

# Assessing (in) equalities in contraceptives use and family planning demand satisfied with modern contraceptives in Kenya

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## Research

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## Abstract

**Background:** Family planning plays an important role in reducing high-risk and unwanted pregnancies and associated complications. Kenya has made progress increasing the use of modern contraceptives. We assessed inequalities in contraceptive use and family planning demand satisfied.

**Methods:** We used data from seven rounds of Performance, Monitoring and Accountability 2020 cross-sectional surveys, 2014-2018. Women aged 15-49 years were interviewed after informed consent was obtained. Contraceptive prevalence and demand for family planning satisfied standard definitions were used. Data were stratified by type of contraception (long-acting/permanent, short-acting, or traditional); wealth, residence, education, age, and wealth. Data were analysed using Stata v14.

**Results:** Modern contraceptive prevalence has increased from 58.7% in 2014 to 64.2% in 2018 among sexually active married women. Total demand for family planning satisfied (DFPS) has increased from 70.5% in 2014 to 79.0% in 2018. There was a significant increase in long acting/permanent methods from 27.1% in 2014 to 42.9% in 2018 and a decrease in short acting methods from 71.6% in 2014 to 54.0% in 2018. The odds of contraception use among older women was 1.48 times higher than among adolescents (aOR=1.48; 95% CI: 1.21, 1.81); among married women 0.74 times compared to the unmarried women (aOR 0.74; 95% CI: 0.63, 0.86). The odds of contraception use increased with increasing education (secondary or higher education: aOR 3.78; 95% CI: 2.90, 4.92) and wealth quintiles (highest wealth quintile: aOR = 1.36; 95% CI: 1.12, 1.65). There were significant differences in DFPS by modern methods: older women vs adolescents (aOR = 2.40; 95% CI: 1.96, 2.93); married vs unmarried women (aOR = 1.53; 95% CI: 1.32, 1.78); secondary or higher education vs no education: aOR 2.39 (95% CI: 1.95, 2.94); and highest vs lowest wealth quintile: aOR = 1.53 (95% CI: 1.24, 1.89).

**Conclusion:** Contraceptive use and specifically long-acting reversible contraceptives are on the rise in Kenya. However, persistent inequities need to be addressed if no women are going to be left behind to access and use family planning/contraceptives. Current achievements should be maintained while targeting women who are poor, uneducated/illiterate, young, and living in rural areas.

## Plain English Summary

Family planning plays an important role in a woman's life. It can prevent pregnancies and complications related to pregnancies. Kenya has a strong reproductive health program to increase access to and use of family planning/contraceptives. This study used data from 11 of the 47 counties in Kenya to examine whether the improvement in access to and use of contraceptives is reaching all women. The study shows there was increase in use of contraceptives among sexually active married from 58.7% in 2014 to 64.2% in 2018. Notable also was an increase in long acting methods and decrease in short acting methods. There was also an increase in the percentage of women with a demand for family planning whose demand was satisfied with modern contraceptive from 2014 to 2018. However, the increase in use of contraceptive and demand satisfied with modern contraceptives is not uniform. There are women who are not being reached by current programs. These include women who are: adolescents, unmarried, with low education attainment, poor, and living in rural areas. This study shows that there are persistent inequities that need to be addressed if no women are going to be left behind to access and use family planning/contraceptives. Current achievements should be maintained while targeting women who are poor, low education attainment, young, and living in rural areas.

## Background

Family planning plays an important role in reducing high-risk and unwanted pregnancies, which significantly reduce the risk of maternal and child deaths [1–4]. Studies have indicated that through the prevention of unintended pregnancies, use of family planning has reduced maternal mortality by 44 percent and if all women with unmet need became contraceptive users then a further 29 percent of deaths could be reduced [5]. The Sustainable Development Goals (SDG) target 3.7 calls for universal access to family planning services to ensure healthy lives and well-being [6]. Despite tremendous investment and an enormous increase in family planning use, significant disparities still exist in a number of developing countries [7]. These disparities may constitute inequities. 'Health equity' or 'equity in health' implies that ideally everyone should have a fair opportunity to attain their full health potential and that no one should be disadvantaged from achieving this potential" [8]. Whitehead [9] noted that inequities in health are those that are avoidable, unnecessary and unjust.

Inequities in health can be addressed using Universal Health Coverage (UHC). Under UHC, universal access to FP services is also being tracked using demand for FP satisfied with modern methods (mDFPS) [7, 10]. Using Demographic and Health surveys and Multiple Indicator Cluster surveys data from 1993 to 2017, Hellwig et al [10] study showed overall increase in mDFPS with narrowing of the gap between the rich and the poor with differential coverage and high levels of inequalities. da Silva et al [11] study using Demographic and Health surveys and Multiple Indicator Cluster surveys data from 2010 also showed large inequities in demand for family planning satisfied with modern methods (mDFPS) between countries. mDFPS reflect family planning's aim of supporting individuals' and couples' right to choose whether and when to have a child by providing them the means to implement their decisions and promotes voluntarism, informed choice, rights, and equity, the strength of family planning programs. mDFPS is being proposed as an alternative measure to track Sustainable Development Goals (SDGs) [7]. Tracking mDFPS could unravel inequities between regions within a country.

Many studies conducted in the developing world have shown that wealthier women are more likely to use family planning methods and maternal health care services than their less wealthy counterparts [12–14]. A study of data from 46 developing countries found that the contraceptive prevalence rate (CPR) of the richest population quintile averages 51 percent, compared to 32 percent among the poorest quintile [15]. Despite the disparities between the poor and rich, the nature and trends appear to depend in the context [16,17]. For example, a recent study in Ethiopia showed that the relative inequality in family planning use and contraceptive needs satisfied between wealthiest and poorest women significantly dropped between 2005 and 2011 in rural Ethiopia but not among urban women [18].

Research on economic disparities in contraceptive use is particularly important in Kenya. Previous research on this topic in Kenya has found that less privileged women (by wealth or education) are more likely to resort to short-term methods than their better-off peers [19]. Data from past Demographic and Health surveys (DHS) in Kenya showed that between 2003 and 2008, use of modern contraceptives in urban areas increased from 40 to 47 percent due to rapid growth among the poorest quintiles while use in rural areas grew from 29 to 37 percent, but wealth differentials persisted [16]. The trends in uptake of modern contraception from KDHS show narrowing of differences by rural-urban residence but not by level of educational attainment [20].

Choi & Fabic [7] suggests that for countries to achieve the goal of leaving no one behind, within country disparities need to be monitored and addressed because people at lower social stratum are likely to be left behind and excluded from these priority services. There are now calls for analysis of data on a country-specific and subgroup basis to pinpoint inequalities in service use [15, 17]. The existing disparities continue to pose a challenge to achieve national health sector development program targets and universal family planning coverage. Studies on factors influencing access to services indicate that other than deeply rooted structural causes, factors at the health system level such as quality of the services, hospitality factors and frequent stock outs might prevent vulnerable groups from using family planning services [21].

