

## ORIGINAL RESEARCH ARTICLE

# Trends in Contraceptive Prevalence in Sub-Saharan Africa: The Roles of Family Planning Programs and Education

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## Abstract

Since the 1990s some countries in Africa have experienced very rapid increases in contraceptive prevalence (e.g. Ethiopia, Malawi, Rwanda), while others (e.g. Nigeria) have seen little change. This study aims to shed light on the causes of these different trends which remain controversial. We assess the role of family planning programs vs. socioeconomic development (especially, women's educational attainment). Estimates of the effects of different explanatory factors are obtained by country level regressions in which the prevalence of modern contraception is the dependent variable and women's educational attainment, Gross National Income (GNI) per capita, percent urban and child mortality as well as the family planning program score are the independent variables. The statistical analysis finds no significant effects of GNI per capita, percent urban and child mortality. In contrast, women's educational attainment and program score have highly significant effects and are the dominant drivers of contraceptive prevalence trends. Voluntary family planning programs can increase contraceptive prevalence at all levels of female education. The best programs with prevalence impact above 30% (relative to no program effort) are found in Zimbabwe, Malawi, Kenya, Rwanda, Zambia and Ethiopia. Without family planning programs prevalence remains low even where education levels have risen substantially. (*Afr J Reprod Health* 2019; 23[3]:96-105).

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**Keywords:** Contraceptive prevalence, education, family planning program, sub-Saharan Africa

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## Résumé

Depuis les années 90, certains pays d'Afrique ont connu une augmentation très rapide de la prévalence de la contraception (par exemple, l'Éthiopie, le Malawi et le Rwanda), tandis que d'autres (par exemple, le Nigéria) n'ont connu que peu de changement. Cette étude a pour but de faire la lumière sur les causes de ces différentes tendances qui restent controversées. Nous évaluons le rôle des programmes de planification familiale par rapport au développement socioéconomique (en particulier le niveau d'éducation des femmes). Les estimations des effets de différents facteurs explicatifs sont obtenues par régression au niveau des pays dans lequel la prévalence de la contraception moderne est la variable dépendante et le niveau d'instruction des femmes, le revenu national brut (RNB) par habitant, le pourcentage de mortalité urbaine et infantile ainsi que la planification familiale ainsi que le score du programme sont les variables indépendantes. L'analyse statistique n'a révélé aucun effet significatif du RNB par habitant, du pourcentage de mortalité urbaine et de mortalité infantile. Par contre, le niveau de scolarité et le score du programme des femmes ont des effets très significatifs et sont les principaux facteurs de l'évolution de la prévalence de la contraception. Les programmes de planification familiale volontaires peuvent augmenter la prévalence de la contraception à tous les niveaux de l'éducation des femmes. Les meilleurs programmes ayant un impact de prévalence supérieur à 30% (par rapport à aucun effort de programme) se trouvent au Zimbabwe, au Malawi, au Kenya, au Rwanda, en Zambie et en Éthiopie. Sans les programmes de planification familiale, la prévalence reste toujours faible même lorsque les niveaux d'éducation ont été considérablement augmentés. (*Afr J Reprod Health* 2019; 23[3]:96-105).

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**Mots-clés:** Prévalence de la contraception, éducation, programme de planification familiale, Afrique subsaharienne

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## Introduction

Over the past half century, the practice of contraception has spread rapidly through much of the developing world. The most rapid growth occurred in Asia and Latin America which

reached contraceptive prevalence levels among women in union of 61 and 69%, respectively, by 2015<sup>1,2</sup>. Prevalence in sub-Saharan Africa increased at a much slower pace reaching only 25% in 2015<sup>2</sup>. An extensive literature includes general agreement that two factors have played a

key role in raising prevalence. Conventional demographic transition theory suggests that as countries develop, income and education levels rise, leading couples to reduce their traditionally high desired family size<sup>3,4</sup>.

