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Socioeconomic Determinants and Health Literacy-Related Pathways to Prenatal Care Utilization and Birth Outcomes in Nigeria

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Background and Objectives: Prenatal care utilization and healthy birth outcomes remain unevenly distributed across socioeconomic groups in many low- and middle-income countries (LMICs), including Nigeria. While socioeconomic status (SES) is a well-established determinant of maternal health, less is known about how SES operates through pathways associated with health literacy to influence prenatal care use and birth outcomes at the population level. This study examines the extent to which socioeconomic determinants conceptualized as pathways to health literacy shape prenatal care utilization and birth outcomes among women in Nigeria.

Material and Methods: Using nationally representative data from Nigeria's Multiple Indicator Cluster Survey (MICS) Round 6, we analyzed women aged 15–49 years with a recent live birth. Prenatal care utilization was assessed using both extensive (receipt of any prenatal care) and intensive (frequency of prenatal visits) measures. Birth outcomes were measured using recorded birth weight and maternal assessment of child size at birth and using socioeconomic and health literacy–related proxy indicators including maternal education and media exposure, a composite media exposure index and household wealth index. Multivariable logistic regression models were estimated, reporting adjusted odds ratios, while accounting for survey design and relevant demographic controls.

Results: Higher maternal education, greater household wealth, and increased media exposure were significantly associated with higher odds of receiving prenatal care and, to a lesser extent, more frequent prenatal visits. These associations were stronger for extensive utilization than for intensity of use. For birth outcomes, maternal education and regional location showed consistent associations with both birth weight and child size at birth, while wealth and media exposure demonstrated more pronounced effects when child size was used as a secondary outcome. Substantial regional disparities persisted, highlighting contextual inequities in maternal health access and outcomes.

Conclusion: Socioeconomic determinants influence prenatal care utilization and birth outcomes in Nigeria through health literacy related pathways that enhance informational access, decision-making capacity, and engagement with health services. Policies aimed at improving maternal and neonatal health in LMICs should integrate health literacy strategies alongside socioeconomic interventions to reduce persistent inequities.

Keywords: Health literacy; Prenatal Care Utilization; Birth Outcomes; Socioeconomic Status; Nigeria

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Introduction

Prenatal care is a fundamental component of maternal and neonatal health, serving as a critical platform for risk identification, health education, and early intervention during pregnancy. Adequate and timely prenatal care has been consistently associated with reductions in maternal mortality, preterm birth, low birth weight, and preventable neonatal deaths (1,2). As a result, improving access to quality prenatal care remains central to the achievement of the Sustainable Development Goals (SDGs), particularly Goal 3, which emphasizes maternal and child health equity (3). Despite global progress, substantial disparities in prenatal care utilization persist, particularly in low- and middle-income countries (LMICs), where socioeconomic inequalities continue to shape maternal health outcomes (4,5).

A growing body of evidence indicates that socioeconomic status (SES) strongly influences maternal health behaviors and outcomes through multiple, interrelated pathways. Women from wealthier households and those with higher educational attainment are more likely to initiate prenatal care early, attend the recommended number of visits, and receive higher-quality services compared with their socioeconomically disadvantaged counterparts (2,6,7). Conversely, women with lower SES often face financial constraints, geographic barriers, and limited access to health information, increasing the likelihood of delayed or inadequate care and adverse birth outcomes (8-10). These patterns have been documented across sub-Saharan Africa, including West African contexts comparable to Nigeria, underscoring the consistent role of socioeconomic resources in shaping maternal health service utilization (11,12).

Health literacy provides a critical conceptual lens for understanding how socioeconomic conditions translate into differential prenatal care utilization and birth outcomes. Health literacy refers to the ability to access, understand, appraise, and apply health information in ways that promote informed health decisions and behaviors (13). Limited health literacy, often concentrated among women with low education, low income, and restricted exposure to health information, can impede effective navigation of health systems, comprehension of antenatal recommendations, and adherence to clinical guidance (14). Empirical studies have demonstrated that low maternal health literacy is associated with fewer prenatal visits, delayed care initiation, and poorer pregnancy outcomes, highlighting the importance of informational and cognitive dimensions alongside material resources (13,14).

The Andersen Behavioral Model of Health Service Use offers a robust theoretical framework for situating health literacy within broader socioeconomic determinants of maternal health. The model posits that health service utilization is shaped by predisposing factors (e.g., age, education), enabling resources (e.g., household wealth, access to information), and need factors (15). Within this framework, education and media exposure function as key pathways to health literacy, influencing women's capacity to recognize the importance of prenatal care, interpret health messages, and sustain engagement with maternal health services. By conceptualizing SES as a structural determinant that operates partly through health literacy, the Andersen model provides a theoretically grounded basis for examining inequalities in prenatal care utilization and birth outcomes.

