

The Changing Nature of Community Level Effects on Contraceptive Use Over Time in Sub-Saharan Africa: an analysis of 54 Demographic and Health Surveys

Introduction: Allowing women to decide when, and if, to have children is a central tenant of reproductive health¹. The use of modern contraception has broad benefits for women, their children, families, communities, in addition to significant social and economic impacts. These include reduced poverty^{2,3}, improved maternal and child health outcomes⁴, and gains in female empowerment^{4,5}. However, despite these known advantages, rates of modern contraceptive use remain low in many areas of Sub-Saharan Africa (SSA), with contraceptive prevalence rates in many areas stalled at 25-30%- well below the global average of 54%⁶. While the individual determinants of contraceptive use are well understood, much remains to be learned about how community environments shape women's use of contraception.

Bronfenbrenner's Ecological Systems Theory posits that factors beyond the individual are critical to women's contraceptive behavior^{7,8}, and previous research has demonstrated the importance of community-level factors in shaping decision making regarding contraceptive use⁹⁻¹¹. However, what remains largely unknown is how these community level effects have changed over time. Understanding the dynamic nature of these norms is critical to meaningful engagement with communities and effective, multilevel intervention design, and have the potential to inform and strengthen family planning programs. Therefore, this study aims to analyze how community level effects have changed from the early 21st century to the end of the FP2020 commitments in 2021 in an effort to highlight the changing nature of some norms and the consistent significance of others in their ability to shape women's contraceptive behavior.

Data: Data for this study comes from the individual recode of the Demographic and Health Surveys (DHS) for Sub-Saharan African (SSA) nations. Since the 1980s, the DHS has collected reliable, representative, comparable data from women ages 15-49 using a two-stage sampling design. Within each country, primary sampling units (PSU) are selected using existing census tracts as a sampling frame. Then, 20-30 households are selected from a listing of households within each PSU. This standardized methodology allows for comparability of data across countries and time. The analysis includes data from countries sampled by DHS in three separate time periods: pre-2000, during the first decade of the 21st century (2000-2010), and

in the past five years (2016-2021). All SSA countries with publicly available DHS at all three time points are included (n=18). Three datasets for each of the 18 countries are appended to one another (n=54) to create the analytic database that includes 611,257 women ages 15-49.

Measures: *Outcome measure:* The primary outcome measure will be whether the respondent reported the current use of a modern contraceptive method as surveyed in the DHS (i.e. pills, injectables, implants, condoms, sterilization, foam or jellies). *Key covariates:* The key covariates include measures of community level factors that shape modern contraceptive use in Sub-Saharan African women. To select these, we conducted a review of the literature to ascertain community level factors previously used in DHS-derived studies of modern contraceptive use in LMIC. These include 15 community level factors nested into three groups: community demographics (female educational attainment, community wealth, HIV prevention knowledge, exposure to mass media, and reproductive knowledge), fertility norms (mean age at marriage, first birth, and sexual debut, mean number of children per woman, birth spacing, proportion of women who had a child before age 18, and proportion of women who are dissatisfied with the family planning options or access), and gender norms (mean decision making power, IPV normalization, and preference for male children in the community). A detailed table outlining these norms, their operationalization, and one source where each has been used previously is shown in Table 1.

Table 1: Community Level Effects used as covariates in the analysis of contraceptive use

Community Effect	Operationalization	Source
Demographic Norms		
Female educational attainment	Mean years of education	Mutumba, Wekesa & Stephenson, 2018
Wealth	Mean wealth index	Mutumba, Wekesa & Stephenson, 2018
HIV prevention knowledge	7-item HIV knowledge scale	Mutumba, Wekesa & Stephenson, 2018
Exposure to mass media	3 items on frequency of media consumption	Mutumba, Wekesa & Stephenson, 2018
Reproductive knowledge	5 point scale of reproductive health knowledge	Elfstrom & Stephenson, 2012
Fertility Norms		
Age at marriage	Mean age at first cohabitation	Mutumba, Wekesa & Stephenson, 2018

