

# Assessing contextual influences of modern contraceptive usage among adolescent girls and young women in sub-Saharan African countries: a geospatial modelling study, post 2015

## INTRODUCTION

Modern contraceptives play a critical role in regulating fertility globally, offering substantial social and economic benefits, particularly in developing countries. They are pivotal in preventing maternal deaths and improving women's health and socioeconomic status. Despite these advantages, the use of modern contraceptives among sexually active adolescent girls and young women (AGYW) in sub-Saharan Africa (SSA) remains low, leading to unintended pregnancies with associated morbidities and mortality. This paper focuses on Kenya, Ethiopia, and Nigeria, where prevalence rates among AGYW are low, and unmet needs are high, aiming to understand the factors influencing modern contraceptive use among different population sub-groups.

The study examines the prevalence of modern contraceptives in the three countries, highlighting the necessity of understanding contextual and geographical factors associated with contraceptive use to achieve Sustainable Development Goal (SDG) 3.7. The paper addresses the following research questions:

- What community-level contextual factors influence adolescents' and young women's usage of modern contraceptives?
- How does modern contraceptive usage among adolescents and young women vary geographically within and between sub-Saharan African countries?

Understanding geographical variations in modern contraceptive usage and identifying contextual factors influencing AGYW's use of modern contraceptives are essential for targeted interventions and improving service delivery to ensure universal access to sexual and reproductive healthcare services, particularly in underserved populations.

## DATA AND METHODS

This study utilized nationally representative Demographic and Health Surveys (DHS) data from Nigeria (NDHS 2018), Ethiopia (EDHS 2016), and Kenya (KDHS 2022) focusing on adolescent girls and young women aged 15-24 years. DHS employs a two-stage cluster sampling method. The analysis being restricted to AGYWs, resulted in sample sizes of 15,267 for Nigeria, 6,401 for Ethiopia, and 12,026 (2022) for Kenya. The contextual effects were considered at the community (cluster) level by aggregating individual-level DHS data to the community-level. We obtained raster datasets namely education years, population density, mean parity and probability of seeking care from WorldPop (<http://www.worldpop.org/>). The outcome variable was modern contraception use (yes = 1, no = 0). Independent variables included age, age at first sex, marital status, religion, residence, education level, and sex of household head. Community-level variables comprised mean parity, population density, mean education years, and probability of seeking medical care. Geostatistical modelling included population density to control for inhabited areas.

### *Statistical Analysis:*

We utilised bivariate binary regression models to explore individual and contextual factors related to AGYW's modern contraceptive use, and fitted random effects multilevel logistic regression models to account for the nested DHS data structure. The general multilevel model equation is:  $y_{ijk} = \beta_{0jk} + \beta_{1jk}X_{ijk} + \varepsilon_{ijk}$  where  $y_{ijk}$  is the dependent variable for individual  $i$  in  $j^{th}$  household of cluster  $k$ ,  $\beta_0$  is the intercept,  $\beta_1$  is the coefficient,  $X$  is the vector of covariates, and  $\varepsilon$  is the random variation term (Finch, Bolin, and Kelley 2019).

Using model-based geostatistical (MBG) modelling within a Bayesian framework, we assessed spatial variation in AGYW's modern contraceptive use at national and sub-national levels (Diggle and Ribeiro 2007).

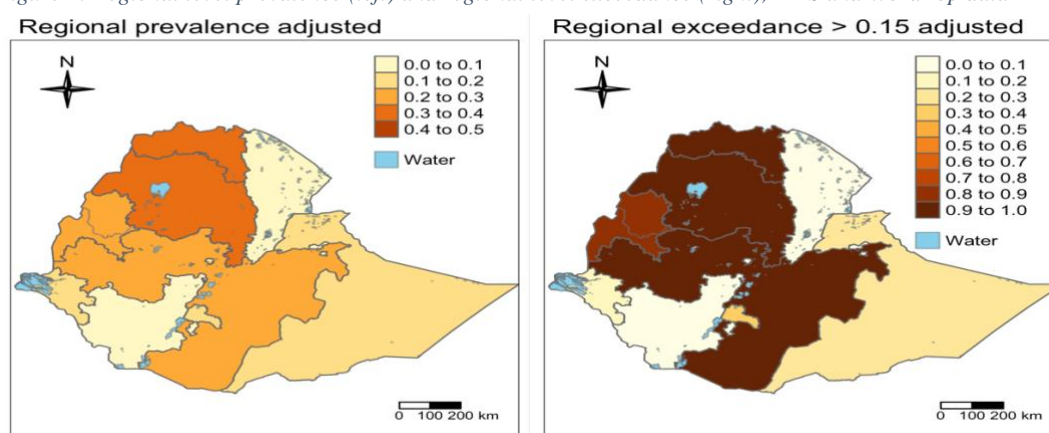
We illustrated sub-national variations using crude modern contraceptive prevalence maps by age groups (15-19 years and 20-24 years). Multi-country analyses compared prevalence across Kenya, Ethiopia, and Nigeria. Exceedance probability (EP) maps delineated sub-national areas with the highest usage likelihood. EP expresses how likely prevalence is above the policy-relevant threshold, say  $t$ , based on the available survey data. An EP close to 1 indicates that usage is highly likely to be above the threshold  $t$ ; if close to 0, usage is highly likely to be below the threshold  $t$ ; finally, if close to 0.5, usage is equally likely to be above or below the threshold  $t$ ; hence corresponding to the highest level of uncertainty. Exceedance probability mapping is necessary to facilitate policy and decision-making in AGYW's modern contraceptive usage interventions at sub-national administration levels.