Nigeria represents a priority setting for investigating these relationships. Despite policy efforts to improve maternal health, such as the expansion of antenatal services and deployment of skilled health workers, the country continues to bear a disproportionate burden of maternal and neonatal morbidity and mortality (9,16). Nationally representative studies reveal persistent socioeconomic and geographic disparities in prenatal care utilization, with women in rural areas and lower wealth quintiles experiencing significantly poorer access to services and worse birth outcomes (4,8,11). These inequities mirror broader global challenges in LMICs, where the benefits of maternal health interventions often fail to reach the most vulnerable populations, emphasizing the need for evidence-based strategies that address both structural and informational barriers.

Accordingly, this study investigates how socioeconomic determinants function as pathways related to health literacy in shaping prenatal care utilization and birth outcomes among women in Nigeria. Specifically, the study examines (i) the association between socioeconomic and health literacy-related factors and prenatal care utilization, and (ii) the relationship between these factors and birth outcomes using nationally representative MICS Round 6 data. By distinguishing between extensive and intensive prenatal care utilization and employing complementary measures of birth outcomes, the study contributes to population-level evidence relevant to maternal health policy and health literacy research in low- and middle-income countries.

Against this backdrop, there is a pressing need for population-based evidence that explicitly links socioeconomic determinants, health literacy-related pathways, prenatal care utilization, and birth outcomes within a unified analytical framework. Using nationally representative data from the Multiple Indicator Cluster Survey (MICS) Round 6, this study examines how socioeconomic factors operationalized through wealth, education, and media exposure shape prenatal care utilization and birth outcomes among Nigerian women. Employing logistic regression models and reporting odds ratios, the study aims to generate policy-relevant insights into how health literacy-related inequalities contribute to maternal and neonatal

health disparities. The findings are intended to inform equitable maternal health policies in Nigeria and offer lessons applicable to other LMIC settings facing similar challenges.

Theoretical and Empirical Literature Review

Theoretical Background

This study is guided by the Andersen Behavioral Model of Health Service Use, a widely applied and empirically validated framework for understanding patterns of health care utilization. Originally developed by Ronald M. Andersen in 1968 and subsequently refined, the model posits that individuals' use of health services is determined by the interaction of predisposing characteristics, enabling resources, and need factors (15,17). The model has been extensively used in maternal and child health research, particularly in low- and middle-income countries, to explain inequalities in access to and utilization of prenatal and delivery services (2,8).

Predisposing factors refer to socio-demographic characteristics that influence an individual's inclination to seek health care prior to the onset of illness or need. These include age, marital status, education, and social structure (15). In maternal health contexts, maternal education plays a particularly salient role, shaping cognitive skills, health awareness, and the capacity to interpret and act upon health information. Education has been consistently linked to higher levels of health literacy, enabling women to better understand antenatal care recommendations, recognize danger signs during pregnancy, and engage proactively with health services (13,14). Within this framework, education may function as an important pathway associated with health literacy, not merely as a socioeconomic marker influencing prenatal care utilization.

Enabling resources represent the means that facilitate or hinder access to health services, independent of individual predispositions. These include household economic resources, health insurance coverage, place of residence, and access to health-related information (17). In this study, household wealth and media exposure are conceptualized as central enabling resources. Household wealth affects the ability to bear direct and indirect costs of care, such as transportation and opportunity costs, which are well-documented barriers to prenatal care in sub-Saharan Africa (11). Media exposure through radio, television, and print media enhances access to health information, reinforces public health messaging, and strengthens health literacy by increasing awareness of available prenatal services and recommended care practices (13,18). Together, these enabling resources shape women's practical capacity to utilize prenatal care services.

Need factors refer to both perceived and clinically evaluated health needs that prompt care-seeking behavior, such as pregnancy-related symptoms, perceived risk, or complications (15). In maternal health research, need factors often capture biological and reproductive

characteristics that influence service uptake regardless of socioeconomic position. While the present study focuses primarily on socioeconomic and health literacy-related pathways, the inclusion of reproductive and demographic controls allows for partial adjustment for underlying need-related differences across women.

By integrating the Andersen Behavioral Model, this study conceptualizes socioeconomic determinants education, wealth, and media exposure as structural pathways to health literacy, which in turn influence prenatal care utilization and birth outcomes. This theoretical approach recognizes that disparities in maternal health are not solely the result of individual choices but are embedded within broader social and informational contexts. In Nigeria, where pronounced socioeconomic and geographic inequalities coexist with persistently high maternal and neonatal mortality, the Andersen model provides a robust framework for examining how structural resources and health literacy jointly shape maternal health behaviors and outcomes. This framework supports the study's empirical strategy and underscores the policy relevance of addressing both economic and informational barriers to improve equitable maternal health outcomes.

In the absence of direct health literacy measures in the Multiple Indicator Cluster Survey (MICS) dataset, this study conceptualizes maternal education and media exposure as health literacy-related enabling pathways rather than direct measures of health literacy itself. This approach is consistent with previous public health studies that utilize educational attainment and information exposure as proxy indicators associated with individuals' ability to access, understand, and utilize health information in resource-constrained settings (13,14).