The purpose of this paper is to identify inequalities in the use of family planning (FP) services based on data from counties in Kenya participating in Performance, Monitoring and Accountability 2020 (PMA2020) project with the aim of better understanding how to improve the effectiveness of reproductive health (RH) policies and programs. This paper therefore examines trends in inequality in key family planning indicators by household wealth, age of women, marital status and rural-urban residence in Kenya during period 2014–2018 in order to ascertain whether, the socio-economic disparities have narrowed. Monitoring trends in disparities is useful to determine the extent to which programs can be targeted to those who need most and identify key reasons for disparity between the different groups.

## Methodology

### Study setting, design and population

Performance Monitoring and Accountability 2020 (PMA2020) survey was implemented in Kenya from 2014 to 2018 in 11 of the 47 Counties to track the Kenya FP 2020 commitment through key family planning indicators. PMA2020 is a cross-sectional survey which uses standardized questionnaires for households and females to gather data about households and individual females that are comparable across program countries and consistent with existing national surveys. Full details of the PMA2020 methodology has been published elsewhere [22]. In brief, a nationally representative selection of households was identified via a 3-stage cluster design with urban/rural regions as strata. In the first stage of selection, 11 counties were selected probability proportional to size (PPS), followed by a selection of enumeration areas with about 200 households, selected via PPS within urban and rural strata. From each of these EAs, 42 households were selected randomly for the household interview and all women age 15–49 who were regular members of the household or who slept in the household the night before were selected for the female interview. The first four rounds, data was collected 6 months apart in 9 counties (Bungoma, Kilifi, Kitui, Kiambu, Kericho, Nandi, Nyamira, Nairobi, and Siaya counties). From 2016, two additional counties (Kakamega and West Pokot) were selected using the same procedure and enumeration areas were refreshed.

## Data Management

Interviews were conducted by trained interviewers who were residents in the EAs, using a smart phone. Data collected from the field was submitted to a secure server with encryption for aggregation using Open Data Kit (ODK). In this study, data from 7 cross-sectional household PMA2020 surveys were used to examine the socioeconomic disparities in use and demand satisfaction by modern methods. For 2014 and 2015, data from the two surveys conducted each year were pooled to have yearly data. The final analysis was based on the pooled data for the 7 rounds of data collection.

## Study Variables

Contraceptive prevalence rate (CPR) and demand for family planning satisfied by modern methods (mDFPS) were the dependent variables which were defined and computed as per the Demographic and Health Survey methodology [23]. We also defined the type of contraceptive methods as: a) short-acting methods (injectables, contraceptive pills, condoms, diaphragms, spermicidal agents, emergency contraception and Lactational Amenorrhea Method (LAM)); b) long-acting (Intra Uterine Devices (IUDs), hormone implants) and permanent (male and female sterilizations) methods; c) traditional methods (periodic abstinence, withdrawal and other folkloric methods).

The main predictor variable was socioeconomic status which was proxied by household wealth quintile using DHS method of constructing the wealth quintile. Household wealth was measured using a constructed index score based on ownership of 25 household durable assets, house and roof material, livestock ownership and water source, which was converted into quintiles [23]. The wealth index and associated quintiles were created during data processing and are included as part of the publicly available dataset; they were not re-constructed for the purposes of this analysis. Other socioeconomic factors measured included: age of the respondent (adolescent (15–19 years) and older women (20–49 years)), education level (none, primary, and secondary or higher), residence (urban or rural) and marital status (currently in union or not in union), and county of residence. These measures serve as controls in the multivariate analysis, so as to isolate the relationship between socioeconomic status and contraceptive use after accounting for other factors associated with both.

## Statistical analysis

Descriptive statistics and trend analysis for proportions were used to describe the demographic and socio-economic characteristics of the study participants, to identify patterns in contraceptive use and demand for FP satisfied with modern methods and their changes over time. To assess disparity and equality trends across subgroups, we considered and chose to use absolute differences over relative differences, in line with recommendations by Hosseinpoor that for the sake of clarity and ease of understanding, reporting simple pairwise measures rather than more complex measures suffice when both classes of measures are likely to lead to the same conclusion [24]. By definition, absolute differences is the level of health indicator in the most-disadvantaged subgroup subtracted from the health indicator in the most advantaged subgroup (or vice versa) while the relative difference is the level of health indicator in the most-disadvantaged subgroup divided by the health indicator in the most advantaged subgroup (or vice versa).

Though monitoring relative difference over time has the advantage of having changes in the underlying rates between subgroups already adjusted [25], relative difference may, however, over- or under-emphasize disparity when levels across subgroups are relatively low or high, respectively. In addition, while using relative differences, there's a challenge in the selection of a reference group, since the measure can be sensitive to the choice [25]. On the other hand, absolute difference is an intuitive summary measure of disparity whose trend is determined by various trends among subgroups [25]. For example, decreasing disparity can result from different trends in 2 subgroups: improvement in both groups but more rapid improvement in a disadvantaged group; or improvement in the disadvantaged group but no improvement or even deterioration in the advantaged group [7].

For the absolute difference, we calculated the percentage-point difference between the most and the least advantaged groups. That is, for age (adolescent and older women); for education (between secondary or higher education and no education); for wealth (highest wealth quintile and lowest wealth quintile); for residence (urban and rural); for parity (no children and four or more children); and for marital status (currently in union and not in union). The reference point for the absolute difference was the least advantaged. Multivariable logistic regression models were then employed to estimate the effects of the predictors to the response variables, and especially to evaluate how the gap between the most advantaged and the least advantaged categories of the wealth index varied over time.

To compliment the aforementioned approach, we also used concentration curves and the concentration index to summarize the disparities [26]. We also employed an extension to the concentration index for binary health outcomes to measure disparities in the use of contraception. A characteristic feature of the concentration index (CI) of this modified measure is that it takes into account every individual's level of health and every individual's rank in the socioeconomic domain [27].