To implement these desires for fewer offspring contraception is practiced. The second key factor is the family planning movement that started in the developing world in the 1950s. The choice of voluntary family planning programs as a policy instrument to meet people's reproductive needs and to accelerate fertility decline is based largely on the documentation of a substantial unsatisfied demand for contraception<sup>5,6</sup>. Large proportions of married women in the developing world report in surveys that they do not want a pregnancy at the time of the interview. A substantial proportion of these women (more than one-half in some countries) risk unintended pregnancy by not practicing effective contraception. Each year about 73 million unintended pregnancies occur in the developing world (of which 49% end in induced abortions) with detrimental health and economic effects for many women, children and families<sup>7</sup>.

It is therefore not surprising that past evaluations of family planning programs have found their impact on prevalence and fertility to be substantial. One of the best-known controlled experiments was conducted in rural Matlab district of Bangladesh in the late 1970s. The provision of high quality services in the intervention area reduced fertility by 28% and raised contraceptive prevalence to 35% while little change occurred in the control area<sup>8</sup>. A similar experiment conducted in Northern Ghana led to a 15% decline in fertility<sup>9</sup>. A recent review of the evidence concludes that the fertility impact of voluntary family planning ranges up to 35% depending on the intensity and quality of the intervention<sup>10</sup>.

Another key rationale for investments in family planning programs is the economic benefit of fertility decline. This so-called demographic dividend that boosts GDP per capita was first documented in East Asian countries<sup>11</sup>. More recently, African governments are turning their attention to the potential economic benefit of their own demographic dividends<sup>12</sup>. Yet, questions

about the role of family planning programs versus the role of socioeconomic development in reducing fertility continue to be raised<sup>5</sup>. Proponents of family planning programs argue that these programs are essential to reproductive health and point to the high levels of unmet need and unplanned pregnancies as the key rationale for investing in these programs<sup>13</sup>. Critics argue that socioeconomic development and especially female education is the main driver of changes in reproductive behavior and that family planning programs have only a minor impact on trends in contraceptive use. Some also argue that the experimental results such as from Matlab are not replicable at the country level because of the high expense of this experiment<sup>14</sup>.

This paper aims to shed light on this continuing controversy. The main objective is to assess the net impact of family planning programs on contraceptive prevalence after controlling for the effects of socioeconomic factors, most notably female education.

## Methods

This study examined the determinants of trends in the use of contraception in sub-Saharan countries. The variables included in the analysis were as follows:

- *Dependent variable:* contraceptive prevalence of modern methods (mCPR) among women aged 15-49 who are married or in union (MWRA). For simplicity this variable will be referred to as "prevalence"<sup>2,15</sup>.
- *Socioeconomic explanatory variables:* 1) Education as measured by the average years of schooling among women aged 20-39 (women's educational attainment), 2) GNI/cap (PPP), 3) Percent of population that is urban and 4) Child mortality (ages 0-4). Education estimates are from the Wittgenstein Center for Demography and Global Human Capital and estimates of GNI per capita and percent urban and child mortality were taken from World Bank Development Indicators database<sup>16,17</sup>.
- *Family planning program indicator:* To measure the quality and scope of the

government's public family planning program we relied on the "public-sector family planning program impact score" developed by Bongaarts and Hardee<sup>18</sup>. This score ranges from 0 in the absence of a government program to a theoretical value of 100 for the strongest programs. For simplicity we will refer to this variable as the "program score".

The analysis focused on trends from 1990 to 2015 in 24 countries in sub-Saharan Africa with a population size above 5 million in 2015 and with at least two DHS surveys (i.e. Benin, Burkina Faso, Burundi, Cameroon, Chad, Congo Democratic Republic, Cote d'Ivoire, Ethiopia, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Uganda, Zambia, Zimbabwe, covering 84% of the population of sub-Saharan Africa). Many smaller countries have high international migration levels which affect reproductive behavior. The exclusion of smaller populations makes the unweighted regional averages of indicators more representative of the continent and makes the figures easier to interpret (Also excluded are the 2003 survey in Mozambique because it occurred shortly after massive floods had devastated the country and the 1993 survey in Burkina Faso because the coding of traditional methods is not standard).

