

Socioeconomic and Regional Determinants in Childhood Immunization Uptake among Children in Ghana Using Data from the 2022 Ghana Demographic and Health Survey

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Research Article

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Abstract

Background

Achieving universal health coverage requires ensuring that children have access to high-quality, safe, effective and affordable vaccines. The Immunization Agenda 2030 focuses on increasing vaccination services for children who have never received any routine vaccines (zero-dose) and those who have missed some recommended vaccines (under vaccinated children), aiming to reduce immunization rate disparities and promote vaccination equity. This study examines the extent to which socioeconomic and regional factors impact childhood immunization in Ghana among children aged 12–59 months.

Methods

A population-based cross-sectional study was conducted among children aged 12–59 months from the 2022 Ghana Demographic and Health Survey. The analysis was performed using Stata Version 15, which is based on bivariate and multivariate logistic regression models to examine the impact of various independent variables on children's complete immunization in Ghana.

Results

The results revealed that childhood immunization is significantly linked with maternal education, the household wealth index, urban-rural residence, antenatal care attendance, media exposure and perceived distance to a healthcare facility. In addition, our multivariate logistic analysis showed that maternal education, the household wealth index, antenatal care attendance, and marital status remained significantly associated with complete childhood immunization. Surprisingly, our logistics analysis revealed no significant link between full childhood immunization and factors such as urban-rural residence, mother's age, media exposure, employment status, perceived distance to health facilities, and household size.

Conclusions

By exploring these predictors, our paper contributes to the extant literature on ongoing discussions on health equity, vaccination accessibility, and evidence-based public health policy in sub-Saharan Africa. Thus, this paper underlines the need for targeted, equity focused interventions to fully increase childhood vaccination coverage. Further research is needed in developed economies.

1. Background

Globally, childhood immunization is a highly effective and cost efficient public health intervention that greatly decreases morbidity and mortality from vaccine preventable diseases [1, 2]. According to the World Health Organization (WHO), immunization prevents an estimated 3.5 to 5 million deaths each year from diseases including measles, diphtheria, tetanus, pertussis, and poliomyelitis. Despite significant global advancements in vaccine coverage, disparities in childhood immunization remain, especially in

low- and middle-income countries in sub-Saharan Africa (SSA). In many African countries including SSA, incomplete immunization is a major contributor to preventable childhood illnesses, hospitalizations and mortality. Inequalities in vaccine coverage persist as a reflection of wider socioeconomic and healthcare inequalities, despite increased access to routine immunization services via the Expanded Programme on Immunization in several countries. The literature has evidenced that maternal education, household wealth, access to healthcare, use of antenatal care (ANC), and place of residence are critical factors influencing childhood vaccination coverage in SSA [3, 4].

Over the past 20 years, Ghana has been recognized for its comprehensive childhood immunization programmes in SSA, which have significantly increased vaccination coverage [4, 5]. However, national advancements have created disparities in vaccination rates among various demographic groups and regions. Recent evidence from the Ghana Demographic and Health Survey (GDHS) indicates ongoing disparities in childhood immunization coverage among urban versus rural populations, wealth categories, and geographic regions [6]. Furthermore, variability in vaccination coverage leads to an increased risk of outbreaks of vaccine-preventable diseases, with some areas achieving high levels and others experiencing delays and incomplete immunization [7]. However, important gaps remain in the literature. First, previous studies in Ghana were mostly limited to specific vaccines and localized populations which may not reflect recent changes in demographics and healthcare [8]. Furthermore, research in Ghana relies primarily on traditional methods, with few studies addressing how structural inequalities such as wealth, maternal education and geographic location collectively influence immunization outcomes in the evolving healthcare landscape [3, 9].

Moreover, although recent studies have explored vaccination coverage and determinants, limited attention has been given to the joint interaction of socioeconomic inequalities and regional disparities within an integrated analytical framework [6]. Therefore, we close these important gaps to extend the extant literature on the extent to which socioeconomic and regional factors impact childhood immunization in Ghana.

Notably, our paper addresses these gaps by focusing on Ghana for the following valuable reasons. First, Ghana represents a unique public health setting characterized by rapid urbanization, substantial regional socioeconomic variation, expanding healthcare infrastructure, and ongoing immunization policy reforms [9, 10]. Additionally, Ghana's increasing integration of digital health campaigns and community-based health planning services creates an important context for understanding persistent inequalities in vaccine uptake despite improvements in national immunization programmes [11]. Therefore, we suggest that understanding these disparities is essential for designing targeted public health interventions capable of improving equitable vaccine coverage and reducing preventable childhood morbidity and mortality. Against this backdrop, we ask the following important research question:

To what extent do socioeconomic and regional factors influence childhood immunization uptake in Ghana?