The standard version of the concentration index can be derived from the concentration curve and represents twice the area between the concentration curve and the 45° line of equality [28–30]. For a bounded health variable, including binary indicators such as contraceptive use, Erreygers [31] proposed a modified version of the concentration index (i.e. the Erreygers Concentration Index, or ECI). The ECI satisfies the conditions that the absolute value of the index is the same regardless of whether inequality in health or in ill-health is being measured (mirror property), and that the value of the index is invariant to any feasible positive linear transformation of the health variable (scale and translation invariance) [31, 32]. The ECI is defined as:

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where  $h_i$  is the health variable,  $R_i$  is the fractional rank of female respondent  $i$  in the distribution of socioeconomic status,  $n$  is the number of observations and  $b_h$  and  $a_h$  are the variables upper bound and lower bound, respectively. While the standard concentration index measures relative inequality for unbounded variables, the ECI is a measure of absolute inequality for bounded variables. ECI values have a possible range from  $-1$  to  $+1$ . It has a negative value when the health indicator is concentrated among the least disadvantaged; and it has a positive value when the health indicator is concentrated among the most advantaged. When there is no inequality, the ECI value is 0.

STATA 15.0 statistical software was used for all analyses (Stata Corporation, College Station, TX, USA) and took into account sampling weights, as well as clustering and stratification where appropriate.

## Results

### Characteristics of the study population

A total of 20,486 sexually active women aged 15-49 were included. Table 1 presents the distribution of the study population according to their demographic and socio-economic characteristics. Though the minority of women in the sample has consistently been adolescents, the proportion of adolescent participants has increased significantly from 5.4% in 2014 to 6.3% in 2018 ( $p=0.04$ ). The proportion of women with primary or vocational education dropped significantly from 56.3% in 2014 to 50.5% in 2018 ( $p<0.001$ ); while that of women with no education increased slightly from 3.6% in 2014 to 4.9% in 2018 ( $p=0.002$ ) and that of women who reached the secondary education or higher increased from 40.1% in 2014 to 44.6% in 2018 ( $p<0.001$ ). Participation in the study among women residing in rural areas significantly rose from 61.1% in 2014 to 68.0% in 2018 ( $p<0.001$ ). The large majority of women in the sample are married but over time, the proportion of unmarried significantly increased ( $p<0.001$ ). The majority of women have one to three children (about 6 in every 10 women).

{Table 1 here}

### Trends in use of contraceptive methods

Table 1 also shows trends in the use of contraceptive methods, demand for family planning and the proportion of the demand that is satisfied with modern methods over time. From the results demand for contraceptives have been constant over the five-year period. Demand satisfaction have been increasing over time while modern family planning use increased between 2014 and 2015 and then it did plateau. Among the current users of contraception, there has been significant increase in the proportion using long term and permanent methods (27.1% in 2014 to 42.9% in 2018 ( $p < 0.001$ )) while the proportion of users of short term methods has been declining. In addition, the proportion of all sexually active women using any contraceptive method significantly increased from 57.7% in 2014 to 65.0% in 2018 with a trend analysis for proportions,  $p = 0.005$ . The proportion of sexually active women using modern contraceptive methods increased by 6.0% from 57.0% in 2014 (regression slope=0.103;  $p < 0.001$ ). About 80.8% of the sexually active women had a demand for FP in 2014, which slightly increased to 82.6% in 2015 and then there was a decrease to 79.7% in 2018. The percent of demand for FP satisfied (DFPS) with modern contraceptives rapidly increased between 2014 and 2015 (from 70.5% to 75.7%) then there was a slow rise to 79.0% in 2018, this increase was significant (regression slope=0.019;  $P < 0.001$ ). Total unmet need for family planning significantly decreased from 23.8% in 2014 to 16.7% in 2018 (regression slope=-0.017;  $P < 0.001$ ).

### **Trends in contraceptive method mix**

Table 2 shows the trends in contraceptive method mix (method groups) by the demographic and socioeconomic characteristics of the sampled population. The methods have been broadly grouped into: a) short acting methods (injectables, contraceptive pills, condoms, diaphragms, spermicidal agents, emergency contraception and LAM); b) long acting (IUDs, hormone implants) and permanent (male and female sterilizations) methods -LAPM; and c) traditional methods (periodic abstinence, withdrawal and other folkloric methods).

The results show a dramatic decrease overtime of the share of short-acting methods (from 71.6% in 2014 to 54.0% in 2018) and an increase in the share of LAPM (27.1% in 2014 to 42.9% in 2018). Traditional method use has stayed low throughout the period, never rising above 2.1%.

By age, the increase in the share of LAPM has been larger among women age 20 – 49 (having increased from 27.4% in 2014 to 43.5% in 2018) than among the adolescents (from 18.4% in 2014 to 24.4% in 2018). Similarly, the decrease in the share of short-acting methods between 2014 and 2018 was more pronounced among women aged 20 – 49 years (17.9%) as compared to the decrease in use of short-acting methods among adolescents (7.0%).

Though uptake of LAPM over time has been on the increase across all the categories, we observe from the results that the uptake was higher among the (economically) least advantaged women as compared to their most advantaged counterparts – by education, wealth and residence. Indeed, the share of LAPM over time was higher among women with no education (27.7%, 43.6%, 45.6%, 54.2% and 53.7% using LAPM in 2014, 2015, 2016, 2017 and 2018 respectively) as compared to their counterparts with secondary or higher education (26.2%, 30.9%, 35.6%, 32.7% and 38.3%). The share of LAPM among women from the households in the lowest wealth quintile was higher in 2017 and 2018 (41.4% and 48.2% respectively) as compared to those from the higher wealth quintile (34.4% in 2017 and 37.2% in 2018) and the highest wealth quintile (38.7% in 2017 and 41.9% in 2018) households respectively). The same pattern was also observed among women from rural areas as compared to their counterparts in urban areas. Demographically, uptake of LAPM was higher among the most advantaged women as compared to their least advantaged counterparts – by Age, marital status and parity. By age, uptake of long-acting and permanent methods over time was higher among older women as compared to adolescent women. By marital status, uptake of long-acting and permanent methods over time was higher among married women as compared to the unmarried women. By parity, uptake of long-acting and permanent methods over time was higher among women with 4 or more children as compared to women with 1 – 3 children and women with no children. With regards to short-acting methods, there has been a general decrease in share across all categories.

{Table 2 here}

### **Disparities in family planning use**

Figure 1 and Suppl. Fig. 1 shows the trends in contraceptive use disparities by age, residence, marital status, education, household wealth levels and parity and the corresponding 95% Confidence Intervals. For all the characteristics, there are marked disparities in FP use by all the variables considered across the years ( $P < 0.05$ ). The largest disparity occurs by age, education and parity. For age, the largest increase in disparity occurred between 2014 and 2015, there after there was a drop in 2017 followed by an increase in 2018.

Family planning utilization among women with secondary or higher education has also been higher than among those with no education. The same occurred by wealth index where women from resource poor households utilize FP methods less than women from rich households. From the results, there appears to be a pattern of widening poor-rich inequalities (since education can be considered to be closely related to wealth). The widening gap occurred mainly from 2014 up to 2016 but narrowed somewhat in 2017 and 2018. Compared to the other indicator variables, the inequality gap by place of residence seems narrowest.