Regression analyses (ordinary least squares (OLS) and fixed effects models) were used to estimate the impact of the program score and socioeconomic variables on contraceptive prevalence. By using countries as their own controls, fixed effects models account for time-stable differences among countries, which may otherwise introduce bias into parameter estimation.

It should be noted that our analysis does not examine the complex causal pathways through which the explanatory variables affect the mCPR. For example, education can affect contraceptive prevalence because education leads to rising costs of children (e.g., for education and opportunity costs) and their declining economic value (e.g., for labor and old-age security) which leads to a decline in desired family size. This in turn can increase the demand for birth control to implement changing reproductive preferences.

Once contraception and abortion became available, contraceptive prevalence rises. Education can also affect the degree to which demand for contraception is satisfied. Similarly, family planning programs raise contraceptive use through multiple pathways (i.e. by reducing desired family size and by improving the implementation of services that respond to demand for contraception). A full analysis of these intervening processes is beyond the scope of this study and we therefore focus on a reduced model with one set of explanatory variables.

## Results

### *Descriptive findings*

Table 1 presents estimates of the (unweighted) averages and ranges of the dependent and explanatory variables for the 24 countries in 1990 and 2015. Estimates for the program score were only available for years in which a DHS surveys were conducted; the earliest and latest available dates (circa 1996 and 2013 respectively) are also presented.

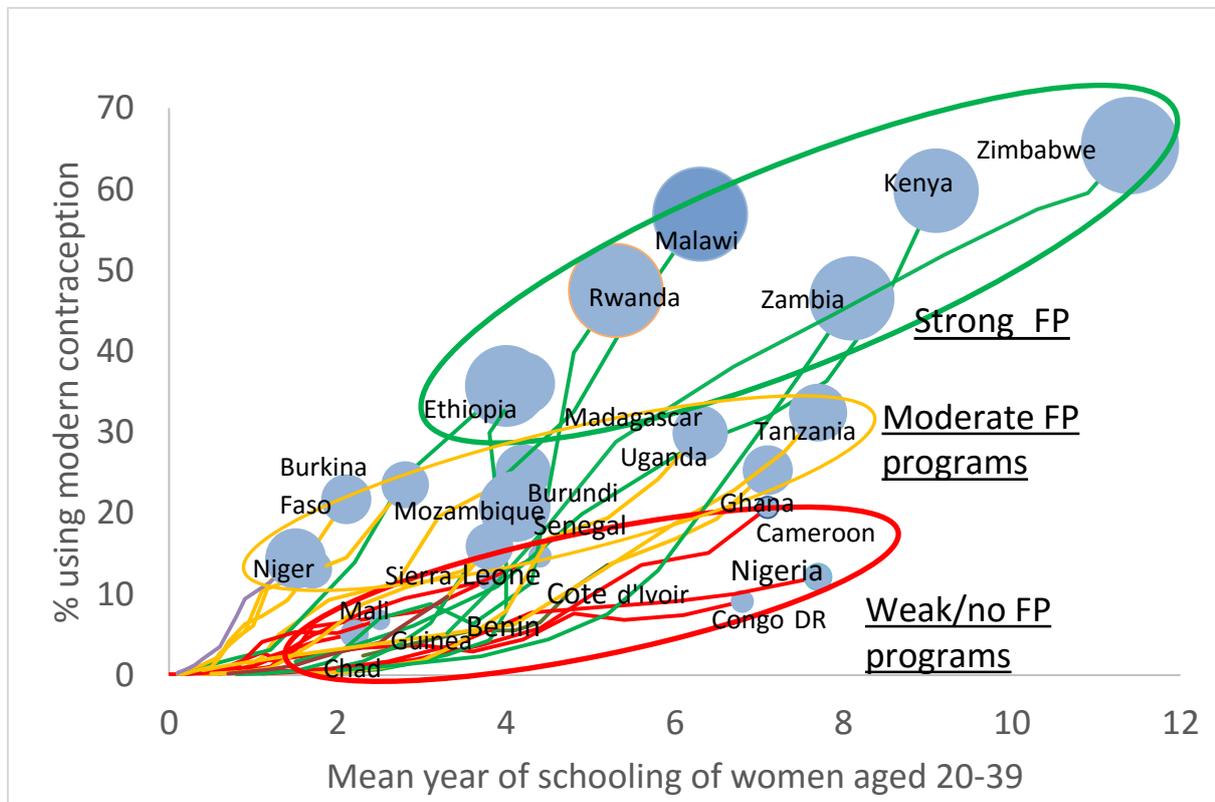
Average (unweighted) prevalence rose from 5.7% to 27.1% between 1990 and 2015. This is a substantial increase, but the 2015 level is far short of prevalence estimate for 2015 elsewhere in the developing world. Prevalence in 2015 varied widely among countries ranging from a low of 5.1% in Chad to 65.4% in Zimbabwe.