Age at first birth	Mean age of mother when first child is born	Mutumba, Wekesa & Stephenson, 2018
Age of first sex	Mean age of reported first intercourse	Mutumba, Wekesa & Stephenson, 2018
Family size	Mean number of children desired	Mutumba, Wekesa & Stephenson, 2018
Birth Spacing	Mean desire for women to limit childbearing by 2 or more years	Zimmerman, Bell, Li, Morzenti, Angelwisch, Tsui, 2019
Early childbearing	Mean number of women who had a child before age 18	Zimmerman, Bell, Li, Morzenti, Angelwisch, Tsui, 2019
Dissatisfied with Family Planning	1) discontinued use in the past 12 mo and cited husband opposition, fear of side effects or health concerns, interference with the body's natural process as the reason or 2) wanted to delay a birth for two or more years but reported not using a method of contraception because of personal, social, partner, or religious opposition, fear of side effects, or concerns about health	Zimmerman, Bell, Li, Morzenti, Angelwisch, Tsui, 2019
Gender Norms		
Decision making	Mean score on five decision making items	Mutumba, Wekesa & Stephenson, 2018
IPV Normalization	Mean score on five IPV justification items	Mutumba, Wekesa & Stephenson, 2018
Son preference	Ratio of boys to girls in the community	Elstrom & Stephenson, 2012

Analysis Methods: Since the DHS does not collect data on community level variables, we will use methods from our previous studies that have examined the influence of community level norms on reproductive health. First, community level variables are created by aggregating data from all individuals within a given primary sampling unit (PSU) (the PSU is used a proxy indicator for the respondent's community) and then this is divided by the number of respondents in the PSU to create a community mean (for continuous variables) or proportion (for dichotomous variables). Once community level variables are created for the global dataset of 54 DHS datasets, a country-time variable will be created. This ordinal variable will be coded 1 for the first dataset from each country (pre-2000), 2 for the second (2000-2010) and 3 for the third (post-2015). This variable allows us to identify community variables at a specific time period.

Four multilevel logistic regression models will then be fit to a binary outcome of modern contraceptive use. Given the nested structure of the data (i.e. women nested within PSU and PSU within countries), a series of four three-level models will be used to examine the influence of community-level factors on contraceptive use, where level one is the individual, level two is PSU, and level three is country. Models 1-

3: Controlling for individual and household-level characteristics (e.g. age, education, household wealth, rural or urban residence, number of children), three stratified models will be fit for each time period (pre-2000, 2000-2010, post-2015) with PSU as a random effect at level 2. This will identify community effects that are significantly associated with contraceptive use at each time point throughout the region. We will also include region (West, Central, Eastern, Southern Africa) as a fixed effect to better understand regional variations in these effects, and the extent to which community effects on contraceptive use have changed differentially over time and across regions. Significant community-level effects will then be compared and contrasted to observe differences and changes in these effects by time period. Model 4: A fourth model will use all 54 datasets and add the country-time variable as a random effect at level 3. Controlling for the same individual and household-level factors, this added random effect will ascertain whether there is a significant change over time in the community level effects that are associated with contraceptive use.

Expected findings: A preliminary analysis of seven of the 18 countries (n=237,711) provides a proof-of-concept for the feasibility of this study. In the stratified analysis, we found that several community level effects across all three groups were significantly associated with modern contraceptive use at one time point but not another. In particular, certain norms (e.g. son preference) were significantly associated with modern contraceptive use before 2000, but were not significant in later time periods. Conversely, other community level effects (e.g. wealth) remained strongly associated with contraceptive use across time. In the fourth analysis, the country-time variable was significant, indicating that there is a significant change in the community level effects shaping modern contraceptive use over time.

Conclusion: Understanding that community level effects are dynamic is important for creating multilevel interventions that respond to the multiple forces that shape a woman's decision to use contraception. By demonstrating that these effects change over time and highlighting which effects remain constant, researchers and social policy makers can better anticipate points of intervention for programs that aim to increase its uptake. As the world turns its attention to the era of FP2030, it is imperative to account for the ways in which community norms shift and new norms emerge so that interventions and policy makers can work together to ensure universal access to family planning for women across the region.

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