Figure 2 shows disparities in demand satisfied with modern contraceptive methods while in Suppl. Fig 2 has the corresponding 95% CI for the differences. From the results, we observe decreasing trends in disparities in demand satisfied with modern methods among the highly educated and those with no education and among women in the highest and those in the lowest wealth quintiles since 2016. The disparity in demand satisfied with modern methods between adolescents and older women sharply increased between 2014 and 2015, which was thereafter followed by slow decrease between 2015 and 2017 and an increase in 2018. Over time, the gap in demand satisfaction between married and unmarried women have remained constant whereas between rural and urban women, the gap in demand satisfaction have slightly narrowed. In addition, though there was an initial decrease of disparities in demand satisfied with modern methods by wealth between 2014 and 2015 followed by an increase (10.3%) in 2016, there has been a consistent decrease in the level of disparity between the wealthiest and poorest women between 2016 and 2018.

## Disparities in contraceptive use and demand satisfaction by demographic and socioeconomic variables

Table 3 shows the results of unadjusted odds ratios (OR) and adjusted odds ratios (aOR) for year and round of data collection as well as the county from which the data were collected. From the results, we observe that the odds of contraceptives use among sexually active older women is about 1.5 times higher than among adolescents (aOR=1.48; 95% CI: 1.21, 1.81). There is no significant difference in the odds of contraceptives use among sexually active urban and rural women (aOR=1.13; 95% CI: 0.99, 1.31). Married women have significantly lower odds of contraceptives use compared to the sexually active unmarried women (aOR 0.74; 95% CI: 0.63, 0.86). Further, the results indicate that the odds of contraception use increased with increasing education (Secondary or higher education: aOR 3.78; 95% CI: 2.90, 4.92). Similarly, the odds of contraception use increase with increasing wealth index (the highest wealth quintile: aOR = 1.36; 95% CI: 1.12, 1.65). By parity, the odds of contraceptives use among women with 4 or more children is about 5.5 times higher than among women with no children (aOR=5.47; 95% CI: 4.52, 6.61). Similar results were observed with regards to use of long acting and short acting methods.

{Table 3 here}

Regarding demand satisfied with modern contraception as shown in Table 4, older women have significantly higher odds of having their demand for FP satisfied with modern contraception as compared to adolescents (aOR = 2.40; 95% CI: 1.96, 2.93). The odds of demand satisfaction with modern contraception among urban and rural women are not different (aOR = 1.14; 95% CI: 0.97, 1.34). There are significant differences in the demand for FP satisfied with modern contraception among married and unmarried women (aOR = 1.53; 95% CI: 1.32, 1.78). Demand for FP satisfied with modern contraception increases significantly with higher education, parity and wealth index [secondary or higher education: aOR 2.39 (95% CI: 1.95, 2.94); 4 or more children: aOR=3.01 (95%CI: 2.33, 3.88); Highest wealth quintile: aOR = 1.53 (95% CI: 1.24, 1.89)]. By county of residence, the odds of demand for FP satisfied with modern contraception were significantly lower for Kilifi and West Pokot as compared to Bungoma county [Kilifi: aOR = 0.64 (95% CI: 0.49, 0.83)]; West Pokot: aOR = 0.41 (95% CI: 0.28, 0.63)] while Kiambu, Nyamira and Kakamega had significantly higher odds of having their demand for FP satisfied with modern contraception as compared to Bungoma [Kiambu: aOR = 1.48 (95% CI: 1.03, 2.13)]; Nyamira: aOR = 2.13 (95% CI: 1.55, 2.94)]; Kakamega: aOR = 1.54 (95% CI: 1.10, 2.17)].

{Table 4 here}

## Concentration curves and concentration indices for contraceptives use

Figures 3 and 4 show concentration indices and the curves (for the pooled data) that summarize the disparities in single index. With the sexually active women ranked by age, residence, marital status, education, wealth and parity the concentration index indicates inequality in contraceptives use and demand satisfied by modern methods in favour of the most advantaged groups i.e. Since the concentration indices by the different demographic and socio-economic characteristics have positive values, contraceptives use and demand satisfied by modern methods are shown to be concentrated among the most advantaged groups. Concentration curves and indices for each study year are shown as supplementary materials [see Additional file 1].

## Discussion

Using a nationally representative sample of sexually active women, in this paper, we examined trends in disparities in use of modern contraception and proportion of demand satisfied. The data shows an initial increase and then a plateau in the uptake of modern methods for contraception across all the socio-economic groups with a significant increase from 2014 to 2018. Further, there has been an increase in proportion of demand satisfied and unmet need declined across all the socio-economic groups.

In addition to increase in uptake, the patterns of use have been changing. There is a dramatic change in contraceptive method mix with an increasing share of long acting methods. The shift in the share of long acting methods was more pronounced among women in the lower socio-economic strata. This result is in contrast to other studies in Africa using past demographic and health surveys data, which indicated increased use of short-term methods but unchanging or decline in long acting methods [19,33]. For example, Fotso et al [19] observed that between 1993 and 2009, the proportion of long-acting method users in Kenya dropped by half from 39.0 percent to 18.2%. Our findings could be accounted for the guarantee program for implants as well increased efforts by government to improve access for LAPM.

Despite the increase in use of modern methods, disparity in use still persists. The results of the logistic regression analyses confirm the existence of socio-economic inequality in contraception use as well as demand satisfied with modern methods. Regression analysis results are supported by findings from analysis using concentration index of contraceptive use and demand satisfied by modern methods. The most disadvantaged groups include; adolescents, those residing in rural areas, the unmarried, those with no education as well as those from poor households. Our findings are similar to those reported by others [34-37]. The results on trends in disparities are similar to an earlier study in Kenya [19] and a worldwide study [36] which indicated that there was a narrowing of the gap in uptake of contraception between women living in urban areas and those living in rural areas, [39] the poor versus the wealthy and those with low education attainment versus those with higher education. However, in our study, education differences were unchanging which is consistent with a similar study by Asamoah et al [40] from Ghana.

The results obtained here further confirm the need to examine disparities in different contexts because causes of disparities may vary and based on the definitions used [24,40,41]. Creanga et al, [33] asserts that disparities can be the product of inequality that reflects different fertility intentions or inequity which reflects different ability to achieve desired fertility but in most sub-Saharan African countries, both factors are involved. Hotchkiss, et al. [37] study on "horizontal inequity" in use of modern contraceptives noted that there can be inequality in mCPR which is based on actual use, and mCPR inequity, which is based on need standardized use". For clearer program interventions, there is need to focus on the understanding of major factors behind the continued

disparities in use such as structural causes, quality of the services among others because a review barriers to method use among the poor can allow for a rigorous approach to closing the equity gap [33-35,40,41].