On average, the socio-economic variables moved in the expected direction between 1990 and 2015. That is, women's educational attainment, GNI per capita and percent urban all rose, and child mortality declined. Variation in socio-economic indicators was wide. The program scores also rose substantially over time, averaging 11.5 at the time of the first available survey circa 1996 to 29.5 at the time of the last survey circa 2013. The program score ranged from a low of 4.6 in Guinea to a high of 62.2 in Zimbabwe at the time of the last DHS survey.

To provide a first look at the relationship between socio-economic variables and prevalence, we plot in Figure 2 the prevalence level by mean years of schooling of women aged 20-39. (As will be shown later, education is the most important of the socio-economic determinants).

**Table 1:** Average (unweighted and weighted) and Range for Dependent and Explanatory Variables used in the Regression Analyses

| Variable  | 1990            |              | 2015           |              |
|---|-----------------|--------------|----------------|--------------|
|   | Average (unw/w) | Range        | Average(unw/w) | Range        |
| Contraceptive prevalence (%MWRA)                                      | 5.7 (5.7)       | 0.70 - 38.1  | 27.1(26.8)     | 5.10 - 65.4  |
| Women’s educational attainment (years of schooling, women ages 20-35) | 2.52 (2.18)     | 0.40 - 6.70  | 5.18(5.90)     | 1.50 - 11.4  |
| GNI per capita (PPP), log transformed                                 | 2.93 (2.98)     | 2.38 - 3.27  | 3.28 (3.40)    | 2.87 - 3.77  |
| % population urban  | 24.3 (23.8)     | 5.40 - 39.7  | 34.1 (34.9)    | 12.1 - 64.4  |
| Child mortality (per 1000 births)                                     | 187.4 (188.2)   | 75.2 - 328.9 | 78.5 (79.1)    | 40.5 - 130.9 |
| Family Planning Program score (range from 0 to 100)                   | 11.5 (10.5)     | 2.5 - 53.3   | 29.5 (28.1)    | 4.6 - 62.2   |



**Figure 1:** Contraceptive prevalence by mean years of schooling and program score (circle), 24 sub-Saharan countries 1970-2015

The figure contains 24 lines, one for each country, representing time series of five-year estimates from 1970 to 2015<sup>2</sup>. The size of the circle at the end of each line is proportional to the program score of the country at the time of the most recent survey (ca. 2013). If female education were the only determinant of mCPR, observations for all

countries and all years would fall on a single line. This is clearly not the case, indicating an impact of programs and other factors. In general, the higher the level of women’s educational attainment and the higher the program score, the higher the prevalence. The seven countries in the upper green oval have the strongest program

