

# Empowerment of Women in Union is Associated with Improved Skilled Antenatal Care Attendance: A Pooled Cross-Sectional Analysis of DHS Data in West and Central Africa

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## Abstract

**Background:** Maternal mortality remains unacceptably high in West and Central Africa. Skilled antenatal care (ANC) can prevent avoidable maternal and neonatal deaths, yet coverage remains unequal. Women's empowerment may increase timely and adequate use of ANC, but comparable measurement has been challenging. **Methods:** We conducted a secondary analysis of the most recent Demographic and Health Surveys (2015-2021) from nine West and Central African countries with very high maternal mortality (Cameroon, Chad, The Gambia, Guinea, Liberia, Mali, Mauritania, Nigeria and Sierra Leone). The study included 46,759 women in union. The outcome was receipt of at least four ANC visits with a skilled provider (ANC4+). Women's empowerment was measured using the Survey-based Women's emPOWERment index (SWPER) and categorized into quartiles. Weighted descriptive analyses and survey-adjusted logistic regression were used. **Results:** Overall, 58.68% of women reported ANC4+, ranging from 32.74% in Chad to 90.12% in Sierra Leone. Compared with women in the lowest empowerment quartile, the odds of ANC4+ increased progressively for women with medium (aOR = 1.14, 95%CI 1.02 - 1.27), high (aOR=1.50, 95%CI 1.34 - 1.68) and very high empowerment (aOR = 2.02, 95%CI 1.77 - 2.31), after adjustment for socio-demographic factors. **Conclusion:** Women's empowerment is strongly associated with skilled

ANC use in West and Central Africa. Empowerment-oriented, intersectoral actions should complement health-system efforts to accelerate progress toward SDG target 3.1.

## Keywords

Skilled Antenatal Care, ANC4+, Women's Empowerment, SWPER, Demographic and Health Surveys, West and Central Africa

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## 1. Introduction

Improving maternal health remains a major public health priority and is central to Sustainable Development Goal (SDG) 3. SDG target 3.1 aims to reduce the maternal mortality ratio (MMR) to fewer than 70 deaths per 100,000 live births by 2030 [1] [2]. Despite progress, maternal mortality is still “unacceptably high” and reflects persistent inequities in access to quality care before, during and after pregnancy [3] [4]. In 2023, an estimated 260,000 women died from causes related to pregnancy and childbirth, including in the postpartum period [3] [4]. Sub-Saharan Africa remains the epicenter of this burden, accounting for approximately 70% of maternal deaths worldwide in 2023 [3]. Within the region, disparities are marked, and West and Central Africa have particularly high maternal mortality, with an estimated MMR of 629 deaths per 100,000 live births in 2023—well above the global average of 197 deaths per 100,000 live births [4]. Such levels threaten SDG attainment and underscore the need to act simultaneously on health-system determinants and broader social determinants of maternal health.

In this context, antenatal care (ANC) is a key intervention associated with reductions in maternal and neonatal morbidity and mortality, particularly when initiated early, delivered regularly and provided with adequate content and quality [5]-[7]. The World Health Organization (WHO) recommends an ANC model centered on a positive pregnancy experience and advises at least eight contacts to improve detection and management of complications, prevention, health education and birth preparedness [5] [6]. However, many countries continue to monitor ANC using the legacy indicator of at least four visits (ANC4+), which remains widely available and comparable across surveys [8] [9]. Women's empowerment is increasingly recognized as a central lever for maternal healthcare utilization through women's ability to make decisions, mobilize resources and negotiate social norms within households and communities [10]-[12]. Evidence from systematic reviews and meta-analyses indicates positive associations between empowerment and multiple dimensions of maternal health service use, including skilled ANC, early ANC initiation and completion of an adequate number of visits [10] [11]. Nevertheless, empowerment is multidimensional and its measurement has varied across studies, limiting comparability across settings.