There are some limitations to consider when interpreting the data. The data utilized in this study comes from the areas in the country that has higher levels of development and longer history of contraceptive use and therefore does not include poorer northern arid areas with lower use of contraceptive uptake which may require greater attention. No attempt was made to decompose the different components of disparity such as changing distributions of the different groups.

The strength of this study was the inclusion of demand satisfied for contraception beyond measuring modern contraceptive use. mDFPS reflect family planning's aim of supporting individuals' and couples' right to choose whether and when to have a child by providing them the means to implement their decisions and promotes voluntarism, informed choice, rights, and equity, the strength of family planning programs (7,41). MDFPS is being used as an alternative measure to track Sustainable Development Goals (SDGs).

## Conclusion

Efforts to increase use of contraceptives and improve levels of demand satisfied by modern contraceptive use in Kenya are bearing fruits as demonstrated by overall increase in contraceptive use and mDFPS among sexually active women. However, there are many women who are still not being reached by current programs. Special programs such as targeted outreach will be required to reach those being left behind. Multisectoral approach will be required to further improve education attainment and poverty reduction. A decomposition analysis to better understand the drivers of the disparities e.g. due to fertility preferences or inability to pay as well as tracking changes at individual level via longitudinal studies are recommended.

## Abbreviations

AOR-Adjusted Odds ratio

CPR-Contraceptive Prevalence Rate

DFPS-Demand for family planning satisfied

IUD-Intrauterine contraceptive device

LAM-Lactation amenorrhea

mDFPS- demand for Family Planning satisfied with modern methods

NCPD-National Council for population and development

OR-Odds ratio

PMA2020-Performance, monitoring and accountability 2020

## Declarations

### *Ethics approval and consent to participate*

Ethical approval for conducting PMA2020 study was provided by Kenyatta National Hospital/University of Nairobi ethical review committee (REF: P15/01/2014), administrative approval by National Commission for Science, Technology and Innovation (REF: NACOSTI/P/14/0813/1676). Interviews were conducted after informed consent or parental consent was obtained as well as assent from the minors. All interviews were conducted in spaces which offered visual and audial privacy.

### *Consent for publication*

Written informed consent for publication was obtained from all study participants and the manuscript does not have individual-specific data.

### *Availability of data and materials*

All datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### *Competing interests*

The authors declare that they have no competing interests.

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### Authors' contributions

PG led the conception, design, acquisition of data, analysis, interpretation of data, and drafting of the manuscript. AA guided data analysis, interpretation and revising of the manuscript. MT and MW were responsible for data collection, analysis and revision of the manuscript. SR, MT, SA, PA, AT and LZ revised the manuscript for intellectual content and have given final approval for the final version. All authors read and approved the final manuscript.

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## Tables

Table 1: Demographic, socio-economic characteristics of the participants and contraceptives use

Variable	Year 2014*	Year 2015*	Year	Year	Year 2018
			2016	2017	
All participants	4,465	5,658	3,462	3,532	3,369
<b>Age</b>					
Adolescents (15-19)	5.4%	6.6%	6.3%	6.4%	6.3%
Older women (20-49)	94.6%	93.4%	93.7%	93.6%	93.7%
<b>Education</b>					
No education	3.6%	4.3%	5.0%	5.7%	4.9%
Primary or vocational	56.3%	54.0%	52.0%	52.0%	50.5%
Secondary or higher	40.1%	41.7%	43.0%	42.3%	44.6%
<b>Household wealth</b>					
Lowest wealth quintile	26.9%	21.0%	17.6%	19.3%	18.6%
Lower wealth quintile	22.1%	21.0%	21.5%	21.8%	20.7%
Middle wealth quintile	18.2%	19.6%	20.7%	20.5%	20.1%
Higher wealth quintile	16.7%	18.8%	19.0%	18.5%	19.5%
Highest wealth quintile	16.1%	19.6%	21.1%	19.9%	21.1%
<b>Residence</b>					
Rural	61.1%	60.6%	67.2%	70.8%	68.0%
Urban	38.9%	39.4%	32.8%	29.2%	32.0%
<b>Marital status</b>					
Unmarried	11.3%	11.3%	14.5%	16.1%	14.4%
Married	88.7%	88.7%	85.5%	83.9%	85.6%
<b>Parity</b>					
No children	9.3%	12.7%	12.1%	13.4%	11.8%
1 - 3 children	58.3%	57.2%	55.5%	54.2%	56.0%
4 or more children	32.4%	30.1%	32.3%	32.4%	32.1%
<b>County</b>					
Bungoma	9.5%	9.0%	9.3%	9.7%	9.0%
Kericho	13.0%	12.9%	11.1%	10.9%	9.5%
Kiambu	8.6%	11.4%	7.4%	6.5%	7.0%
Kilifi	12.2%	12.4%	8.8%	8.7%	8.3%
Kitui	9.4%	11.6%	8.3%	8.6%	8.4%
Nairobi	17.0%	16.1%	10.6%	9.3%	12.2%
Nandi	10.7%	8.9%	9.2%	10.1%	9.8%
Nyamira	9.4%	8.0%	7.6%	6.8%	7.0%
Siaya	10.2%	9.7%	6.8%	7.2%	6.2%
Kakamega	NA	NA	15.7%	15.9%	16.7%
West Pokot	NA	NA	5.2%	6.4%	5.9%
<b>Current contraceptive method use</b>					
Any method (all women)	57.7%	64.7%	64.3%	62.7%	65.0%
Long acting/ permanent	27.1%	32.6%	38.1%	38.5%	42.9%
Short acting	71.6%	64.2%	59.3%	59.1%	54.0%
Traditional	1.3%	3.2%	2.7%	2.4%	3.1%
<b>Modern methods</b>					
All women	57.0%	62.6%	62.6%	61.2%	63.0%
Married women	58.7%	64.0%	64.1%	62.2%	64.2%
<b>Total demand</b>	80.8%	82.6%	80.4%	78.4%	79.7%
<b>Total unmet need</b>	23.8%	20.1%	17.8%	17.2%	16.7%
<b>Total demand satisfied by modern methods</b>	70.5%	75.7%	77.9%	78.1%	79.0%

\*For 2014 and 2015, there were two rounds of data collection 6-months apart. In other years, there was only one round one year apart.

