pregnancy-related services but also promotes autonomy and decision-making capacity, which are crucial for healthcare utilization.
- Health promotion programs should engage community influencers including male household heads, traditional leaders, and religious institutions to challenge harmful cultural beliefs and gender norms that limit ANC use.
- Conditional cash transfers and transportation vouchers should be integrated into maternal health programs to reduce direct and indirect costs associated with ANC access for poor households.
- Health planners should adopt data-driven, multilevel models in resource allocation and service delivery. This includes mapping underserved clusters and tailoring interventions to both individual and contextual determinants.

- Health systems should recruit, train, and deploy more female health workers in rural and culturally conservative communities. Facilities should also ensure privacy, respectful maternity care, and active community engagement to encourage trust and service uptake.
- ANC uptake should be addressed not only by ministries of health but also through partnerships with education, gender affairs, and social welfare sectors. Such collaboration enhances the sustainability and scalability of maternal health interventions.

By embedding these recommendations into national and regional strategies, countries in Sub-Saharan Africa can make meaningful strides toward achieving Sustainable Development Goal 3, which aims to ensure healthy lives and promote well-being for all, including reducing the global maternal mortality ratio to less than 70 per 100,000 live births by 2030.

Compliance with ethical standards

Disclosure of conflict of interest

The author declares no conflict of interest related to the design, execution, analysis, or publication of this research.

Statement of ethical approval

This study is based on secondary analysis of publicly available Demographic and Health Survey (DHS) data, which are anonymized and de-identified prior to release. The DHS program obtains ethical clearance for each country-specific survey from relevant national ethics committees and the Institutional Review Board (IRB) of ICF International, USA. Therefore, no additional ethical approval was required for this study. Access to the data was granted through formal registration and approval from The DHS Program (<https://dhsprogram.com>).

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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