To address measurement challenges, the Survey-based Women's emPOWERment (SWPER) index was developed using Demographic and Health Surveys (DHS) data

to provide a standardized empowerment measure, first validated in Africa and later extended to all low- and middle-income countries [13] [14]. DHS-based analyses suggest that higher empowerment measured by SWPER is associated with better coverage of reproductive, maternal, newborn and child health interventions in low- and middle-income settings, indicating an important pathway to reduce inequalities in service use [15]. In West and Central Africa—where maternal mortality remains extremely high and progress is heterogeneous—it is therefore particularly relevant to examine the role of women’s empowerment in the use of skilled ANC [4] [8] [10]. This study aimed to assess the association between empowerment among women in union (measured using SWPER) and the use of skilled antenatal care defined as at least four ANC visits with a skilled provider (ANC4+) in nine West and Central African countries.

## 2. Methods

### 2.1. Study Design and Setting

This study is a secondary analysis of cross-sectional data from the Demographic and Health Surveys (DHS). We included nine sub-Saharan African countries (two in Central Africa and seven in West Africa) selected because they had very high maternal mortality ( $MMR \geq 500$  deaths per 100,000 live births) and had a recent DHS conducted between 2015 and 2021. The included countries were Cameroon (MMR 529 per 100,000 live births), Chad (MMR 1140 per 100,000 live births), The Gambia (MMR 597 per 100,000 live births), Guinea (MMR 576 per 100,000 live births), Liberia (MMR 661 per 100,000 live births), Mali (MMR 562 per 100,000 live births), Mauritania (MMR 766 per 100,000 live births), Nigeria (MMR 992 per 100,000 live births) and Sierra Leone (MMR 1120 per 100,000 live births).

### 2.2. Study Population and Sampling

The study population comprised women in union (married or living with a partner) from the women’s individual recode files in each DHS. DHS surveys use nationally representative, stratified probability sampling designs, typically with two stages (selection of clusters followed by households) and stratification by geographic region and urban/rural residence. All countries used this sampling design except for Mauritani, which used a three-stage design. We included women in union with complete data on the outcome, empowerment and covariates. Women with missing information on key variables were excluded.

### 2.3. Study Variables

The outcome was skilled antenatal care defined as completing at least four ANC visits (ANC4+) with a skilled provider for the most recent pregnancy. In this study, a skilled provider refers to a health professional who is trained and authorized to deliver quality antenatal care to pregnant women and adolescents, in line with standard maternal health care practice. Based on the provider categories available in DHS, we defined skilled providers as physicians, midwives, and

nurses. Auxiliary birth attendants/auxiliary health workers and other cadres were not included in our operational definition because their classification as “skilled” may vary across countries and contexts in DHS-based coverage indicators. Excluding them improved comparability of estimates across the included countries. Although WHO now recommends at least eight contacts, this study focused on ANC4+ because the updated recommendation is not yet fully implemented in all countries and ANC4+ remains a widely used and comparable indicator across DHS surveys. The outcome was coded as “yes” if the woman reported ANC4+ and “0” otherwise.

The main exposure was women’s empowerment measured using the SWPER index (Survey-based Women’s emPowERment index) [13] [14]. SWPER is typically reported as three separate domains capturing key dimensions of empowerment: attitudes toward intimate partner violence, social independence (education, information exposure and life-course indicators), and household decision-making (participation in decisions about own health, major purchases and visits to relatives) [13] [14]. In this study, however, we derived a single overall empowerment score to obtain a parsimonious summary measure suitable for pooled, multi-country analyses and to incorporate an additional context-relevant dimension (house and land ownership). Specifically, we selected 16 DHS items capturing the three SWPER domains and added two items on ownership of a house and land in line with recommendations from the 2018 expert workshop for adapting SWPER to other regional contexts. All items were recoded according to SWPER methodological guidance, including assigning equal coding/weight to joint decision-making and sole female decision-making. We then performed a principal component analysis (PCA) on the full set of recoded items to extract the underlying empowerment structure; adequacy for PCA was verified using the Kaiser-Meyer-Olkin statistic ( $KMO = 0.78$ ) and inspection of inter-item correlations. Individual component scores were predicted, and the first five components, which explained the largest share of the total variance, were retained. The overall empowerment score was computed as a weighted composite of these retained component scores, with weights proportional to each component’s relative contribution to explained variance. Potential confounders were selected based on prior literature and data availability in the DHS datasets. They included the woman’s age, the woman’s education and partner’s education, household wealth quintile, place of residence (urban/rural), reproductive status, country (Cameroon, Chad, Gambia, Guinea, Liberia, Mali, Mauritania, Nigeria, Sierra Leone), country language group (Francophone/Anglophone), perceived distance to a health facility, perceived need for permission to seek care, perceived lack of money for care, and DHS survey year.

