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CLINICAL ARTICLE

Equity and achievement in access to contraceptives in East Africa between 2000 and 2010

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ABSTRACT

Objective: To examine trends in equity in contraceptive use, and in contraceptive-prevalence rates in six East African countries. **Methods:** In this repeated cross-sectional study, Demographic and Health Surveys Program data from women aged 15–49 years in Ethiopia, Kenya, Malawi, Rwanda, Tanzania, and Uganda between 2000 and 2010 were analyzed. Individuals were ranked according to wealth quintile, stratified urban/rural populations, and calculated concentration index—a statistic integrating information from all wealth quintiles to analyze disparities. **Results:** Equity and contraceptive-prevalence rates increased in most country regions over the study period. Notably, in rural Rwanda, contraceptive-prevalence rates increased from 3.9 to 44.0, and urban Kenya became the most equitable country region, with a concentration index of 0.02. The Pearson correlation coefficient between improvements in concentration index and contraceptive-prevalence rates was 0.52 ($P = 0.011$). **Conclusion:** The results indicate that countries seeking to increase contraceptive use should prioritize equity in access to services and contraceptives.

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1. Introduction

Contraception has broad, positive effects on the health and well-being of women, as well as on neonate and child survival and health [1,2]. However, disparities in knowledge of, and access to, contraception are barriers to fulfilling unmet contraceptive needs, and inequalities in contraceptive-prevalence rates across wealth strata are well documented throughout the world [3–9]. In Africa, a woman's likelihood of using contraception increases with her wealth [10,11].

Within countries, increases in the uptake of contraception are not always equally distributed. This is supported by fundamental cause theory, which suggests that individuals with more resources utilize medical interventions more rapidly [12]. The uptake of contraception often occurs first among urban populations and richer groups [13]. Discrepancies in healthcare utilization between groups within a country could reflect inequity in access and uptake, with inequity defined as an inequality that is inherently unjust [14–16]. Evidence highlights that inequalities in contraceptive-prevalence rates do in fact represent such an inequity [4,5]; the characterization of such inequities is a critical first

step towards rectifying them through targeted policies and programs. Indeed, Sub-Saharan Africa experienced the onset of a transition from high to low fertility later than other regions globally and has experienced a slower transition than those seen in Latin America and Asia during the 1970s [17]. Examining simultaneous trends in contraceptive-prevalence rates and equity of use can help to produce a clearer picture of this process and highlight areas for improvement.

A previous study examined inequities in contraceptive-prevalence rates [4]. However, we are not aware of any study that has utilized the preferred geographical stratification of wealth index, which utilizes achievement scores to discuss intra-country progress over time and to make cross-country comparisons; similarly, to the best of our knowledge, no study has assessed any correlation between changes in equity in contraceptive use and changes in contraceptive-prevalence rates. The aim of the present study was to examine progress in equity of contraceptive-prevalence rates, and trends in average levels of contraceptive prevalence in six East African countries (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, and Uganda) between 2000 and 2010. The present study updates previous analyses of equity in contraceptive-prevalence rates and improves upon them by: tracking equity indicators over three time points; addressing the limitations of the Demographic and Health Surveys (DHS) wealth index by considering wealth disparities in urban and rural population subsets separately; and by calculating achievement scores to analyze prevalence and equity simultaneously.

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It was hypothesized that countries that increased their equity in contraception use over the study period would exhibit the greatest overall increases in contraceptive-prevalence rates.

2. Materials and method

The present study utilized nationally representative DHS data in a repeated cross-sectional study. The DHS programs included household-based surveys of women aged 15–49 years collected by ICF International in collaboration with host-country governments. DHS programs collected data related to health, including contraception use. The surveys were implemented using a census-style, multi-stage, cluster-sampling strategy (<http://www.measuredhs.com>). Questionnaires and study procedures were approved by the ICF International institutional review board; typically, an institutional review board in each host country also reviewed study protocols and ensured compliance with domestic laws. Informed consent was obtained from each survey participant in each DHS program. The present study utilized the de-identified public data sets created from these survey results. The secondary analysis of these data by the present study's authors was exempt from institutional review board review at Stony Brook University owing to the data being publicly available and de-identified.

DHS data from the six countries in East Africa that had been included in at least three such surveys between 1998 and 2010 were analyzed: Ethiopia, Kenya, Malawi, Rwanda, Uganda, and Tanzania (Table 1). For the analyses, the sub-sample of currently married and co-habiting women was examined.