By utilizing nationally representative GDHS 2022 data, we examine how maternal education, household wealth, urban-rural residence, antenatal healthcare utilization, media exposure, and geographic region shape childhood immunization outcomes in Ghana. By adopting both bivariate and multivariate logistic regression models, we found that childhood immunization is significantly linked with maternal education, the household wealth index, urban-rural residence, ANC attendance, media exposure and perceived distance to a healthcare facility. In addition, our multivariate logistic analysis revealed that maternal education, the household wealth index, ANC attendance, and marital status remained significantly associated with complete childhood immunization. Surprisingly, our logistics analysis demonstrated no significant link between full childhood immunization and factors such as urban-rural residence, mother's age, media exposure, employment status, perceived distance to health facilities, and household size. By exploring these predictors, our paper contributes to the extant literature on ongoing discussions on health equity, vaccination accessibility, and evidence-based public health policy in sub-Saharan Africa.

The rest of the paper is organized as follows: Section 2 discusses the data source, descriptions of the variables and summary statistics of the sample. Section 3 presents the results and discussions obtained from both bivariate and multivariate logistics regressions. The paper ends with conclusions in section 4, summarizing the key findings, and highlighting the policy recommendations based on the findings.

2. Methods and Data

This paper employed a cross-sectional analytical method utilizing secondary data obtained from the Demographic and Health Survey (DHS) programme. The DHS Programme conducts household surveys in low and middle-income countries to provide standardized data on health indicators, including population health, maternal and child health, fertility, nutrition, and immunization [12]. The study used data from the latest GDHS, applying a multistage stratified sampling design for national representativeness across all administrative regions. The GDHS is suitable considering its extensive and standardized data on childhood immunization, maternal characteristics, household socioeconomic conditions, and healthcare utilization. The survey enables comparative regional analyses because of its nationally representative sampling and detailed geographic breakdown.

In particular, the study used a population aged 12–59 months included in the GDHS dataset. This study suggested that restricting the analysis to children within this age range ensured that participants had sufficient time to complete the recommended national immunization schedule at the time of the survey. The DHS employs a two-stage stratified cluster sampling approach. In the first stage, enumeration areas are selected on the basis of probability proportional to population size. In the second stage, households are systematically selected within each enumeration area. Children with incomplete immunization records or missing information on key explanatory variables were excluded from the final analysis. The sampling weights provided by the DHS dataset were applied during the statistical analyses to account for the complex survey design and ensure nationally representative estimates. The study included a sample of 5,695 children after data cleaning.

2.1. Study Variables

2.1.1. Dependent Variables

Our paper focuses on child immunization status in Ghana, which serves as the main outcome measure of our research. Notably, child immunization is categorized as either complete immunization or incomplete immunization. For complete immunization, it is defined on the basis of the Ghana Expanded Programme on Immunization schedule and DHS vaccination indicators. Children are considered fully immunized if they have received all age-appropriate routine vaccinations, as verified by vaccination cards or maternal recall during the survey. However, children who have not received all recommended vaccine doses are considered incompletely immunized.

2.1.2. Independent Variables

The research included 11 independent variables based on the extant literature examining the determinants of childhood immunization updates in SSA and Ghana. These variables include maternal education level, the household wealth index, region of residence, urban-rural residence, maternal age, ANC attendance, exposure to mass media, marital status, employment status, distance to healthcare facility, and household size. These were selected because the DHS views them as essential elements of maternal healthcare and the literature has shown a strong correlation between them and full immunization [13–16]. Maternal education level was categorized into four categories: no formal education, primary education, secondary education and higher education. The household wealth index developed by the DHS using principal component analysis of household assets is divided into poorest, middle, richer and richest. Region of residence describes the administrative area in Ghana where households are situated, accelerating the evaluation of geographic disparities in immunization uptake according to the GDHS dataset. The place of residence was classified as either rural or urban and defined as a binary variable. Maternal age was measured as a continuous variable in years categorized as: 15–24, 25–34, and 35–49 years. The number of ANC visits was recoded as ≥ 4 visits vs < 4 visits. Exposure to mass media was categorized as “yes” or “no” based on self-reported access to print media, radio, or television. Marital status was recorded as either unmarried or married. Maternal employment status was categorized as either currently employed or not employed during the survey period. Distance to healthcare facilities was examined based on respondents’ perceptions categorized as: “big problem” or “not a big problem” in accessing care. Household size was quantified as a continuous variable for the total number of members and categorized into small (1–4 members), medium (5–7 members), and large (8 or more members) households for subgroup analysis.

2.2. Data analysis

In this study, we used STATA version 15 to analyse the data. The study employed both descriptive and inferential statistics. The variables are presented as frequencies and percentages. The research adopted two models, bivariate and multivariate logistic regression, to examine the effects of independent variables on the complete immunization of children in Ghana. Specifically, multivariate logistic

regression analysis was used to identify independent predictors of childhood immunization uptake, accounting for confounding variables. Adjusted odds ratios with 95% confidence intervals were reported to assess the strength of associations between explanatory variables and complete childhood immunization. The logistic regression model adopted in our study is as follows:

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

where p denotes the probability of the child being fully immunized. $X_1 \dots X_n$ represents the independent variables included in the model, including maternal education, the household wealth index, region of residence, place of residence, maternal age, ANC attendance, media exposure, marital status, employment status, distance to health facilities, and household size. β_0 is the intercept term. The coefficients $\beta_1 \dots \beta_n$ represent the log-odds change in the likelihood of complete immunization associated with a one-unit change in each predictor variable, with all other variables held constant. Statistical significance was determined as two-sided ($p < 0.05$). Notably, all analyses considered the complex survey design of the GDHS, including sampling weights, clustering, and stratification, to ensure validity. Multicollinearity among independent variables was evaluated through the variance inflation factor (VIF) and model goodness of fit.