Empirical Literature Review

A substantial body of empirical evidence demonstrates that socioeconomic factors play a decisive role in prenatal care utilization and birth outcomes, particularly in low- and middle-income countries (LMICs). Globally, maternal education and household wealth are consistently associated with earlier initiation of prenatal care and higher likelihood of meeting recommended antenatal visit thresholds (2,19). Education enhances women's capacity to understand health information and engage with health systems, while household wealth reduces financial and logistical barriers to accessing care (6). Further empirical studies also link low socioeconomic status to adverse birth outcomes, including low birth weight, preterm delivery, and neonatal mortality. Women with limited education often have reduced knowledge of maternal nutrition, pregnancy danger signs, and appropriate care-seeking behaviors, increasing their risk of complications (14). Financial constraints further restrict access to quality prenatal and obstetric care, reinforcing vulnerabilities to poor birth outcomes in resource-limited settings (9).

Similar studies further underscore the relevance of health literacy frameworks for understanding maternal health behaviors. Health literacy has emerged as an important mechanism through which socioeconomic factors may influence maternal health behaviors

and outcomes. Higher health literacy, often associated with education and exposure to health information through mass media, is linked to improved understanding of antenatal guidelines, greater adherence to care recommendations, and increased utilization of prenatal services (13). Conversely, low health literacy can intensify the effects of socioeconomic disadvantage, particularly in LMICs with complex and under-resourced health systems (14,19). Moreover, research from diverse settings, including Iran, demonstrates significant associations between maternal health literacy, prenatal care adequacy, and pregnancy outcomes (20,21). Additional studies report consistent relationships between health literacy and prenatal care practices among women attending health facilities, reinforcing the global applicability of health literacy-focused approaches (22,23).

In Nigeria, socioeconomic inequalities in prenatal care utilization are well documented. Analyses of nationally representative surveys show that women in higher wealth quintiles are significantly more likely to receive adequate prenatal care compared with those in lower quintiles, with rural residence further exacerbating disparities due to limited geographic access and infrastructure constraints (8,11). These inequities translate into unequal maternal and neonatal health outcomes across socioeconomic and geographic groups. To sum it up, evidence from Nigeria and other sub-Saharan African countries suggests that interventions combining socioeconomic empowerment with information dissemination can significantly improve prenatal care utilization and reduce adverse birth outcomes (8,11).

Despite extensive evidence linking socioeconomic status, health literacy, and maternal health outcomes, several gaps remain. First, many studies examine either socioeconomic determinants or health literacy in isolation, with limited empirical integration of both within a unified analytical framework. Second, evidence from Nigeria has largely focused on prenatal care utilization, with comparatively fewer studies jointly assessing prenatal care and birth outcomes using nationally representative data. Third, few studies explicitly operationalize socioeconomic factors as pathways to health literacy, as theorized by the Andersen Behavioral Model of Health Service Use, while reporting adjusted odds ratios to enhance policy relevance. This study addresses these gaps by leveraging nationally representative MICS Round 6 data to examine how socioeconomic determinants operate through health literacy-related pathways to influence both prenatal care utilization and birth outcomes in Nigeria.

Materials and Methods

Study Design and Data Source

This study employed a cross-sectional design using data from the Nigeria Multiple Indicator Cluster Survey (MICS) Round 6, conducted between 2016 and 2017. MICS is a nationally representative household survey implemented by UNICEF in collaboration with national statistical agencies to monitor key health, education, and social indicators, with a strong emphasis on maternal and child health. The survey adopts a two-stage stratified cluster

sampling design, ensuring representativeness at national and subnational levels. Sampling weights were applied to account for unequal probabilities of selection and non-response, in line with standard survey analysis practice (24,25). The analytical sample comprised women aged 15–49 years who reported a live birth within two years preceding the survey. Women with missing information on key outcome, explanatory, or control variables were excluded to maintain analytical consistency and data completeness.

Outcome Variables

Two categories of outcome variables were examined: first, prenatal care utilization, measured using two indicators that include receipt of any prenatal care (binary: yes/no), and adequate prenatal care, defined as attending four or more antenatal visits, consistent with World Health Organization guidelines at the time of the survey (1). Second, birth outcomes, captured using birth weight, dichotomized as low birth weight (<2.5 kg) versus normal weight, and child size at birth, based on maternal assessment (small versus average/large), commonly used in LMIC settings where measured birth weight may be missing (26). Therefore, for analytical consistency, prenatal care frequency was dichotomized into adequate versus inadequate utilization based on WHO recommendations.

Independent Variables

The key independent variables reflected socioeconomic determinants conceptualized as pathways to health literacy including maternal education level (no formal education, primary, secondary, higher); household wealth index, constructed by MICS using principal component analysis of household assets and categorized into quintiles (poorest to richest); and media exposure, measured as a composite index capturing regular exposure to radio, television, or newspapers, reflecting access to health-related information. These variables capture both structural resources and informational access consistent with the Andersen Behavioral Model.

Control Variables

The models controlled for potential confounders commonly associated with maternal health service use and birth outcomes, including maternal age (grouped), place of residence (urban/rural), marital status, and geopolitical zone. These controls help isolate the independent effects of socioeconomic and health literacy related factors.