## RESULTS

### Prevalence Mapping

**Ethiopia:** Figure 1 illustrates adjusted modern contraceptive prevalence among AGYW in Ethiopia. Northern regions like Tigray and Amhara show the highest prevalence, followed by Oromia and Benishangul Gumuz. The map on the right displays modern contraceptive exceedance probability, indicating regions with predicted prevalence above 15%, such as Northwest, central, and southern regions. Further analysis using a 5x5-kilometer resolution map reveals varying prevalence within each region, with some locations showing higher and others lower prevalence.

Figure 1: Regional level prevalence (left) and regional level exceedance (right), DHS and WordPop data



**Kenya:** In Kenya, the adjusted prevalence of modern contraceptives among AGYWs at the county level, shows higher prevalence in western and central Kenya compared to the northern and eastern parts (Figure 2). Overall county prevalence was low, averaging 21%, but varied within counties. The exceedance probability (right map), highlights counties with predicted prevalence above 21%, mainly in western and central regions, while counties below 21% certainty are shown in lighter colours.

**Nigeria:** Nigerian states in the southern region exhibited higher prevalence of modern contraceptive usage compared to those in the north, depicted in Figure 3 (left map). The exceedance probability map (right), highlights states where the predicted prevalence exceeds 5% with high certainty, being predominantly in the southern part of the country.

Figure 2: County level prevalence (left); county level exceedance probability (right), Kenya DHS and WordPop data

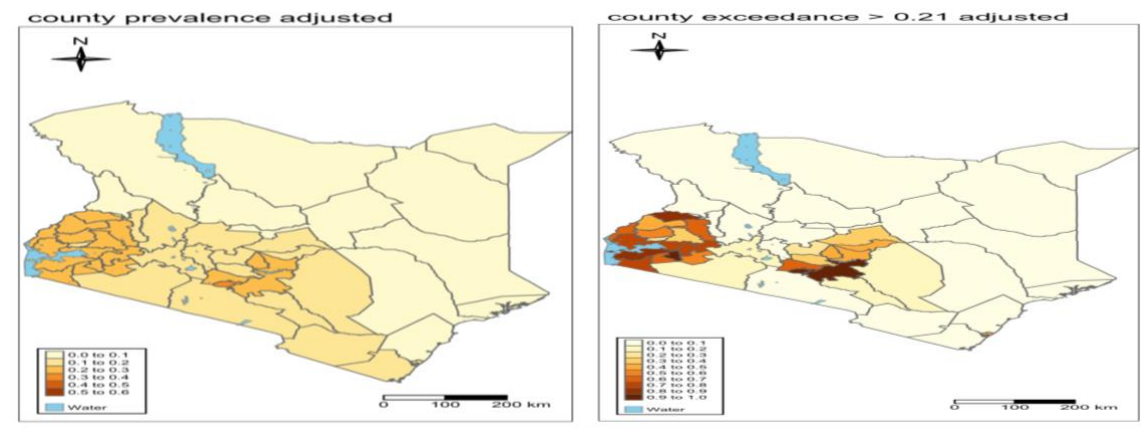
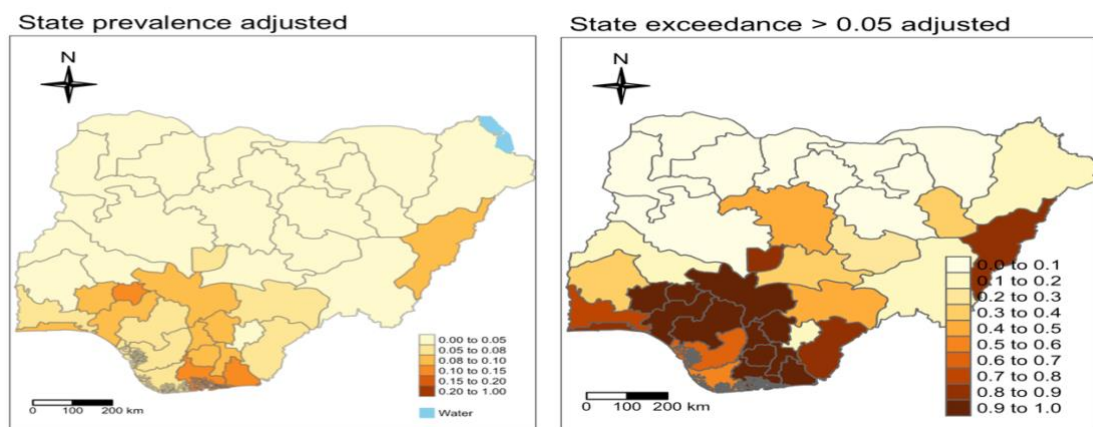