3. Results and Discussions

3.1. Sociodemographic and economic characteristics

The study sample was weighted to be descriptive of 5,695 children aged 12–59 months. The sociodemographic, maternal and household characteristics associated with these children are shown in Table 1. According to the findings, most mothers were between the ages of 25 and 34 (49.85%), followed by those between the ages of 35–49 (29.52%) and 15–24 (20.63%). In terms of education level, only a small percentage of mothers had higher education (4.46%), with secondary education accounting for the majority (48.10%), followed by no formal education accounting for 27.4%, and primary education representing 20%. With respect to household wealth status, a greater percentage of children came from households in the lowest wealth quintile (22.18%), followed by those in the middle (19.56%) and poorer (21%) categories, few children came from households in the richest (18.41%) and richer representing 18.85% of all children. Next, most of the children were from rural families representing 55%, whereas the others were from urban families representing 45%.

Table 1
Bivariate Results

Variable	Category	COR	95% CI	p-value
Maternal education	Primary vs none	1.3	1.03–1.63	0.027
	Secondary vs none	1.85	1.42–2.42	< 0.001
	Higher vs none	2.68	1.79–4.01	< 0.001
Wealth index	Poorer vs poorest	1.18	0.93–1.49	0.162
	Middle vs poorest	1.29	1.01–1.64	0.041
	Richer vs poorest	1.42	1.11–1.81	0.006
	Richest vs poorest	2.1	1.59–2.77	< 0.001
Residence	Urban vs rural	1.65	1.30–2.09	< 0.001
Maternal age	25–34 vs 15–24	1.1	0.88–1.38	0.39
	35–49 vs 15–24	1.07	0.82–1.40	0.62
ANC visits	≥ 4 visits vs < 4 visits	2.4	1.82–3.18	< 0.001
Media exposure	Yes, vs No	1.38	1.13–1.69	0.002
Marital status	Married/cohabiting vs not married	1.15	0.91–1.46	0.24
Employment status	Employed vs Unemployed	1.08	0.86–1.35	0.51
Distance to facility	Not a big problem vs big problem	1.44	1.12–1.85	0.004
Household size	5–7 vs 1–4	0.95	0.76–1.19	0.65
	≥ 8 vs 1–4	0.89	0.70–1.14	0.35
Note: COR cumulative Odds Ratio, CI= Confidence Interval, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$				

According to the regional distribution, the Ashanti Region (18.7%), Greater Accra Region (15.46%) and Northern Region (12.4%) had the highest proportions of children, whereas the Upper West Region had the lowest proportion. Most mothers were either married or cohabiting with insufficient data suggesting that they were never married, divorced, separated or widowed. Regarding employment, most of the mothers representing 79.3% were employed, with few unemployed mothers during the survey period. Finally, a sizable portion of mothers stated that distance to a medical facility was not a considerable issue representing 72.2%, whereas some mothers still saw distance as a barrier to receiving care, representing 27.74%. Based on the overall results, we suggest that our study population has significant socio-demographic differences in maternal, household and geographic factors that could influence the prevalence of childhood immunization in Ghana.

3.2 Bivariate analysis

We present the results of the bivariate logistic regression analysis examining the crude relationships among explanatory factors and full childhood immunization among Ghanaian children aged 12–59 months, as shown in Table 1.

Table 1 shows that evidence of childhood immunization was significantly linked with maternal education, the household wealth index, urban-rural residence, ANC attendance, media exposure and perceived distance to a healthcare facility at the bivariate level. First, maternal education showed a positive and significant association with childhood immunization. It can be observed that children whose mothers had completed primary school were 1.30 times more likely to be fully immunized than were children whose mothers had not received any formal education (COR = 1.30, 95%, CI = 1.03–1.63, p value = 0.027). Similarly, children whose mothers completed secondary education were 1.85 times more likely to be fully immunized, and those whose mothers completed higher education had an even higher likelihood of 2.68, indicating significant correlations between maternal education rates and child immunization rates (mothers who completed secondary education = COR=1.85, 95%, CI:1.42–2.42, p < 0.001, those who completed higher education = COR=2.68,95%, CI = 1.79–4.01, p value < 0.001).

Moreover, the household wealth index showed a significant effect on childhood immunization, with children from middle-income households having higher odds of full immunization than those from the poorest households (COR = 1.29,95%, CI:1.01–1.64, p value = 0.041). However, those from wealthier households were more likely to be fully immunized, with significant odds ratios of 1.42 and 2.10 for those from the richest and richer households, respectively (COR = 1.42, 95%, CI:1.11–1.81, p = 0.006, COR = 2.10, 95%, CI:1.59–2.77, p < 0.001). The previous findings reinforced our findings such as those of [17–19]. However, the associations for poorer households were not statistically significant.