Estimation Strategy

Data analysis was conducted using Stata 17, accounting for survey weights, clustering, and stratification. Descriptive statistics summarized sample characteristics, followed by bivariate analyses assessing unadjusted associations. Multivariable logistic regression models were estimated for each binary outcome. The general model specification is:

$$\text{logit}\,(Y_i) = \beta_0 + \beta_1 SES_i + \beta_2 HL_i + \beta_3 X_i + \varepsilon_i \quad ----------(1)$$

Where Y_i denotes prenatal care utilization or birth outcomes, SES_i represents socioeconomic indicators, HL_i captures health literacy related proxies, and X_i is a vector of control variables.

Results are presented as adjusted odds ratios (AORs) with 95% confidence intervals. To enhance robustness and policy relevance, average marginal effects (AMEs) were computed and reported as appendix, consistent with best practices for nonlinear models (27,28), and model fit was evaluated using Pseudo R^2 statistics.

Results

Descriptive Statistic

Socioeconomic Distribution of the Respondents

Table 1 presents the socioeconomic characteristics of the respondents disaggregated by place of residence. The distribution reveals pronounced urban–rural disparities across key socioeconomic indicators, highlighting structural inequalities relevant to maternal health and health literacy in Nigeria. Maternal education levels vary substantially by residency. Women residing in rural areas disproportionately report no formal education or only primary education, whereas urban residents are more heavily represented in secondary and tertiary education categories. Notably, higher and tertiary education is overwhelmingly concentrated among urban women, while the majority of women without formal education reside in rural areas. This educational gradient is particularly relevant from a health literacy perspective, as education strongly influences women's capacity to access, comprehend, and apply health information related to prenatal care and pregnancy outcomes.

Table 1. Socioeconomic Distribution of the Respondents

Variables	Residency		Total
	Urban	Rural	
Maternal Education Level			
None	1,816	10,172	11,988
Primary	1,373	4,399	5,772

Junior secondary	1,106	2,528	3,634
Senior secondary	5,370	7,646	13,016
Higher/tertiary	2,778	1,612	4,390
Marital Status			
Currently married	7,084	17,852	24,936
Formerly married	751	1,440	2,191
Never married	5,133	7,849	12,982
Wealth Index			
Poorest	387	8,334	8,721
Second	732	8,112	8,844
Middle	2,892	5,634	8,526
Fourth	4,171	2,996	7,167
Richest	4,264	1,284	5,548

Source: Authors Computation Using Nigeria's MICS Dataset (2023)

Also, marital status distributions also show differences across residential contexts. While the majority of respondents are currently married or in union in both settings, rural areas account for a larger share of currently married women, whereas urban areas show relatively higher proportions of women who have never been married. Marital status is an important contextual factor in maternal health, as it may shape household decision-making dynamics, economic support, and autonomy in seeking prenatal care. Similarly, clear socioeconomic stratification is further evident in the wealth index distribution. Women from the poorest and second wealth quintiles are predominantly concentrated in rural areas, while those in the richest and fourth quintiles are largely urban residents. This stark wealth gradient underscores persistent economic inequalities between urban and rural populations and suggests differential access to enabling resources such as transportation, healthcare facilities, and information channels. From a health literacy standpoint, wealth may facilitate exposure to health-promoting information and reduce financial barriers to prenatal care utilization.

Thus, the patterns observed in the table indicate that educational attainment and household wealth are closely intertwined with place of residence, reflecting structural disadvantages faced by rural women. These disparities provide important context for subsequent analyses examining how socioeconomic status and health literacy-related pathways influence prenatal care utilization and birth outcomes in Nigeria.

Distribution of Respondents by Media Exposure

Table 2 describes patterns of media exposure among respondents by place of residence, revealing marked urban–rural differentials in access to information channels that are central to health literacy. Across all three media types newspapers, radio, and television rural women are substantially more likely to report no exposure, while regular media engagement is concentrated among urban residents. Newspaper readership is particularly limited, with the vast majority of respondents reporting no exposure at all, especially in rural areas. Regular newspaper consumption (at least once a week or almost every day) remains low nationwide

but is disproportionately higher among urban women. This pattern closely mirrors the educational distribution observed in the table, where higher levels of maternal education are concentrated in urban areas. Given that newspaper use requires basic literacy skills, the low levels of newspaper exposure among rural women likely reflect lower educational attainment and constrained access to print media, reinforcing informational inequalities relevant to maternal health.

Radio remains the most accessible medium across both residential contexts, although significant disparities persist. While a notable proportion of rural women report listening to the radio, a large share still indicates no exposure. Urban women are more evenly distributed across frequency categories, with higher proportions reporting regular listening. Radio's relatively wider reach suggests its continued importance as a channel for disseminating maternal health information, particularly in settings with low literacy; however, uneven access may still limit its effectiveness among the most disadvantaged groups. Television exposure exhibits the strongest urban–rural contrast. Urban respondents are far more likely to watch television regularly, including almost daily, whereas rural women predominantly report no exposure. This pattern aligns with the wealth gradient indicated in the table, as television ownership and access are closely linked to household economic resources and electricity availability. The concentration of frequent television exposure among urban and wealthier women suggests that audiovisual health messaging may disproportionately benefit those already advantaged in terms of socioeconomic status.