## 2.4. Statistical Analysis

Analyses were conducted using Stata version 16.1. Descriptive analyses reported weighted frequencies and percentages. Survey commands (*svy*) were used to account for sampling weights, clustering and stratification. Sample weights were

denormalized to treat countries equally. Don't know' responses were treated as missing, and variables with more than 10% non-response were not retained. Multivariable logistic regression was used to estimate adjusted odds ratios (aORs) and 95% confidence intervals (CIs) for the association between empowerment quartiles and ANC4+. Covariates associated with ANC4+ at  $p < 0.20$  in bivariate analysis were considered for inclusion. Multicollinearity was assessed using variance inflation factors (VIF) and a threshold of  $VIF < 5$  was used. Statistical significance was set at  $p < 0.05$ .

## 2.5. Ethics

The DHS datasets used were anonymized and contained no identifying information. Access to the datasets was obtained through a formal request to The DHS Program. Given the use of de-identified, publicly available data, no additional ethical approval was required for this secondary analysis.

## 3. Results

A total of 46,759 women in union were included in the pooled analysis. Nigeria contributed the largest share of the pooled sample (68.34%), while Liberia was the least represented (1.24%) (**Table 1**).

**Table 1.** Distribution of participants by country (weighted).

Country	Unweighted frequency	Weighted frequency	Percentage
Nigeria	16,154	31,955	68.34
Mali	4739	2842	6.08
Sierra Leone	4533	2431	5.2
Cameroon	4166	2235	4.78
Mauritania	4146	2080	4.45
Guinea	4104	2029	4.34
Gambia	4176	1893	4.05
Chad	2456	715	1.53
Liberia	2285	579	1.24
Total	46,759	46,759	100

Women aged 25 - 34 years represented 47.25% of the sample. Educational attainment was low: 48.76% of women had no formal education, slightly higher than their husbands/partners (42.85%). Most participants were married (95.46%) and lived in rural areas (61.67%). Regarding perceived barriers, 50.71% reported lack of money as a major problem for accessing care, 43.23% reported distance as a major problem, and 22.19% reported needing permission as a major problem (**Table 2**).

**Table 2.** Socio-demographic and economic characteristics of participants (weighted).

Variables (n = 46,759)	Unweighted frequency	Weighted frequency	Percentage
Woman's age			
<18 years	839	795	1.70
18 - 24 years	10,649	10,321	22.07
25 - 34 years	21,587	22,095	47.25
≥35 years	13,684	13,548	28.97
Woman's education			
None	24,782	22,784	48.76
Primary	8763	7654	16.36
Secondary	11,097	12,998	27.79
Higher	2117	3313	7.08
Partner's education			
None	23,378	20,037	42.85
Primary	6531	6463	13.82
Secondary	12,566	14,361	30.71
Higher	4284	5901	12.62
Marital status			
Married	43,310	44,637	95.46
Living with a partner	3449	2122	4.54
Reproductive status			
Fecund	29,287	28,341	60.61
Postpartum amenorrhea	17,472	18,418	39.39
Number of children			
1 - 4	28,777	28,762	61.51
5 - 9	16,383	16,080	34.39
≥10	1599	1917	4.10
Wealth quintile			
Poorest	11,268	10,348	22.13
Poorer	10,424	10,254	21.93
Middle	9849	9371	20.04
Richer	8488	8744	18.70
Richest	6730	8042	17.20