Our bivariate analysis further revealed that place of residence was significantly associated with immunization status. Children living in urban areas were 1.65 times more likely to be fully immunized than those in rural communities (COR = 1.65,95%, CI:1.30–2.09, p value < 0.001). This finding departs from prior studies in developing countries that reported statistically significant rural disadvantages in child immunization coverage [20–22]. Our findings imply that despite urban health facilities and immunization centres, barriers remain, leading to low immunization coverage among underserved populations in informal settings [23, 24]. Over the last two decades, Ghana has witnessed a rapid pace of urbanization, with substantial growth in slums and informal settlements [3]. Thus, the growing number of underserved children in slums and informal settlements in urban areas in Ghana have contributed to the observed urban disadvantage in the coverage of child immunizations. Given the existence of large spatial disparities in access to and utilization of health services and facilities, the child immunization strategy in Ghana appears to have placed emphasis on rural areas, much to the neglect of underserved populations in urban areas. In line with this, there has been much emphasis on expanding basic health services in rural areas through the Community-based Health Planning and Services (CHPS) programme. The urban-based CHPS has been much more challenging to implement, as the population is more volatile and less well demarcated [25].

Next, we discovered that complete immunization was highly correlated with prenatal care service attendance. Children whose mothers have four or more ANC visits are more likely to be fully immunized than are those whose mothers have fewer visits (COR = 2.40, 95% CI = 1.82–3.18, $p < 0.001$). This implies that having four or more prenatal appointments may increase a child's chances of receiving all recommended immunizations, perhaps because of increased health education, counselling and interaction with medical professionals during pregnancy. These findings are consistent with those of prior studies in SSA [26, 27]. This may be explained by the fact that in Ghana, local health centres are the backbone of the primary health care approach and offer a range of preventive and curative services, including immunization programmes, which have been strengthened at the all-district level following WHO recommendations.

Mass media exposure was significantly correlated with full childhood immunization, with children of mothers exposed to mass media having 1.38 times greater odds of full immunization than those without exposure (COR = 1.38, 95% CI: 1.13–1.69, p value = 0.002). This result is in line with those of previous studies, such as [3, 8, 28]. This is evident in Ghana because mass media platforms, including radio and television, are extensively utilized to communicate public health (PH) information and immunization campaigns, leading to increasing attention to caregivers' awareness, knowledge and acceptance of childhood immunization services. Additionally, compared with mothers who saw the distance to medical facilities as a major obstacle, mothers who saw it as a minor issue were 1.44 times more likely to fully immunize their children (95% CI: 1.12–1.85, p value = 0.004). On the other hand, complete childhood immunization was not significantly correlated with maternal age, marital status, employment status and household size at the bivariate level (p value > 0.05). Thus, we suggest that maternal socioeconomic characteristics, healthcare utilization and accessibility factors are significant predictors of childhood immunization uptake in Ghana.

3.3. Multivariate Analysis

The multivariate logistic regressions used in this study are presented in Table 2. The model supports the examination of factors associated with complete childhood immunization among children aged 12–59 months in Ghana. After adjusting for potential confounding variables, maternal education, the household wealth index, ANC attendance, and marital status remained significantly associated with complete childhood immunization. The results revealed that maternal education was significantly associated with childhood immunization status. Compared with children whose mothers had no formal education, children whose mothers had completed secondary school had a 1.63-fold greater chance of being fully immunized (AOR = 1.63, 95% CI: 1.22–2.18, p value < 0.001). This affirms the findings of previous studies [8, 20, 29]. This suggests that a mother's educational attainment improves access to information and communication with health workers, resulting in a better understanding of immunization schedules and practices [30]. Thus, we argue that improving female and maternal education can serve as a global mechanism to enhance child health outcomes, especially in developing countries including Ghana.

Table 2
Logistic Regression Results

Variable	Category	AOR	95% CI	p-value
Maternal education	Primary vs none	1.21	0.93–1.58	0.154
	Secondary vs none	1.63	1.22–2.18	0.001
	Higher Vs none	2.31	1.45–3.69	< 0.001
Household wealth index	Poorer Vs poorest	1.09	0.84–1.42	0.502
	Middle Vs poorest	1.19	0.91–1.56	0.201
	Richer vs poorest	1.33	1.00-1.77	0.048
	Richest vs poorest	1.82	1.29–2.56	0.001
Urban–rural residence	Urban vs rural	1.14	0.87–1.50	0.337
Maternal age	25–34 Vs 15–24	1.06	0.82–1.38	0.646
	35–49 vs 15–24	1.01	0.74–1.39	0.939
ANC attendance	≥ 4 visits vs < 4 visits	1.87	1.39–2.55	< 0.001
Exposure to mass media	Yes, Vs No	1.24	0.98–1.57	0.071
Marital status	Married/cohabiting vs not married	1.41	1.04–1.92	0.028
Employment status	Employed Vs unemployed	0.96	0.75–1.26	0.831
Distance to healthcare facility	Not a big problem vs big problem	1.22	0.94–1.58	0.126
Household size	5–7 vs 1–4	0.94	0.73–1.21	0.634
	≥ 8 vs 1–4	0.87	0.65–1.16	0.339
Note AOR =Adjusted odds ratio, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CI= Confidence Interval.				