**Table 2:** Results of OLS and fixed effects regression models of contraceptive prevalence on socioeconomic variables on in 24 sub-Saharan Africa countries

| <b>Panel 1: OLS</b>           |             |       |
|-------------------------------|-------------|-------|
|                               | Coefficient | P     |
| Education                     | 2.72        | 0.000 |
| Child mortality               | -0.030      | 0.612 |
| Program score                 | 0.672       | 0.000 |
| Constant                      | -5.988      | 0.466 |
| N                             | 24          |       |
| R <sup>2</sup> adj            | 0.921       |       |
| <b>Panel 2: Fixed effects</b> |             |       |
| Education                     | 3.320       | 0.000 |
| Child mortality               | 0.027       | 0.069 |
| Program score                 | 0.696       | 0.000 |
| Constant                      | -14.17      | 0.001 |
| N                             | 98          |       |
| R <sup>2</sup> adj            | 0.892       |       |
| <b>Panel 3: Fixed effects</b> |             |       |
| Education                     | 2.814       | 0.000 |
| Program score                 | 0.640       | 0.000 |
| Constant                      | -7.460      | 0.000 |
| N                             | 98          |       |
| R <sup>2</sup> adj            | 0.888       |       |

scores (>35). Nine out of the ten countries in the second orange oval have program scores between 15 and 35 and in the third red oval all countries have scores below 15. At any level of women's educational attainment, prevalence varies widely. For example, in the three countries with schooling levels between six and seven years, prevalence ranges from 10% in DR Congo to 29.9% in Uganda to 56.9% in Malawi.

The findings in Figure 1 suggest that education and program score both have a substantial association with prevalence, but the estimation of the magnitudes of these effects requires regression analysis.

### **Regression analysis**

Although country-level data on five explanatory variables were available, it was desirable to reduce this number to reach more stable regression results. To identify which explanatory variable(s) to retain we first estimated separate bivariate OLS regressions of mCPR on each of the explanatory variables at the time of the last DHS survey with countries as the unit of analysis (N=24). The results show a strong and highly

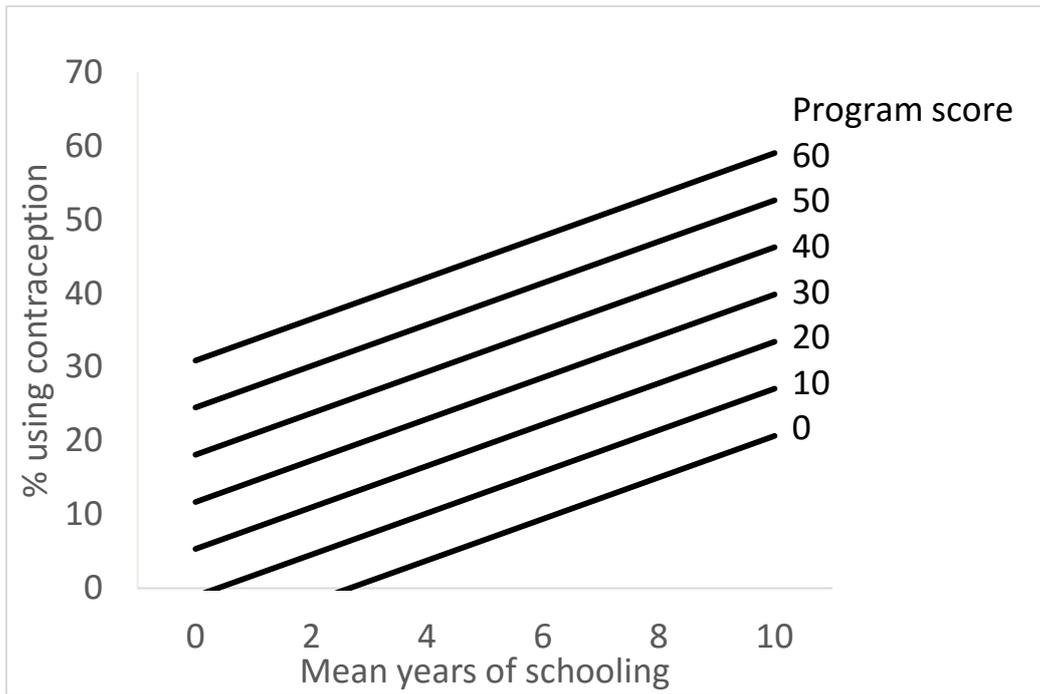
significant correlation ( $P < 0.000$ ) in the expected direction between mCPR and three of the explanatory variables: women's educational attainment, child mortality and program score. In contrast, the correlations between prevalence and GNI/cap and percent urban were not significant ( $P > 0.05$ ). Thus, GNI/cap and percent urban are excluded from the remaining regressions.