Table 2: Percent of FP users by contraceptive method used and year of survey

Variables	Long acting and permanent methods*					Short acting methods*					All contraceptive methods**				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
<b>Total among users/population</b>	27.1%	32.6%	38.1%	38.5%	42.9%	71.6%	64.2%	59.3%	59.1%	54.0%	57.7%	64.7%	64.3%	62.7%	65.0%
<b>Age</b>															
Adolescents	18.4%	16.2%	22.1%	19.1%	24.4%	81.0%	72.3%	72.8%	77.5%	74.0%	37.6%	36.7%	37.5%	41.3%	31.8%
Older women	27.4%	33.2%	38.7%	39.4%	43.5%	71.3%	63.9%	58.7%	58.2%	53.4%	58.9%	66.6%	66.1%	64.2%	67.2%
<b>Education</b>															
No education	27.7%	43.6%	45.6%	54.2%	53.7%	72.3%	47.2%	50.0%	43.4%	44.6%	29.3%	37.6%	22.5%	21.7%	26.1%
Primary/ vocational	27.8%	33.5%	40.0%	43.2%	46.9%	71.2%	63.8%	58.2%	55.0%	50.7%	56.1%	63.4%	64.7%	62.3%	64.4%
Secondary/ higher	26.2%	30.9%	35.6%	32.7%	38.3%	72.2%	65.6%	60.8%	64.2%	57.9%	62.6%	69.1%	68.7%	68.7%	70.0%
<b>Household wealth quintiles</b>															
Lowest	27.0%	31.5%	38.8%	41.4%	48.2%	71.7%	65.4%	59.9%	56.9%	48.0%	54.3%	60.9%	47.2%	48.5%	53.6%
Lower	25.8%	29.3%	39.2%	36.4%	51.6%	72.9%	69.0%	59.5%	61.5%	45.2%	55.6%	59.8%	64.4%	61.8%	68.4%
Middle	27.5%	33.0%	36.4%	42.7%	36.2%	70.7%	64.8%	60.3%	54.6%	61.4%	58.6%	64.4%	69.0%	63.0%	65.3%
Higher	23.5%	37.9%	37.1%	34.4%	37.2%	76.1%	60.0%	59.7%	62.6%	60.6%	59.9%	68.0%	71.2%	71.5%	68.1%
Highest	31.9%	31.3%	39.2%	38.7%	41.9%	66.7%	62.1%	57.2%	59.0%	54.1%	63.3%	71.0%	67.6%	69.1%	68.6%
<b>Residence</b>															
Rural	26.2%	33.5%	39.6%	39.6%	45.3%	73.0%	64.1%	58.3%	58.3%	51.6%	55.0%	61.6%	63.3%	60.0%	63.7%
Urban	28.3%	31.3%	35.1%	36.4%	38.0%	69.7%	64.4%	61.1%	60.7%	58.8%	62.0%	69.3%	66.4%	69.2%	67.8%
<b>Marital status</b>															
Unmarried	17.4%	17.4%	18.7%	27.2%	28.0%	82.1%	80.8%	77.0%	69.5%	69.5%	43.7%	56.1%	56.1%	58.0%	57.1%
Married	28.0%	34.9%	40.9%	40.5%	45.1%	70.7%	61.7%	56.7%	57.2%	51.8%	59.5%	66.2%	65.7%	63.6%	66.3%
<b>Parity</b>															
No children	8.4%	2.9%	5.6%	6.1%	14.0%	90.5%	95.0%	86.9%	89.1%	81.8%	28.0%	32.9%	37.4%	39.2%	32.4%
1 - 3 children	25.0%	32.9%	37.6%	38.8%	40.9%	73.7%	63.9%	59.9%	59.5%	56.5%	63.7%	71.1%	70.6%	68.0%	70.0%
4 or more children	34.2%	38.2%	46.1%	46.4%	51.5%	64.6%	58.4%	51.9%	50.5%	44.6%	55.6%	65.9%	63.6%	63.6%	68.2%

Note: \* - Among all contraceptive users in the sub-population; \*\* - Among all sexually active women in the sub-population

Table 3: Pooled odds ratios and 95% confidence interval of contraception use according to socio-demographic characteristics

ble	n	Any contraceptive method use		LAPM		Short acting	
		OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
lescents	1,272	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
er women	19,214	3.10 (2.60, 3.71)**	1.48 (1.21, 1.81)**	3.90 (3.05, 4.98)**	1.33 (1.02, 1.75)*	1.71 (1.39, 2.1)**	1.47 (1.21, 1.79)**
ence							
al	13,279	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
an	7,207	1.31 (1.17, 1.47)**	1.13 (0.99, 1.31)	0.99 (0.87, 1.14)	1.05 (0.9, 1.22)	1.25 (1.14, 1.38)**	1.06 (0.95, 1.19)
al status							
married	2,940	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
ried	17,546	1.49 (1.31, 1.70)**	0.74 (0.63, 0.86)**	2.36 (1.95, 2.86)**	1.18 (1.0, 1.39)	0.89 (0.78, 1.02)	0.68 (0.59, 0.78)**
ition status							
education	946	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
nary/vocational	10,898	4.19 (3.17, 5.54)**	2.75 (2.13, 3.56)**	2.11 (1.54, 2.89)**	2.14 (1.62, 2.81)**	3.63 (2.48, 5.33)**	2.16 (1.51, 3.11)**
ondary or	8,640	5.42 (4.12, 7.15)**	3.78 (2.90, 4.92)**	1.98 (1.42, 2.76)**	2.37 (1.78, 3.15)**	4.67 (3.19, 6.83)**	2.55 (1.77, 3.65)**
r							
children	2,435	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
3 children	11,552	4.26 (3.64, 4.99)**	5.24 (4.39, 6.25)**	13.43 (8.90, 20.25)**	12.91 (8.44, 19.74)**	1.76 (1.49, 2.07)**	1.97 (1.67, 2.33)**
more children	6,492	3.34 (2.81, 3.96)**	5.47 (4.52, 6.61)**	16.02 (10.38, 24.70)**	17.03 (10.97, 26.44)**	1.20 (1.02, 1.42)*	1.60 (1.34, 1.91)**
h quintiles							
rest	4,295	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
ver	4,384	1.35 (1.17, 1.55)**	1.15 (1.03, 1.29)*	1.20 (1.03, 1.39)*	1.04 (0.89, 1.22)	1.21 (1.07, 1.37)**	1.13 (1.01, 1.26)*
dle	4,045	1.51 (1.30, 1.76)**	1.18 (1.04, 1.33)*	1.23 (1.02, 1.48)*	1.12 (0.94, 1.33)	1.30 (1.12, 1.51)**	1.09 (0.97, 1.22)
her	3,781	1.78 (1.52, 2.08)**	1.37 (1.18, 1.60)**	1.30 (1.09, 1.56)**	1.34 (1.11, 1.62)**	1.46 (1.26, 1.69)**	1.11 (0.96, 1.28)
hest	3,981	1.83 (1.56, 2.14)**	1.36 (1.12, 1.65)**	1.40 (1.15, 1.69)**	1.54 (1.24, 1.9)**	1.35 (1.16, 1.57)**	0.95 (0.79, 1.14)
4	4,254	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
5	5,760	1.34 (1.16, 1.55)**	1.44 (1.25, 1.65)**	1.44 (1.22, 1.70)**	1.49 (1.26, 1.77)**	1.01 (0.89, 1.14)	1.03 (0.92, 1.16)
6	3,497	1.32 (1.12, 1.56)**	1.39 (1.19, 1.63)**	1.75 (1.47, 2.08)**	1.66 (1.40, 1.97)**	0.87 (0.75, 1.02)	0.93 (0.80, 1.08)
7	3,574	1.23 (1.05, 1.45)*	1.36 (1.17, 1.58)**	1.72 (1.44, 2.05)**	1.69 (1.41, 2.02)**	0.83 (0.72, 0.97)*	0.91 (0.79, 1.05)
8	3,401	1.36 (1.17, 1.58)**	1.43 (1.23, 1.65)**	2.09 (1.74, 2.50)**	2.00 (1.68, 2.39)**	0.77 (0.66, 0.89)**	0.81 (0.7, 0.93)**
y							
goma	1,899	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
icho	2,401	1.07 (0.84, 1.36)	0.97 (0.78, 1.22)	0.69 (0.5, 0.95)*	0.65 (0.48, 0.86)**	1.31 (1.05, 1.64)*	1.26 (1.01, 1.56)*
mbu	1,750	1.41 (1.10, 1.80)*	1.14 (0.87, 1.49)	0.94 (0.68, 1.32)	0.86 (0.61, 1.19)	1.41 (1.13, 1.78)**	1.26 (1.00, 1.58)
ñ	2,130	0.49 (0.39, 0.63)**	0.60 (0.48, 0.75)**	0.72 (0.5, 1.04)	0.85 (0.61, 1.18)	0.56 (0.44, 0.72)**	0.64 (0.51, 0.81)**
ü	1,954	1.17 (0.88, 1.54)	1.14 (0.86, 1.51)	0.87 (0.61, 1.24)	0.88 (0.62, 1.23)	1.25 (1.00, 1.57)	1.19 (0.95, 1.50)
robi	2,767	1.26 (1.04, 1.53)*	0.99 (0.80, 1.22)	0.71 (0.52, 0.97)*	0.61 (0.45, 0.84)**	1.50 (1.25, 1.81)**	1.35 (1.10, 1.66)**