Table 2. Distribution of the Respondents by Media Exposure

Variables	Residency		Total
	Urban	Rural	
Frequency of Reading Newspapers			
Not at All	9,865	24,428	34,293
Less than Once a Week	1,245	1,114	2,359
At Least Once a Week	1,000	709	1,709
Almost Every Day	328	90	418
Frequency of Listening to the Radio			
Not at All	5,024	16,809	21,833
Less than Once a Week	2,082	3,704	5,786
At Least Once a Week	2,513	3,493	6,006
Almost Every Day	2,825	2,345	5,170
Frequency of Watching TV			
Not at All	3,499	17,919	21,418
Less than Once a Week	1,304	2,606	3,910
At Least Once a Week	2,297	3,244	5,541
Almost Every Day	5,333	2,579	7,912

Source: Authors Computation Using Nigeria's MICS Dataset (2023)

Therefore, the findings from the table underline media exposure as a critical intermediary between socioeconomic status and health literacy. The strong overlap between higher

maternal education, urban residence, and frequent media engagement highlights how educational and economic advantages translate into greater access to health-related information. Conversely, limited media exposure among rural and less educated women may constrain opportunities to acquire knowledge about prenatal care recommendations and pregnancy-related risks. These descriptive patterns provide important context for subsequent multivariable analyses examining the role of media exposure as a pathway through which socioeconomic inequalities shape prenatal care utilization and birth outcomes in Nigeria.

Maternal Health Experience of the Respondents

Table 3 describes respondents' maternal health experiences, with a focus on reproductive history and place of childbirth, disaggregated by place of residence. The distribution highlights substantial urban–rural differences in engagement with formal maternal health services, which are central to understanding health literacy–related disparities. A majority of respondents in both urban and rural areas report having ever given birth, reflecting the high fertility context of Nigeria. However, the absolute number of women who have given birth is considerably higher in rural areas, consistent with demographic patterns observed in the table. This difference underscores the importance of examining maternal health behaviors within rural contexts, where women are more likely to experience repeated exposure to pregnancy and childbirth-related risks.

Table 3. Socioeconomic Distribution of the Respondents by Maternal Health Experience

Variables	Residency		Total
	Urban	Rural	
Ever Given Birth			
Yes	7,302	17,984	25,286
No	5,146	8,378	13,524
Place of Child Delivery			
Respondent's Home	637	3,718	4,355
Other Home	127	664	791
Tertiary Hospital	57	26	83
General/Specialist Hospital	587	495	1,082
Health Centre/Clinic	636	1,644	2,280
Other Public Clinic	13	29	42
Private Hospital	392	284	676
Private Clinic	59	111	170
Private Maternity Home	76	273	349
Other Private Medical	6	18	24
Public or Private	1	2	3
Other	43	106	149

Source: Authors Computation Using Nigeria's MICS Dataset (2023)

Pronounced disparities emerge in the place of child delivery. Home deliveries either in the respondent's home or another home are overwhelmingly concentrated among rural women. This pattern suggests persistent barriers to the utilization of facility-based delivery services in

rural settings, which may include geographic inaccessibility, financial constraints, and limited awareness of the benefits of skilled birth attendance. From a health literacy perspective, lower levels of education and restricted access to health information, as shown in Tables 1 and 2, may reduce women's ability to recognize delivery-related risks or navigate the health system effectively. On the other hand, facility-based deliveries, particularly in tertiary hospitals and general or specialist hospitals, are disproportionately utilized by urban women. These facilities often require greater financial resources, better physical access, and higher levels of health system familiarity, all of which are more common among urban and socioeconomically advantaged populations. Similarly, deliveries in private hospitals and clinics are more prevalent among urban respondents, reflecting the strong association between household wealth, information access, and use of higher-cost health services.

Primary-level public facilities, such as health centres and clinics, serve a substantial proportion of rural women, indicating their role as the most accessible formal delivery option in resource-limited settings. However, the continued reliance on non-facility deliveries alongside the use of lower-tier facilities suggests gaps in both service availability and health literacy, particularly regarding the perceived importance of skilled delivery care. Thus, the patterns observed in the table reinforce the descriptive evidence from earlier tables, illustrating how socioeconomic disadvantage and limited health literacy converge to shape maternal health experiences. The concentration of home deliveries among rural women highlights the need for interventions that strengthen both access to maternal health services and women's capacity to understand and act on health information. These findings provide essential context for the subsequent multivariable analyses assessing how socioeconomic and health literacy-related pathways influence prenatal care utilization and birth outcomes in Nigeria.