Second, we estimated multivariate OLS regressions using mCPR data for the year of the latest DHS survey with women's educational attainment, child mortality and program score as the independent variables. As shown in panel 1 of Table 1, the coefficients for education and program score are statistically significant, while the coefficient for child mortality is not.

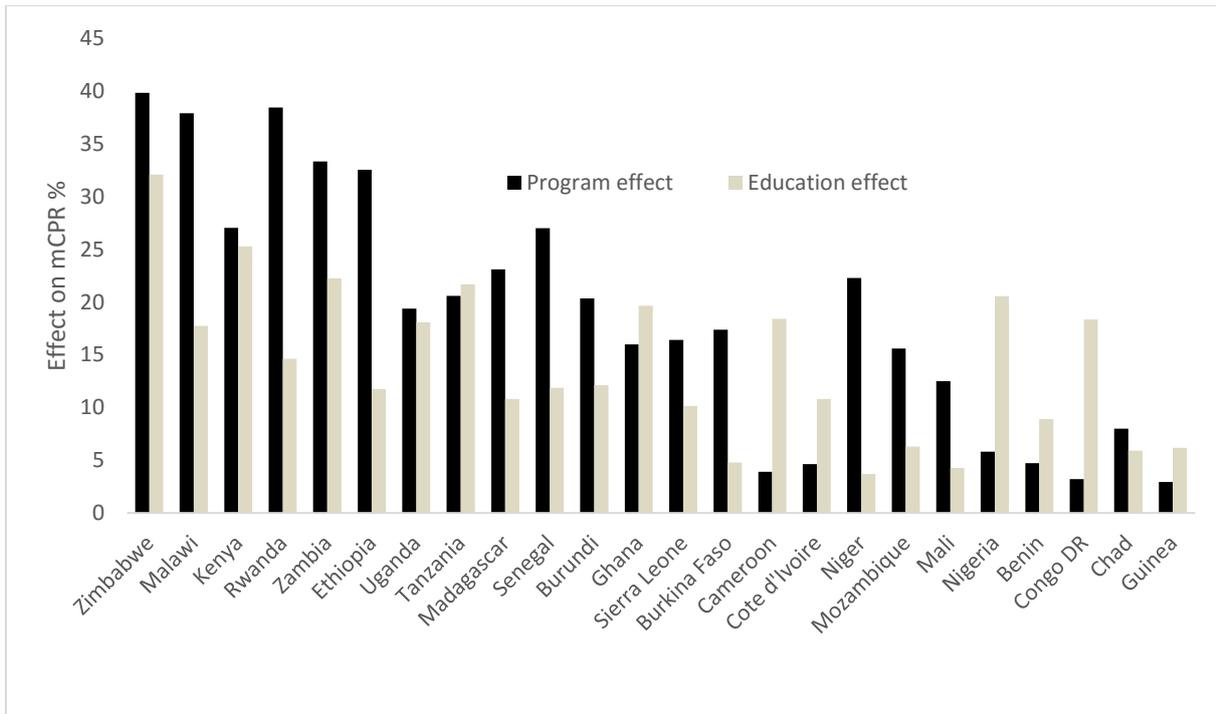
Finally, we estimated the effect of education level and program score on contraceptive prevalence using fixed effects models to better control for time-invariant confounding variables (e.g. desired family size) using all available DHS surveys for the 24 countries (N=98). The results, shown in panel 2 of Table 2, again show no statistically significant effect of child mortality. Thus, we dropped the child survival variable. Panel 3 in Table 2 presents the fixed effect regression results using only women's educational attainment and program score as explanatory variables.