idi	1,986	1.22 (0.96, 1.57)	1.20 (0.95, 1.51)	0.56 (0.39, 0.81)**	0.56 (0.40, 0.78)**	1.76 (1.37, 2.27)**	1.69 (1.32, 2.15)**
mira	1,607	1.60 (1.27, 2.01)**	1.50 (1.19, 1.87)**	0.52 (0.37, 0.72)**	0.49 (0.36, 0.67)**	2.30 (1.84, 2.87)**	2.18 (1.77, 2.69)**
ra	1,695	0.90 (0.73, 1.11)	0.93 (0.76, 1.14)	1.16 (0.85, 1.58)	1.21 (0.90, 1.62)	0.78 (0.63, 0.97)*	0.78 (0.63, 0.96)*
omega	1,684	1.51 (1.16, 1.96)**	1.44 (1.11, 1.87)*	1.59 (1.16, 2.18)**	1.37 (1.02, 1.83)*	0.97 (0.76, 1.23)	1.04 (0.81, 1.33)
st Pokot	613	0.23 (0.12, 0.45)**	0.32 (0.19, 0.54)**	0.39 (0.21, 0.73)**	0.45 (0.26, 0.77)**	0.30 (0.17, 0.54)**	0.44 (0.27, 0.71)**

Note: \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; OR - Odds Ratio; aOR - Adjusted Odds Ratio; 95% CI - 95% Confidence Interval

Table 4: Pooled unadjusted and adjusted odds ratio and 95% confidence interval of demand satisfied with modern methods according to socio-demographic characteristics

Variable	Demand satisfied with modern methods	
	OR (95% CI)	aOR (95% CI)
Age		
Adolescents	Ref.	Ref.
Older women	4.74 (3.92, 5.73)**	2.40 (1.96, 2.93)**
Residence		
Rural	Ref.	Ref.
Urban	1.38 (1.20, 1.59)**	1.14 (0.97, 1.34)
Marital status		
Unmarried	Ref.	Ref.
Married	2.57 (2.23, 2.97)**	1.53 (1.32, 1.78)**
Education status		
No education	Ref.	Ref.
Primary/vocational	3.29 (2.62, 4.14)**	2.96 (2.48, 3.52)**
Secondary or higher	4.30 (3.44, 5.37)**	2.39 (1.95, 2.94)**
Parity		
No children	Ref.	Ref.
1 - 3 children	4.61 (3.87, 5.49)**	2.35 (1.81, 3.06)**
4 or more children	3.08 (2.55, 3.73)**	3.01 (2.33, 3.88)**
Wealth status		
Lowest wealth quintile	Ref.	Ref.
Lower wealth quintile	1.34 (1.15, 1.56)**	1.19 (1.04, 1.37)*
Middle wealth quintile	1.58 (1.34, 1.86)**	1.29 (1.11, 1.5)**
Higher wealth quintile	1.94 (1.65, 2.28)**	1.54 (1.29, 1.83)**
Highest wealth quintile	2.04 (1.72, 2.43)**	1.53 (1.24, 1.89)**
Year		
2014	Ref.	Ref.
2015	1.31 (1.09, 1.56)**	1.45 (1.22, 1.73)**
2016	1.47 (1.20, 1.80)**	1.58 (1.30, 1.92)**
2017	1.49 (1.23, 1.80)**	1.68 (1.39, 2.04)**
2018	1.57 (1.32, 1.87)**	1.65 (1.37, 1.99)**
County		
Bungoma	Ref.	Ref.
Kericho	1.01 (0.72, 1.40)	0.90 (0.67, 1.20)
Kiambu	2.02 (1.40, 2.91)**	1.48 (1.03, 2.13)*
Kilifi	0.56 (0.41, 0.76)**	0.64 (0.49, 0.83)**
Kitui	1.28 (0.90, 1.81)	1.25 (0.90, 1.73)
Nairobi	1.49 (1.13, 1.97)**	0.96 (0.73, 1.27)
Nandi	1.27 (0.93, 1.74)	1.28 (0.96, 1.70)
Nyamira	2.35 (1.66, 3.34)**	2.13 (1.55, 2.94)**
Siaya	1.06 (0.81, 1.39)	1.09 (0.86, 1.38)
Kakamega	1.72 (1.22, 2.43)**	1.54 (1.10, 2.17)*
West Pokot	0.43 (0.26, 0.72)**	0.41 (0.28, 0.63)**