Similarly, children whose mothers have higher education tend to be more fully immunized than those whose mothers have no education (AOR = 2.31, 95%, CI = 1.45–3.69, p value < 0.001) (see Table 2). However, there was no significant correlation between primary education and full immunization (AOR = 1.21, 95%, CI = 0.93–1.58, p value = 0.154). This finding indicates that immunization rates may not depend solely on education, which can be linked to effective immunization campaigns, community health services and public health education that target mothers irrespective of their educational levels [8, 31].

Table 2 further indicates that household wealth has a significant effect on complete childhood immunization. In particular, children from the wealthiest households were substantially more likely to be fully immunized than were children from the poorest households (AOR = 1.82, 95%, CI: 1.29–2.56, p value < 0.001). In comparison, children from the wealthiest households had a higher probability of being

immunized (AOR = 1.33, 95%, CI = 1.00-1.77, p value = 0.048). No significant associations were observed for the poorer and middle wealth categories. These findings were supported by previous studies [18, 19, 26, 32, 33]. For example, [26] reported that children born to mothers in Ethiopia with a higher wealth index were 40% more likely to have received full vaccination status compared with children from women in the poor wealth index group. Similarly, [33] demonstrated that higher economic status was associated with better health. These findings suggest that socioeconomic status significantly impacts childhood immunization uptake in Ghana. Usually, wealthier families have better access to healthcare services, transportation and health information, whereas poorer households encounter barriers such as transportation costs and limited access to health information, reducing their chances of full immunization.

The results in Table 2 show that children whose mothers attended four or more ANC visits were more prone to be fully immunized than those whose mothers had fewer visits (AOR = 1.88, 95%, CI = 1.39–2.55, p value < 0.001). These findings suggest that attendance at ANC services significantly predicts complete immunization. These findings are consistent with those of prior studies in Ghana [34–36]. This finding is pertinent in Ghana because ANC visits provide opportunities for mothers to receive health education, counselling on childhood vaccination and data about immunization meetings from healthcare specialists. In Ghana, ANC services are significant components of maternal and child health programmes and indispensable entry points for the promotion of full childhood immunization. Moreover, our results from the logistics analysis indicate that marital status has significant effects on full childhood immunization. In particular, children of married or partners living together are more likely to be fully immunized juxtaposed with those of single mothers (AOR = 1.41, 95%, CI = 1.04–1.92, p = 0.028), which is consistent with the findings of previous studies [37–40]. [41] did not report significant differences between carers of children with or without complete vaccination status and those with marital status in rural Mozambique, however, other previous studies have associated being in union with a greater likelihood of having a child with a complete vaccination status [38–40]. [39] reported that many women in Uganda, reported significant support from their partners for their child's vaccination, including financial assistance for transportation and permission to proceed with the vaccination process. These findings emphasize the substantial influence of male partners on child vaccination, with the extent of this effect eventually liable upon the male partners' opinions regarding childhood immunization. After adjusting for other factors, our multivariate logistic analysis revealed no significant associations between full childhood immunization and urban-rural residence, maternal age, mass media exposure, employment status, perceived distance to a health facility and household size (see Table 2, p > 0.05). These results indicate that these determinants may not independently influence childhood vaccine uptake in Ghana. First, the lack of major variations amid urban and rural locations may reflect the widespread adoption of national immunization programmes and community-based health services throughout the country [3]. Likewise, the lack of correlation with mothers' age, employment level and household size may suggest that immunization services are universally available to mothers independent of their socioeconomic features. According to [37], nonsignificant connection with the perceived distance to health facilities can signal improvements in outreach programmes and basic

healthcare delivery in Ghana. Overall, our findings suggest that maternal socioeconomic characteristics and the use of maternal health care services are important factors in increasing the use of childhood immunization in Ghana.

4. Conclusion and Policy Recommendations

Improving child health outcomes is essential for development in Sub-Saharan Africa, especially Ghana. Global initiatives such as the Sustainable Development Goals (SDGs) emphasize that investments in child health are crucial for economic growth, as they significantly impact cognitive development, education, and productivity. Therefore, this research investigated the extent to which socioeconomic and regional factors impact childhood immunization in Ghana. The paper analyses children aged 12–59 months from the 2022 GDHS, utilizing bivariate and multivariate logistic regression models to assess the impact of various independent variables on children's complete immunization in Ghana.

The findings from our bivariate analysis revealed that childhood immunization is significantly linked with maternal education, the household wealth index, urban-rural residence, parental care attendance, media exposure and perceived distance to a healthcare facility. Specifically, children's likelihood of being fully immunized increases with maternal education: 1.30 times for primary, 1.85 times for secondary, and 2.68 times for higher education, illustrating a strong correlation between maternal education and immunization rates. Moreover, household wealth significantly influences childhood immunization rates, with middle-income children faring better than those from lower-income families. These findings suggest that socioeconomic status significantly impacts childhood immunization uptake in Ghana.