Multivariate Results

Socioeconomic Determinants and Prenatal Care Utilization

Table 4 presents adjusted odds ratios from multivariable logistic regression models examining the association between socioeconomic determinants, health literacy-related pathways, and prenatal care utilization in Nigeria. Two dimensions of utilization are considered: receipt of any prenatal care (extensive margin) and frequency of prenatal care visits (intensive margin), allowing for a more nuanced assessment of maternal health-seeking behavior. The results indicate strong and statistically significant associations between key socioeconomic indicators and the likelihood of receiving prenatal care. Maternal education emerges as a robust predictor, with higher educational attainment significantly increasing the odds of utilizing prenatal care. Similarly, household wealth is positively and significantly associated with prenatal care utilization. Women in higher wealth quintiles are substantially more likely to receive prenatal care, reflecting reduced financial and logistical barriers to accessing services. The media exposure index, conceptualized as a pathway to health literacy, is also positively associated with prenatal care receipt.

Among control variables, maternal age and marital status are positively associated with prenatal care utilization. Married women may benefit from greater household support and decision-making stability, while older women may have accumulated experience or heightened risk perception motivating care-seeking. In contrast, rural residence is associated with lower odds of prenatal care utilization, reflecting persistent geographic and infrastructural barriers, even after controlling for socioeconomic factors. Substantial regional disparities are evident. Women residing in the North West have significantly lower odds of receiving prenatal care compared to the reference region, consistent with longstanding regional inequalities in maternal health service utilization in Nigeria. Conversely, women in the South East exhibit markedly higher odds of prenatal care use, reflecting regional differences in education, health system development, and sociocultural norms.

Table 4. Adjusted Odds Ratios for Socioeconomic Determinants, and Health Literacy-Related Pathways to Prenatal Care Utilization in Nigeria

Independent Variables	(1) Received Prenatal Care	(2) Frequency of Prenatal Care Visits
Education	1.592***	1.262***
	(0.048)	(0.033)
Wealth index quintile	1.537***	1.24***
	(0.049)	(0.039)
Media Exposure Index	1.207***	1.035
	(0.075)	(0.069)
Age Group	1.084***	1.016
	(0.019)	(0.02)
Place of Residence (Rural)	0.851*	1.011
	(0.073)	(0.079)
Married	1.406***	1.093
	(0.184)	(0.148)
North East	1.005	1.016
	(0.084)	(0.083)
North West	0.649***	0.916
	(0.05)	(0.073)
South East	2.89***	2.399***
	(0.544)	(0.309)
South South	0.614***	1.658***
	(0.074)	(0.2)
South West	0.972	2.504***
	(0.131)	(0.337)
Constant	0.553***	0.879
	(0.104)	(0.165)
Observations	9985	7597
Pseudo R^2	0.173	0.086

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1 refer to statistical significance at 99%, 95%, and 90% confidence intervals.

Source: Authors Computation Using Nigeria's MICS Dataset (2023)

Regional effects remain pronounced in the intensive margin, with women in the South East, South South, and South West exhibiting significantly higher odds of frequent prenatal visits. These results highlight the importance of regional health system capacity and contextual factors in sustaining prenatal care utilization. This implies that the results demonstrate that socioeconomic status and health literacy-related pathways operate differently across the extensive and intensive margins of prenatal care utilization. Education, wealth, and media exposure strongly influence whether women access prenatal care at all, while education and wealth play a more decisive role in determining the frequency of visits. These findings are consistent with the Andersen Behavioral Model and existing empirical literature, and they emphasize the need for maternal health interventions that address both informational barriers to care initiation and structural constraints affecting care continuity.

Socioeconomic Determinants, Health Literacy–Related Pathways, and Birth Outcomes

Table 5 presents adjusted odds ratios from multivariable logistic regression models examining the relationship between socioeconomic determinants, health literacy–related pathways, and birth outcomes in Nigeria. Consistent with the analytical strategy, birth weight is treated as the primary outcome, while child size at birth, a maternally reported proxy, is estimated as a secondary outcome to address anticipated missingness in recorded birth weights. Maternal education is positively and statistically significantly associated with favorable birth weight outcomes. In contrast, the wealth index is not statistically significant in the birth weight model. This attenuation may reflect selective reporting of birth weight in low-resource settings, where institutional deliveries and therefore recorded birth weights are more common among wealthier households. Similarly, the media exposure index does not exhibit a statistically significant association with birth weight. On the other hand, regional patterns reveal substantial heterogeneity. Relative to the reference region, women residing in the North East have significantly lower odds of favorable birth weight outcomes, reflecting the compounded effects of conflict exposure, food insecurity, and constrained health system capacity. Conversely, residence in the South East, South South, and South West are strongly associated with improved birth weight outcomes, consistent with regional advantages in maternal education, service access, and socioeconomic development.