The primary outcome was current modern contraceptive use, measured using contraceptive-prevalence rates and defined as the use of female and male sterilization, oral hormonal pills, intra-uterine device, male condoms, injectables, implants, vaginal barrier methods, female condoms, or emergency contraceptive pills. In the DHS program, women were asked if they were currently using each of these methods. Contraceptive-prevalence rates were calculated as the percentage of women currently using a modern method; participants were stratified in each country according to whether they resided in urban/rural areas, and by wealth. The main independent variable in this analysis was the DHS wealth index, which was used to rank individuals in urban and rural areas separately.

Traditionally, inequalities in contraceptive-prevalence rates are measured using rate ratios, which compare the richest and poorest wealth quintiles [6]. However, this method neglects the three middle quintiles of society. The present study utilized a more comprehensive method employing the concentration index, which simultaneously integrates information for individuals across all wealth strata to evaluate inequality.

The concentration index quantifies the income-related inequality in a health variable after ranking individuals according to their wealth. It is calculated directly from concentration curves. A concentration curve plots the cumulative percentage of a health indicator against the cumulative percentage of the population ranked by wealth (an example is present in Supplementary Material S1). The concentration index is calculated as follows:

$$C = \frac{2}{n\mu} \sum_{i=1}^n h_i r_i - 1 - \frac{1}{n}$$

Table 1
Demographic and Health Surveys data time points for each study country.

Country	Time point 1	Time point 2	Time point 3
Ethiopia	2000	2005	2011
Kenya	1998	2003	2009
Malawi	2000	2004	2010
Rwanda	2000	2005	2011
Tanzania	1999	2004	2010
Uganda	2001	2006	2011

where C is the concentration index, n is the sample size, h is the health variable and μ is its mean, and r is the fractional rank according to wealth index [18]. When there is perfect equality of the health variable, the concentration index will equal zero. When the health variable is concentrated among the rich, the concentration curve lies below the line of equality, and the concentration index will be greater than zero (Supplementary Material S1).

One caveat to the application of the concentration index is that its accuracy depends upon the quality of the wealth indicator. The DHS wealth index score is calculated by analyzing household assets and is likely biased towards urban assets as indicators of wealth. Consequently, ranking individuals from urban and rural areas on the same scale based upon their household wealth index scores over-categorizes people from urban areas to the “rich” quintiles and people from rural areas to the “poor” quintiles. Therefore, a regionally stratified analysis is a preferred method of addressing the DHS urban/rural wealth index discrepancy [19].

After stratifying participants by urban or rural regions, individual women were assigned a weighted rank according to their sample weight and DHS wealth index scores. The concentration index of each participant was subsequently calculated at each of the three time points using the convenient regression method described by Kakwani et al. [20]. Because contraceptive use is a binary variable, the methodology established by Wagstaff was applied to correct the concentration index for bounded variables [21].

Importantly, the concentration index does not simultaneously communicate prevalence and equity. This was accomplished using the achievement score, which is the product of the contraceptive-prevalence rate multiplied by 1 minus the concentration index [21,22]. Consequently, the achievement score adjusts the contraceptive-prevalence rate according to the equality of distribution, such that a country with a lower contraceptive-prevalence rate but greater equity could have the same achievement score as a country with a higher contraceptive-prevalence rate but lower equity.

In order to test the hypothesis that country regions that increased their equity in contraception use over the study period would have the greatest increases in contraceptive-prevalence rates, the significance of the Pearson correlation coefficient between changes in concentration index and changes in contraceptive-prevalence rates was calculated and tested. Statistical significance was defined as $P = 0.05$. All analyses were conducted using Stata version 13 (StataCorp LP, College Station, TX).

3. Results

In Table 2, contraceptive-prevalence rates, equity (concentration index), and achievement scores are presented for all country regions at each time point. Trends in the national, rural, and urban data are presented in Figs. 1–3, respectively. Specific data from each country are described below.

Urban, rural, and national data from Ethiopia demonstrate increasing contraceptive-prevalence rates and achievement scores between 2000 and 2010; however, the urban and rural regions have diverged in terms of progress in equity (Figs. 2 and 3). Between 2000 and 2005, Ethiopia demonstrated increasing equity in contraceptive-prevalence rate distribution in urban areas (2000 concentration index = 0.20, 2005 concentration index = 0.10) and decreasing equity in the distributions observed in rural areas (2000 concentration index = 0.19, 2005 concentration index = 0.34). Between 2005 and 2011, the concentration index stabilized at 0.10 in urban areas and rural Ethiopia became more equitable (the concentration index decreased to 0.23), contributing to an improvement in the national concentration index from 0.47 to 0.34. Whereas initial increases in contraceptive-prevalence rates in rural Ethiopia exhibited a pattern of decreasing equity, the sharp increase in rural Ethiopia's contraceptive-prevalence rate from 10.6 to 22.5 between 2005 and 2011 demonstrated a return to a more equitable distribution, indicated by a decreasing concentration index (Table 2).

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