Note: \* p<0.05; \*\*p<0.01; OR - Odds Ratio; aOR - Adjusted Odds Ratio; 95% CI - 95% Confidence Interval

## Figures

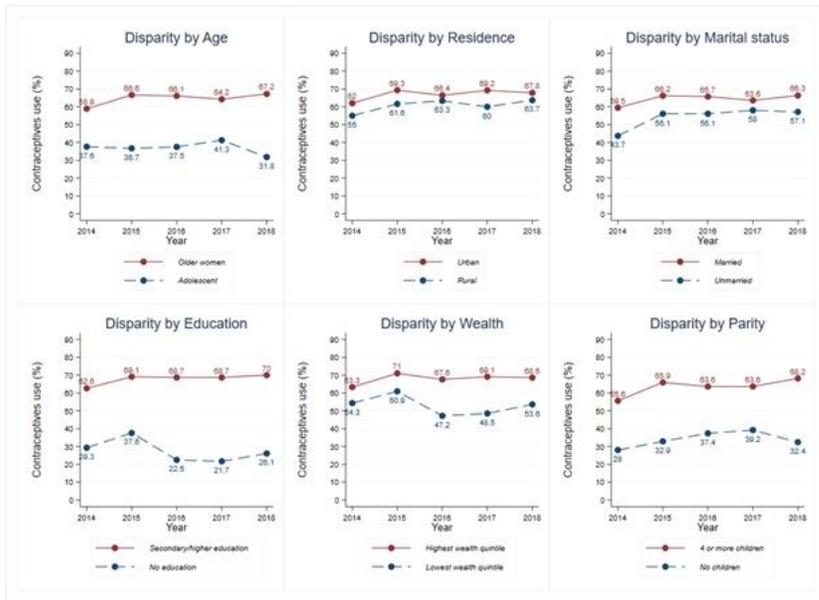


Figure 1

Disparities in FP use by select variables Disparity in demand for FP satisfied with modern methods

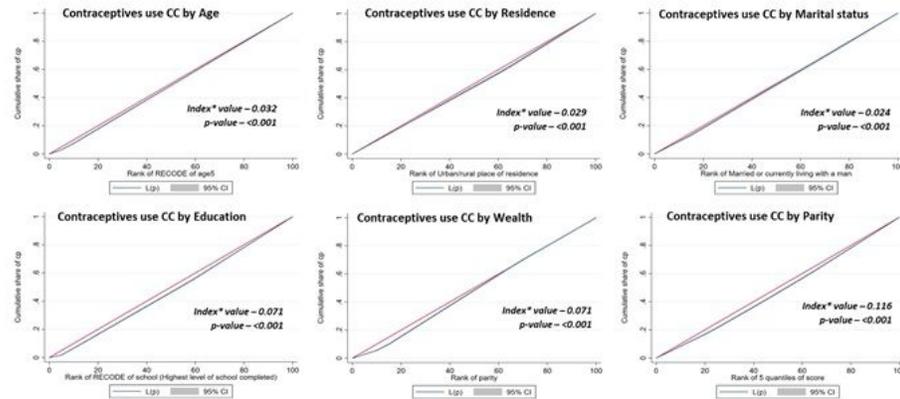


Figure 2

Disparities in demand for FP satisfied with modern methods by select variables

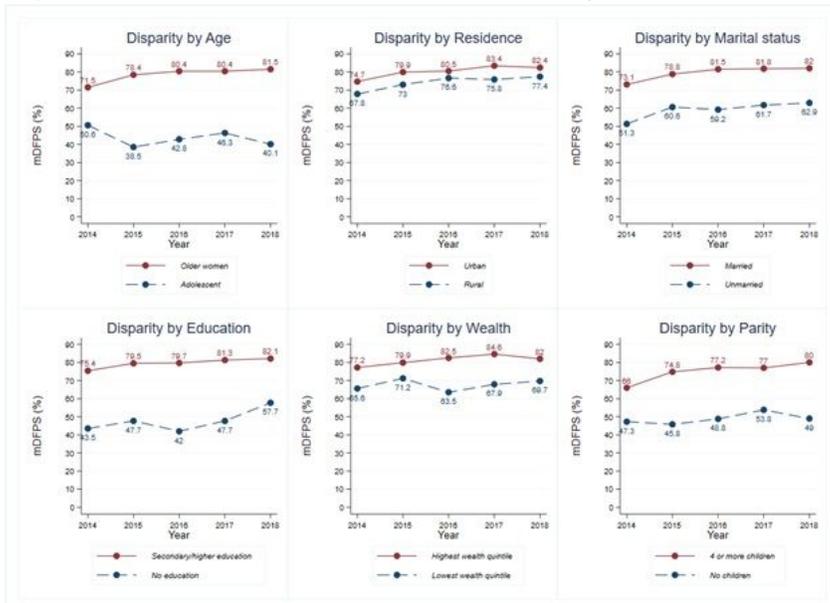


Figure 3

Concentration curves and indices for contraceptives use Note: CC – Concentration curve; \* - Ereygers normalized Concentration Index; Red line is the line of equality

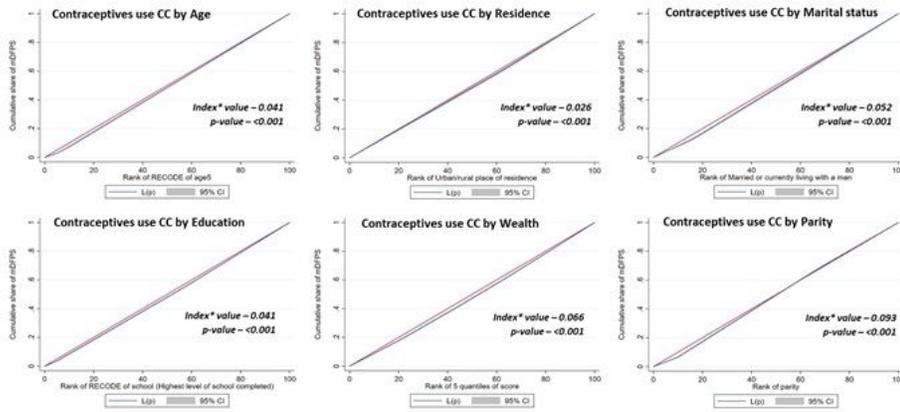


Figure 4

Concentration curves and indices for demand satisfied by modern methods Note: CC – Concentration curve; \* - Ereygers normalized Concentration Index; Red line is the line of equality

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1.xlsx](#)