Our bivariate analysis showed a significant correlation between place of residence and immunization status, revealing that children in urban areas are 1.65 times more likely to be fully immunized than are those in rural areas. This underscores ongoing barriers in underserved populations. Additionally, children whose mothers attend four or more antenatal visits are more likely to be fully immunized due to better health education. Mothers exposed to mass media also see their children having 1.38 times greater odds of full immunization than those without such exposure.

In addition, our multivariate logistic analysis depicted that maternal education, the household wealth index, ANC attendance, and marital status remained significantly associated with complete childhood immunization. The results revealed that maternal education was significantly associated with childhood immunization status. Children whose mothers have secondary education are 1.63 times more likely to be fully immunized than those whose mothers are uneducated, highlighting the role of maternal education in understanding immunization. However, primary education alone does not significantly impact immunization rates, suggesting that other factors, such as effective campaigns and community services, also play a role.

Additionally, household wealth significantly influences immunization uptake, with wealthier families in Ghana having higher vaccination rates. The study revealed that children whose mothers had four or more ANC visits are more likely to be fully immunized. Additionally, we established that marital status affects

immunization rates, with children of married or cohabiting mothers being more likely to be fully vaccinated than those of single mothers are, highlighting the influence of male partners on vaccination decisions.

Surprisingly, our logistics analysis showed no significant link between full childhood immunization and factors such as urban-rural residence, mother's age, media exposure, employment status, perceived distance to health facilities, and household size. These findings indicate that these factors do not influence vaccine uptake independently. The study highlights that immunization services in Ghana are accessible to all socioeconomic groups because of improved outreach programmes, emphasizing the role of maternal socioeconomic factors and healthcare service utilization in increasing childhood immunization rates.

The findings of the paper provide important policy implications for addressing socioeconomic and regional disparities in childhood immunization uptake in Ghana. Significant disparities will still exist especially regarding maternal education, family wealth, ANC utilization and marital status despite Ghana having made enormous strides in increasing immunization coverage through government vaccination programmes and outreach services. These findings underline the need for targeted, equity focused interventions to fully increase childhood vaccination coverage.

First, the strong relationship between maternal education and childhood immunization highlights the necessity of investing in female education as a long-term PH approach. Children of mothers with secondary education were substantially more likely to be fully immunized than those of uneducated mothers were, indicating that educated mothers may have greater knowledge, awareness and comprehension of vaccination benefits and schedules. Consequently, policymakers should increase girl-child education programmes, encourage female retention in secondary school and incorporate maternal and child health education into the school curriculum. In the short term, community-driven health education programmes should target mothers with limited or no formal education by utilizing local languages and culturally appropriate communication tactics. Second, Ghana's ongoing socioeconomic disparities in access to child healthcare services are highlighted by the substantial impact of household wealth on vaccination uptake. Although child immunization programmes are normally free, poorer households may be disproportionately subject to indirect expenses such as transportation, time away from work and other opportunity costs. Thus, government and health stakeholders should enhance pro-poor interventions such as mobile vaccination clinics, community outreach services, transportation support and expanded CHPS programmes in underserved areas.

Third, our findings highlight the importance of ANC attendance in boosting childhood immunization rates. Mothers who attended four or more ANC visits were more likely to fully immunize their children. This suggests the key role of ANC services in maternal health education and vaccine awareness [42]. Thus, we suggest that policies should focus on enhancing healthcare access to improve ANC attendance, starting early pregnancy registration campaigns and improving the quality of ANC counselling. This includes immunization education and postnatal follow up in ANC sessions to motivate

mothers to follow vaccination schedules. In addition, the strong correlation between childhood immunization and marital status indicates that maternal healthcare decisions in Ghana are influenced by partner and family support. Children of married or cohabiting mothers are more likely to be fully immunized than are those of single mothers, potentially because of the support from partners in financial, emotional or decision-making aspects [43]. This highlights the importance of interventions and policies to promote male partner involvement in maternal and child health programmes.

Finally, the lack of significant correlations between full childhood immunization and maternal age, media exposure, employment, perceived distance to health facilities, urban-rural residence and household size indicates that Ghana healthcare delivery systems and immunization outreach activities have enhanced accessibility for several demographic groups. This highlights the positive effects of community-based healthcare initiatives and national immunization programmes. To sustain successes and address remaining socioeconomic inequalities in Ghana, additional funding is essential. Accordingly, policymakers should prioritize equity-based immunization policies focused on vulnerable groups, particularly low-income households and mothers with reduced education to ensure widespread and comprehensive vaccination coverage.

This study has limitations and calls for further for further research. First, the study utilized cross-sectional data from the DHS, thus, causal nexus between socioeconomic factors and childhood immunization uptake could not be established. Moreover, the research relied on important contextual factors such as cultural beliefs, vaccine hesitancy, parental perceptions and the quality of healthcare services, which were not captured in the datasets. Thus, we call for further studies to employ longitudinal and qualitative methods to better understand the underlying social, cultural and healthcare related factors influencing childhood immunization uptake in Ghana, especially in vulnerable populations.