Figure 3: State level prevalence (left); state level exceedance probability (right), Nigeria DHS and WordPop data



*Multilevel logistic regression model for predictors of modern contraceptive use.*

A full model controlling for the ecological level factors shows contextual, individual, and household level factors strongly influence modern contraceptive usage among AGYW. Mean years of education and mean parity at the community level showed significant associations with contraceptive use across all three countries. Additionally, we found other factors influencing low usage among AGYW included marital status (single status), religion, age at first sex, and household wealth. Table 1 highlights geospatial model covariates of modern contraceptive use, controlling for contextual variables.

Table 1. Contextual analysis of modern contraceptives using geospatial modelling

Covariate	Kenya aOR (95% CI)	Ethiopia aOR (95% CI)	Nigeria aOR (95% CI)
Years of education	10.47(6.96,15.96)	1.62(1.17,2.24)	4.12(2.48,7.10)
Population density	0.93(0.84,1.04)	0.99(0.95,1.04)	0.99(0.92,1.06)
Mean parity	2.91(2.59,3.27)	0.80(0.75,0.85)	1.45(1.19,1.77)
Probability of seeking care	1.86(1.19,2.93)	0.79(0.61,1.03)	1.04(0.82,1.33)

Source: Computed from DHS and WorldPop data, post 2015

## **DISCUSSION**

The study has revealed low modern contraceptive use among adolescent girls and young women (AGYW) with significant geographic disparities observed at national and sub-national levels in all the three countries. Contextual, individual, and household level factors strongly influence modern contraceptive usage among AGYW.

The resulting higher usage of modern contraceptives among young women aged 20-24, is likely due to socioeconomic status such as secondary and higher-level education or school attendance, as alluded to by other studies such as Dombola, Manda, and Chipeta (2021) who cite that young women in school are motivated to prevent pregnancy for fear of repercussions, such as social stigma and expulsion from school. The higher prevalence among AGYW living in urban areas may likely be due to better access to and availability of healthcare and contraceptive provider services (Alemu, Ambelie, and Azage, 2020) in these areas. Similar to work done by Kabagenyi, Habaasa, and Rutaremwa (2016), household wealth was found to be correlated to contraceptive use, which they opine to be likely due to disparities in financial access to contraceptives. Similarly, the higher prevalence among married women could likely be due to normative approval and less stigma surrounding accessibility to contraceptives, contrary to the stigma attached when a woman is not married and not expected to be sexually active (Sserwanja et al., 2022).

The spatial mapping of modern contraceptive use in Kenya revealed higher usage in the central and western counties, which are predominantly urban areas with better access to services, transportation networks, and facilities. This is supported by previous studies (Macharia, Mumo, and Okiro 2021; Njoka et al. 2016; Fish et al. 2020).

Significant geographical variations in the spatial distribution of modern contraceptive use were in Amhara, Oromia, and Benishangul Gumuz regions of Ethiopia, where there was higher usage, potentially due to the presence of more family planning services and government focus in these areas (Tegegne et al., 2020). In contrast, regions like Afar and Somali had lower prevalence, likely due to the pastoralist nature and seasonal mobility in these regions (Lakew et al., 2013).

In Nigeria the southern parts exhibited higher usage compared to the Northern part. These findings align with other studies (Bolarinwa et al., 2021; Ajayi, Adeniyi, and Akpan 2018). The regional variation may be attributed to socio-cultural norms and religious beliefs. For instance, women in south tend to be more receptive to contraceptive usage compared to the north which is predominantly Muslim and pro-natalist (Bolarinwa et al., 2021).

## **CONCLUSION**

Modern contraceptive use among AGYW in the studied countries remains low, underscoring the need for targeted interventions. Addressing geographical barriers, and inequalities in access to sexual and reproductive healthcare, and tailoring family planning programs to local contexts are essential steps towards achieving Sustainable Development Goal 3.7. Integration of sexual and reproductive health services within broader health systems is critical for comprehensive care delivery. Sub-national-specific interventions based on prevailing factors can enhance family planning outcomes across SSA.