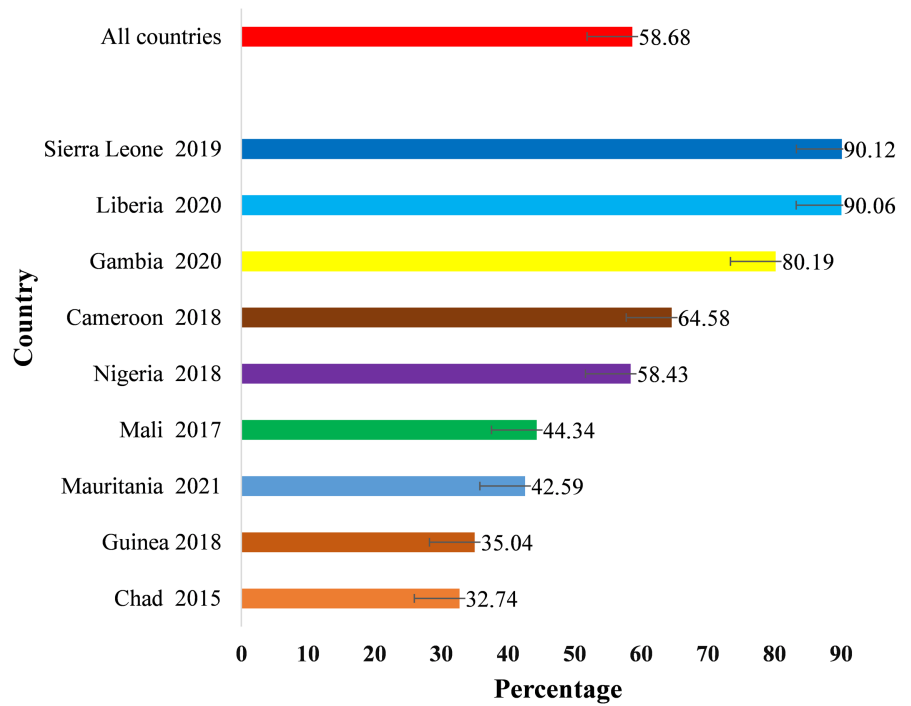
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Place of residence			
Urban	15,901	17,922	38.33
Rural	30,858	28,837	61.67
DHS survey year			
2015	2456	716	1.53
2017	4739	2843	6.08
2018	24,424	36,220	77.46
2019	4533	2430	5.20
2020	6461	2469	5.28
2021	4146	2081	4.45
Distance to facility			
Big problem	18,338	15,229	32.57
Not a big problem	28,421	31,530	67.43
Need permission to seek care			
Big problem	10,282	7766	16.61
Not a big problem	36,477	38,993	83.39
<b>Need money for care</b>			
Big problem	25,472	23,515	50.71
Not a big problem	21,287	23,244	49.29