Abbreviations

ANC	
Antenatal Care	
AOR	
Adjusted Odds Ratio	
CHPS	
Community-based Health Planning and Services	
CI	
Confidence Interval	
COR	
Crude Odds Ratio	
DHS	
Demographic and Health Survey	
GDHS	

Ghana Demographic and Health Survey

IA2030

Immunization Agenda 2030

PH

Public Health

SDGs

Sustainable Development Goals

SSA

Sub-Saharan Africa

VIF

Variance Inflation Factor

WHO

World Health Organization

Declarations

Ethics statement

This study used secondary data from the 2022 Ghana Demographic and Health Survey (GDHS), which was conducted by the DHS Program in collaboration with national partners in Ghana. The survey protocol was reviewed and approved by the Ghana Health Service Ethics Review Committee (GHS-ERC) and the Institutional Review Board of ICF. The survey was conducted in accordance with relevant ethical guidelines and regulations for research involving human participants.

Permission to access and analyse the GDHS dataset was obtained from the DHS Program. The data were fully anonymised before being made available to researchers, and all information was treated confidentially in accordance with DHS data-use policies. As this study involved the analysis of de-identified secondary data, additional ethical approval was not required.

Informed consent

Written informed consent was obtained from all participants before participation in the 2022 GDHS. For participants who were minors, informed consent was obtained from a parent or legal guardian in accordance with DHS ethical procedures and approved survey protocols.

Consent for publication

Not applicable. The manuscript contains no individual personal data.

Availability of data and materials

In this study, we cannot make the data publicly available, because we were not permitted to do so by the data providers. The datasets analysed during this study are publicly available from the DHS Programme

repository. Access to the data is subject to registration and approval by the DHS Programme and can be requested through the DHS Programme website at <https://dhsprogram.com/>

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

J.A.Y conceptualised the study, developed the methodology, conducted the literature review, performed the statistical analyses, interpreted the findings, and drafted the manuscript.

S.B contributed to study design, interpretation of results, critical revision of the manuscript, and overall intellectual content. Both authors read and approved the final manuscript.

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References

1. Brenzel L et al. *Vaccine-preventable diseases*. Disease Control Priorities in Developing Countries. 2nd edition, 2006.

2. Kaufmann SH. Highly affordable vaccines are critical for our continued efforts to reduce global childhood mortality. *Hum Vaccines Immunotherapeutics*. 2019;15(11):2660–5.
3. Asuman D, Ackah CG, Enemark U. Inequalities in child immunization coverage in Ghana: evidence from a decomposition analysis. *Health Econ Rev*. 2018;8(1):9.
4. Budu E, et al. Trend and determinants of complete vaccination coverage among children aged 12–23 months in Ghana: analysis of data from the 1998 to 2014 Ghana demographic and health surveys. *PLoS ONE*. 2020;15(10):e0239754.
5. Walana W, et al. Childhood immunization in Ghana: Tracing the history and projecting the future. *Public Health Challenges*. 2024;3(2):e176.
6. Saani AT, Azumah GE. Sociodemographic and geographic determinants of childhood immunization coverage and equity in Ghana: Analysis of the 2022 demographic and health survey. *PLoS ONE*. 2026;21(4):e0337505.
7. de Cantuária Tauil M, Sato APS, Waldman EA. Factors associated with incomplete or delayed vaccination across countries: a systematic review. *Vaccine*. 2016;34(24):2635–43.
8. Yeboah D, Engmann GM, Jakperik D. Modelling the determinants of uptake of complete immunization of children in Ghana. *BMC Pediatr*. 2025;25(1):808.
9. Budu E, et al. Inequalities in the prevalence of full immunization coverage among one-year-olds in Ghana, 1993–2014. *Vaccine*. 2022;40(26):3614–20.
10. Damte E, Manteaw BO, Wrigley-Asante C. Urbanization, climate change and health vulnerabilities in slum communities in Ghana. *J Clim Change Health*. 2023;10:100189.
11. Adusei AB et al. Community-based Health Planning and Services programme in Ghana: a systematic review. *Front Public Health*, 2024. Volume 12–2024.
12. Corsi DJ, et al. Demographic and health surveys: a profile. *Int J Epidemiol*. 2012;41(6):1602–13.
13. Tanou M, Kamiya Y. Assessing the impact of geographical access to health facilities on maternal healthcare utilization: evidence from the Burkina Faso demographic and health survey 2010. *BMC Public Health*. 2019;19(1):838.
14. Fatema K, Lariscy JT. Mass media exposure and maternal healthcare utilization in South Asia. *SSM-population Health*. 2020;11:100614.
15. Sanogo NdA, Yaya S. Wealth status, health insurance, and maternal health care utilization in Africa: evidence from Gabon. *Biomed Res Int*. 2020;2020(1):4036830.
16. Budu E, et al. Determinants of complete immunizations coverage among children aged 12–23 months in Papua New Guinea. *Child Youth Serv Rev*. 2020;118:105394.
17. Dixit P, Dwivedi LK, Ram F. Strategies to improve child immunization via antenatal care visits in India: a propensity score matching analysis. *PLoS ONE*. 2013;8(6):e66175.
18. Mbengue MAS et al. *Determinants of complete immunization among senegalese children aged 12–23 months: evidence from the demographic and health survey*. *BMC public health*, 2017. 17(1): p. 630.