Table 5. Adjusted Odds Ratios for Socioeconomic Determinants, and Health Literacy-Related Pathways to Birth Outcomes in Nigeria

	(1)	(2)
Independent Variables	**Birth Weights**	**Child Size at Birth**
Education	1.151**	1.118***
	(0.067)	(0.034)
Wealth index quintile	1.044	1.099***
	(0.076)	(0.038)
Media Exposure Index	0.848	1.196**
	(0.146)	(0.088)

Age Group	0.974	1.041*
	(0.049)	(0.022)
Place of Residence (Rural)	0.815	1.094
	(0.144)	(0.096)
Married	0.992	1.095
	(0.313)	(0.153)
North East	0.636**	0.747***
	(0.116)	(0.074)
North West	1.075	0.692***
	(0.259)	(0.065)
South East	1.884***	0.692***
	(0.436)	(0.092)
South South	2.294***	0.797*
	(0.613)	(0.106)
South West	2.324***	1.018
	(0.584)	(0.145)
Constant	8.263***	3.895***
	(3.749)	(0.788)
Observations	3160	9822
Pseudo R^2	0.047	0.019
Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1 refer to statistical significance at 99%, 95%, and 90% confidence intervals.		

Source: Authors Computation Using Nigeria's MICS Dataset (2023)

Results from the secondary model using child size at birth largely corroborate the primary findings while offering additional insights. Maternal education and household wealth are both positively and significantly associated with larger reported child size at birth, reinforcing their roles as key socioeconomic determinants of neonatal health. The stronger wealth gradient observed in this model likely reflects broader coverage and reduced selection bias, given the substantially larger sample size.

Maternal age also shows a weak but positive association with child size, indicating that older mothers may benefit from experience, greater autonomy, or more stable socioeconomic conditions. In contrast, rural residence and marital status do not exhibit statistically significant effects, suggesting that their influence on birth outcomes may operate indirectly through education, wealth, and access to care. Regional disparities persist in the secondary model. The North East and North West are associated with significantly lower odds of larger child size, underscoring entrenched geographic inequalities in maternal and child health. Interestingly, the South East and South South display lower odds in the child size model despite strong positive effects in the birth weight model, highlighting potential reporting heterogeneity and cultural variation in maternal perceptions of newborn size.

Discussion

Discussion of the Empirical Results

The empirical result presented in subsection 4.2.1 is consistent with prior studies documenting education as a critical determinant of antenatal care uptake in Nigeria and other LMICs, largely through enhanced health literacy, autonomy, and capacity to navigate health systems (2,8,29,30). Also, the coefficient of household wealth index aligns with extensive evidence from Nigeria and sub-Saharan Africa showing that economic resources facilitate engagement with formal maternal health services (6,11,31). In addition, evidence from the study suggests that greater exposure to mass media significantly increases the likelihood of accessing prenatal services, supporting findings that information access enhances awareness of antenatal care benefits and service availability (18,32). This underscores the relevance of informational environments in shaping maternal health behaviors beyond purely economic constraints.

Moreover, when examining the frequency of prenatal care visits, the magnitude and significance of associations differ. Education and household wealth remain positive and statistically significant predictors, indicating that socioeconomic advantages not only influence the decision to seek care but also the intensity of engagement with prenatal services. These findings reinforce the role of sustained enabling resources in facilitating adherence to recommended antenatal schedules. In contrast, the statistically insignificant effect of media exposure in the intensive utilization model suggests that while information access may be critical for initiating prenatal care, additional structural and economic constraints may limit women's ability to attend multiple visits. Similar patterns have been observed in previous studies, where informational interventions improved initial uptake but had weaker effects on care continuity (19,33). While media exposure may influence health-seeking behaviors such as prenatal care utilization, its direct effect on birth weight may be mediated through intermediate inputs like nutrition, infection prevention, and quality of care, which are not fully captured in the model.

Nevertheless, the empirical findings on the association between socioeconomic and informational pathways and birth outcomes presented under subsection 4.2.2 indicate that higher educational attainment increases the odds of normal birth weight, supporting extensive evidence that maternal education improves fetal health through enhanced health knowledge, nutrition practices, and utilization of prenatal services (34,2,35). This finding reinforces education as a foundational health literacy-related pathway influencing early-life health. The non-significant estimated wealth effect on measured birth weight may be biased toward null due to non-random missingness, a challenge well documented in Demographic and Health Surveys (DHS) and MICS-based studies (36,31). Notably, the media exposure index is positively and significantly associated with child size at birth. This suggests that information access and health messaging may meaningfully influence maternal behaviors such as nutrition, rest, and care-seeking during pregnancy that translate into improved fetal growth, even when objective birth weight data are unavailable. This finding aligns with studies linking

mass media exposure to improved maternal nutrition and newborn outcomes in low-income settings (37-39).