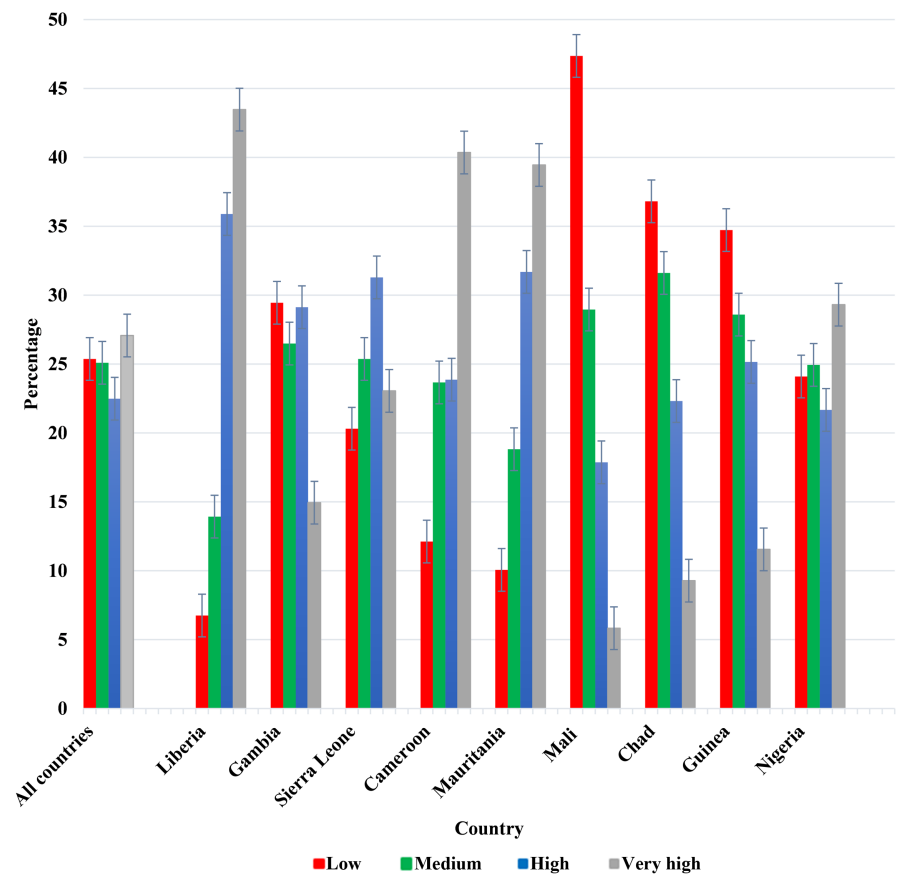
Overall, 58.68% of women reported skilled antenatal care (ANC4+). Coverage varied widely across countries: the lowest prevalence was observed in Chad (32.74%) and Guinea (35.04%), whereas the highest prevalence was observed in Sierra Leone (90.12%) and Liberia (90.06%) (**Figure 1**).

Women's empowerment was categorized into quartiles. Overall, 25.36% of women were in the lowest empowerment quartile and 27.07% in the highest. At the country level, Mali, Chad and Guinea had the highest proportions of women in the lowest empowerment quartile (each > 35%), while Liberia (43.46%) and Cameroon (40.35%) had the highest proportions of women in the higher empowerment categories (**Figure 2**).

In multivariable analysis adjusted for socio-demographic and access-related factors, higher empowerment was associated with higher odds of ANC4+. Compared with women in the lowest empowerment quartile, women with medium empowerment had 14% higher odds of ANC4+ (aOR = 1.14; 95%CI 1.02 - 1.27), women with high empowerment had 50% higher odds (aOR = 1.50; 95%CI 1.34 - 1.68), and women with very high empowerment had more than double the odds (aOR = 2.02; 95%CI 1.77 - 2.31) (**Table 3**).



**Figure 1.** Overall and country-specific prevalence of skilled antenatal care (ANC4+).



**Figure 2.** Overall and country-specific distribution of women's empowerment by SWPER quartiles.

**Table 3.** Association between women empowerment and completing at least four ANC visits (ANC4+) (N = 46,758).

Variable (N = 46,758)	N	Skill antenatal care n (%)	Univariate analysis		Multivariate analysis	
			OR (95%CI)	<i>p</i>	aOR (95%CI)	<i>p</i>
Women's empowerment						
Low	11,860	5541 (46.72)	1		1	
Medium	11,732	6018 (51.29)	1.29 (1.16 - 1.44)	<0.001	1.14 (1.02 - 1.27)	0.014
High	10,512	6569 (62.49)	2.54 (2.26 - 2.85)	<0.001	1.50 (1.34 - 1.68)	<0.001
Very high	12,653	9443 (74.63)	6.07 (5.33 - 6.92)	<0.001	2.02 (1.77 - 2.31)	<0.001

OR: Crude odds ratio; aOR: Adjusted odds ratio; CI: Confidence interval; *p*: *p*-value; Adjustment variables: Year of DHS survey, woman's education level, partner's education level, woman's age, partner's age, number of children, wealth quintile, marital status, place of residence, distance between household and health facility.