19. Gareaballah E, Loevinsohn B. The accuracy of mother's reports about their children's vaccination status. *Bull World Health Organ.* 1989;67(6):669.
20. Abadura SA, et al. Individual and community level determinants of childhood full immunization in Ethiopia: a multilevel analysis. *BMC Public Health.* 2015;15(1):972.
21. Antai D. Gender inequities, relationship power, and childhood immunization uptake in Nigeria: a population-based cross-sectional study. *Int J Infect Dis.* 2012;16(2):e136–45.
22. Bugvi AS, et al. Factors associated with non-utilization of child immunization in Pakistan: evidence from the Demographic and Health Survey 2006-07. *BMC Public Health.* 2014;14(1):232.
23. Awasthi A, et al. Maternal determinants of immunization status of children aged 12–23 months in urban slums of Varanasi, India. *Clin Epidemiol Global Health.* 2015;3(3):110–6.
24. Babirye JN, et al. Urban settings do not ensure access to services: findings from the immunisation programme in Kampala Uganda. *BMC Health Serv Res.* 2014;14(1):111.
25. Adongo PB, et al. Does the design and implementation of proven innovations for delivering basic primary health care services in rural communities fit the urban setting: the case of Ghana's Community-based Health Planning and Services (CHPS). *Health Res policy Syst.* 2014;12(1):16.
26. Lakew Y, Bekele A, Biadgilign S. Factors influencing full immunization coverage among 12–23 months of age children in Ethiopia: evidence from the national demographic and health survey in 2011. *BMC Public Health.* 2015;15(1):728.
27. Mbengue MAS, et al. Determinants of complete immunization among senegalese children aged 12–23 months: evidence from the demographic and health survey. *BMC Public Health.* 2017;17(1):630.
28. Aghaei A, Mowlaei MM. Government-controlled mass media as an obstacle to health policy making: The case of Iran. *Int J Social Determinants Health Health Serv.* 2023;53(2):158–67.
29. Ataguba JE, Ojo KO, Ichoku HE. Explaining socio-economic inequalities in immunization coverage in Nigeria. *Health Policy Plann.* 2016;31(9):1212–24.
30. Landoh DE, et al. Predictors of incomplete immunization coverage among one to five years old children in Togo. *BMC Public Health.* 2016;16(1):968.
31. Forshaw J, et al. The global effect of maternal education on complete childhood vaccination: a systematic review and meta-analysis. *BMC Infect Dis.* 2017;17(1):801.
32. Greenland S. Modeling and variable selection in epidemiologic analysis. *Am J Public Health.* 1989;79(3):340–9.
33. Lynch J, et al. Is income inequality a determinant of population health? Part 1. A systematic review. *Milbank Q.* 2004;82(1):5–99.
34. Akanpaabadai EA, et al. Population-based cross-sectional study of factors influencing full vaccination status of children aged 12–23 months in a rural district of the Upper East Region, Ghana. *BMC Pediatr.* 2024;24(1):168.
35. Asuman D, Ackah CG, Agyire-Tettey F. Disability and household welfare in Ghana: Costs and correlates. *J Fam Econ Issues.* 2021;42(4):633–49.

36. Jiang S. Exploring the Impact of Social Networks on Maternal Attitudes Towards Child Non-NIP Vaccine Uptake: A Mixed-Method Study in Chongqing, China. Duke University; 2025.
37. Adokiya MN, Baguune B, Ndago JA. *Evaluation of immunization coverage and its associated factors among children 12–23 months of age in Techiman Municipality, Ghana*, 2016. Archives of public health, 2017. 75(1): p. 28.
38. Anokye R, et al. Socio-demographic determinants of childhood immunization incompleteness in Koforidua, Ghana. BMC Res Notes. 2018;11(1):656.
39. Zida-Compaore WI, et al. Immunization coverage and factors associated with incomplete vaccination in children aged 12 to 59 months in health structures in Lomé. BMC Res Notes. 2019;12(1):84.
40. Mekonnen AG, Bayleyegn AD, Ayele ET. Immunization coverage of 12–23 months old children and its associated factors in Minjar-Shenkora district, Ethiopia: a community-based study. BMC Pediatr. 2019;19(1):198.
41. Jani JV, et al. Risk factors for incomplete vaccination and missed opportunity for immunization in rural Mozambique. BMC Public Health. 2008;8(1):161.
42. Kajungu D, et al. Vaccines safety and maternal knowledge for enhanced maternal immunization acceptability in rural Uganda: A qualitative study approach. PLoS ONE. 2020;15(12):e0243834.
43. Odero CO, et al. The influence of demographic and socio-economic factors on non-vaccination, under-vaccination and missed opportunities for vaccination amongst children 0–23 months in Kenya for the period 2003–2014. PLOS Global Public Health. 2024;4(5):e0003048.