Hence, the results indicate that education consistently predicts favorable birth outcomes across both objective and subjective measures, underscoring its central role as a health literacy-related pathway. Wealth and media exposure show stronger and more consistent effects when using maternally reported child size, suggesting that measurement constraints in birth weight data may obscure underlying socioeconomic gradients. The modest pseudo-R^2 values are typical of micro-level health outcome models and reflect the multifactorial nature of birth outcomes, many determinants of which, such as maternal nutrition, infection exposure, and stress, are not directly observed in household surveys. The substantial regional disparities observed in the study highlight the contextual nature of maternal healthcare utilization and birth outcomes in Nigeria. Women residing in northern regions exhibited consistently lower utilization of prenatal services and less favorable birth outcomes relative to some southern regions. These disparities likely reflect broader structural inequalities related to educational attainment, poverty, health infrastructure, insecurity, and sociocultural barriers affecting maternal healthcare access (32,33). The findings suggest that nationally uniform maternal health interventions may be insufficient without region-specific health literacy and service delivery strategies.

Thus, the findings demonstrate that health literacy–related socioeconomic factors shape birth outcomes in Nigeria, with effects that are sensitive to outcome measurement. Interventions aimed at improving maternal education and expanding access to reliable health information particularly in disadvantaged regions are likely to yield meaningful gains in neonatal health. The complementary use of birth weight and child size at birth strengthens the robustness of the analysis and enhances its relevance for policy in data-constrained settings.

Study Limitations and Strengths: This study has several limitations. First, the cross-sectional nature of the MICS data limits causal inference and prevents conclusions regarding temporal relationships between socioeconomic factors, prenatal care utilization, and birth outcomes. Second, the dataset does not contain a direct multidimensional measure of health literacy. Consequently, the study relied on proxy indicators, particularly maternal education and media exposure, to capture health literacy–related pathways. While this approach is supported by prior public health literature, it may not fully reflect the broader conceptual dimensions of health literacy, including communication, comprehension, and decision-making skills. Third, mediation analysis was not conducted because of limitations in the available measures and the cross-sectional structure of the data. Future studies using validated health literacy instruments and longitudinal data would therefore provide stronger evidence regarding the mediating role of health literacy in maternal healthcare utilization and birth outcomes. Finally, birth weight data were characterized by missing observations, although the use of child size at birth as a complementary measure helped improve analytical robustness. Future research

should therefore employ longitudinal or mixed-methods designs incorporating validated multidimensional health literacy measures to better examine causal mechanisms linking socioeconomic status, health literacy, prenatal care utilization, and maternal health outcomes in LMIC settings.

Conclusions

This study provides robust empirical evidence that socioeconomic determinants particularly maternal education, household wealth, and media exposure shape prenatal care utilization and birth outcomes in Nigeria through health literacy–related pathways. Drawing on nationally representative MICS data and grounded in the Andersen Behavioral Model of Health Service Use, the findings demonstrate that women with higher educational attainment, greater economic resources, and increased exposure to mass media are significantly more likely to utilize prenatal care extensively and experience favorable birth outcomes. Education emerges as the most consistent predictor across models, underscoring its central role in enhancing women's capacity to access, interpret, and act upon maternal health information.

Importantly, the results reveal substantial regional disparities, with women in northern regions experiencing persistently worse maternal and neonatal outcomes, reflecting structural inequalities in access to education, information, and health services. The differential effects observed across objective (birth weight) and subjective (child size at birth) measures further highlight the value of health literacy frameworks in interpreting maternal health behaviors and outcomes in data-constrained settings. Consequently, this study advances the maternal health literature by empirically linking socioeconomic status and information access to maternal and neonatal outcomes through pathways associated with health literacy, thereby reinforcing the relevance of health literacy as a critical, yet under-integrated, dimension of maternal health policy in low- and middle-income countries.

Policy Recommendations

The findings yield several policy-relevant implications aligned with health literacy-oriented approaches to maternal and child health. First, investments in female education should be prioritized as a long-term health literacy intervention. Policies that promote girls' secondary and tertiary education particularly in underserved regions are likely to generate sustained improvements in prenatal care utilization and birth outcomes by enhancing women's cognitive, informational, and decision-making capacities. Second, health communication strategies should be strengthened through mass media, with an emphasis on accessible, culturally appropriate maternal health messaging. Expanding the reach of radio and television–based maternal health campaigns, especially in rural and low-literacy settings, can improve awareness of prenatal care guidelines, danger signs during pregnancy, and the benefits of facility-based care. Third, health literacy sensitive prenatal care programs should be integrated into routine maternal health services. Antenatal care delivery should go beyond

clinical contact to include simplified counselling tools, visual aids, and language-appropriate education that account for varying literacy levels. Training frontline health workers in health literacy–responsive communication can enhance the effectiveness of prenatal services.

Fourth, regionally targeted interventions are essential to address persistent geographic inequalities. Northern regions, in particular, would benefit from coordinated investments that combine educational empowerment, media outreach, and improved health system accessibility to mitigate compounded disadvantages affecting maternal and neonatal health. Finally, policymakers should recognize health literacy as a cross-cutting determinant of maternal health and embed it explicitly within national maternal and child health strategies. Monitoring frameworks should incorporate health literacy–related indicators to better capture the informational and cognitive dimensions of care utilization and health outcomes. By framing health literacy within maternal health policy and practice, Nigeria can move toward more equitable and effective strategies for improving prenatal care utilization and birth outcomes, with broader relevance for other low- and middle-income country contexts.

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