#### 4. Discussion

This pooled DHS analysis from nine West and Central African countries indicates that skilled ANC coverage remains insufficient and highly heterogeneous, and it confirms a strong, dose-effect association between women's empowerment and the likelihood of completing at least four ANC visits with a skilled provider. These findings are particularly important in a region where maternal mortality remains high and accelerated progress is needed to achieve SDG target 3.1 by 2030 [2]-[4]. Our results suggest that improvements in maternal health will benefit from combining health-system strengthening with interventions that expand women's agency and opportunities.

The overall ANC4+ prevalence (58.68%) can be considered moderate and is consistent with multi-country evidence showing persistent barriers to adequate ANC use in sub-Saharan Africa [7]-[9]. However, ANC4+ mainly reflects the number of contacts and does not fully capture the content and quality of care delivered. Analyses using content-qualified indicators such as ANC quality (ANCq) demonstrate that similar numbers of visits can conceal substantial differences in whether women receive essential services such as blood pressure measurement, urine and blood tests, counseling, and preventive interventions [7] [16] [17].

The wide between-country variation—from about one-third of women in Chad to about 90% in Sierra Leone and Liberia—highlights the critical role of national and local context beyond individual-level characteristics. Differences in health-system performance, geographic accessibility, security conditions, and financial protection policies can influence both demand for and uptake of ANC. In pooled multi-country analyses, large countries can dominate regional estimates; in our sample, Nigeria represents more than two-thirds of observations. Country-specific analyses and sensitivity analyses that account for population size and survey design are therefore important when interpreting pooled results [18].

The main finding—a dose-response relationship between empowerment and ANC4+—was robust after adjustment for socio-demographic and access-related factors. Women in the highest SWPER quartile had more than twice the odds of ANC4+ compared with women in the lowest quartile. This pattern is consistent with prior research showing that empowerment facilitates maternal healthcare use through multiple pathways, including greater social independence (education and access to information), increased participation in household decision-making, reduced tolerance of violence, and greater ability to mobilize resources for health [10]-[12] [15] [19].

From a programmatic perspective, these results indicate that improving skilled ANC use cannot rely on supply-side expansion alone. Strategies should simultaneously strengthen service accessibility and quality—consistent with WHO recommendations for a positive pregnancy experience and prevention of complications [5] [6]—and address social determinants, particularly women’s empowerment. Intersectoral actions that promote girls’ education, expand women’s access to information, reduce economic inequalities, prevent gender-based violence, and shift restrictive social norms are likely to complement health-sector interventions and improve equitable uptake of ANC [20].

This study has several strengths, including the use of large, recent and comparable DHS datasets, appropriate consideration of complex sampling design, and an empowerment index that has been developed, validated and widely used for cross-country comparisons [13] [14]. Nevertheless, limitations should be acknowledged. The cross-sectional design prevents causal inference. The outcome (ANC4+) is based on self-report and does not measure content or quality of care. Finally, as with any pooled DHS analysis, differences in country context and survey timing may contribute to heterogeneity in estimates.

## 5. Conclusion

Using DHS data from nine West and Central African countries with very high maternal mortality, this study shows that skilled ANC coverage (ANC4+) remains suboptimal and varies widely between countries. Women’s empowerment measured with SWPER was independently and positively associated with ANC4+ use, with a clear gradient across empowerment quartiles. Strengthening ANC accessibility and quality should therefore be complemented by empowerment-oriented, intersectoral strategies addressing education, information access, economic barriers and gender norms.

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## Data Availability

The DHS datasets analyzed in this study are available from The DHS Program upon reasonable request and approval.

## Conflicts of Interest

The authors declare no conflicts of interest.

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