These regression results confirm that women's education and family planning programs have a highly significant impact on contraceptive prevalence. The size of the effect can be demonstrated with a simple simulation presented in Figure 2 which plots model mCPR estimates for a range of values of women's educational attainment and program score. The range of mCPR values is consistent with the observed values in Figure 1. At the lowest levels of women's educational attainment even a strong program can raise mCPR only to about 30% due to limited demand. At the other end of the spectrum, countries with 10 years of schooling for women and the strongest programs can reach mCPR around 60% (as observed in Kenya and Zimbabwe).

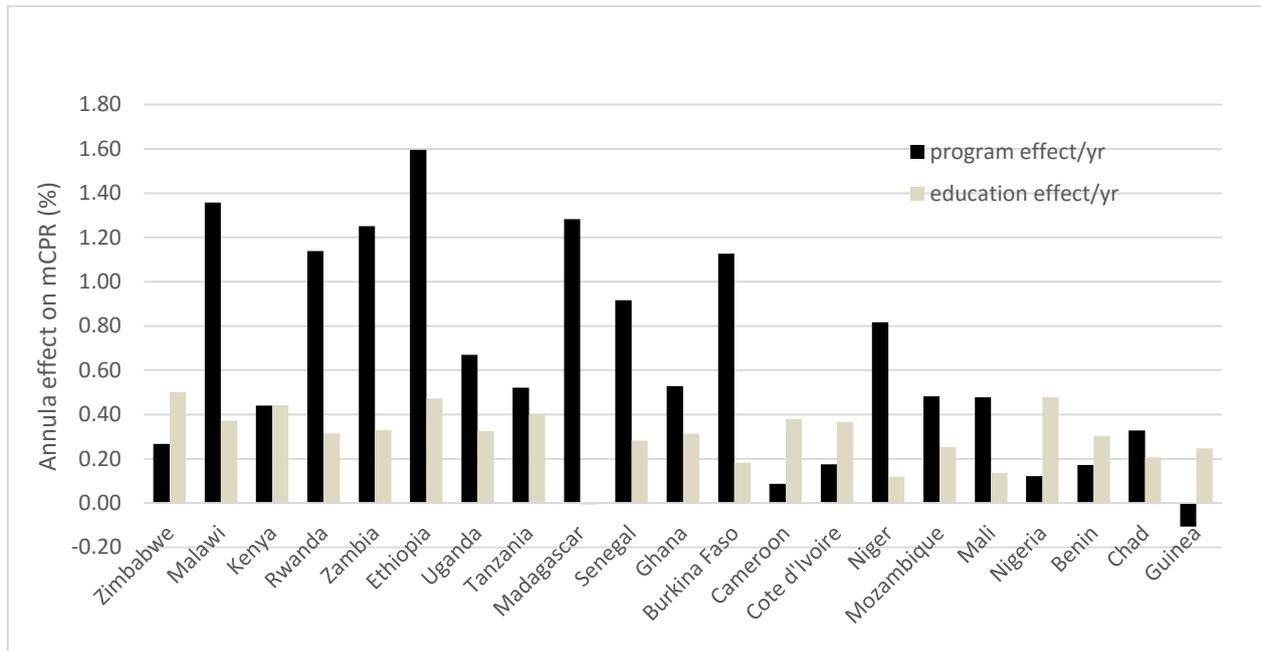
It is noteworthy that the effect of the Matlab experiment in Bangladesh is consistent with these model estimates. In the mid-1970s,



**Figure 2:** Simulated mCPR estimated from mean years of schooling and program score in 24 sub-Saharan countries



**Figure 3:** Model estimates of education and program effects on mCPR, year of latest survey in 24 sub-Saharan Africa countries



**Figure 4:** Annual change in education and program effects on mCPR, between first and last survey in 21 sub-Saharan countries

women’s educational attainment in Bangladesh was 1.4 years which according to the model should lead to a mCPR of 33.1% assuming a program score of 60. This is close to the observed value at the time.

**Country estimates of the roles of education and program score**

The fixed effect regression results from Table 2 (panel 3) allow the estimation of the separate effects of women’s schooling and the program on the mCPR in each of the 24 countries at the most recent survey, using observed values of these explanatory variables. Specifically, the effect coefficient for education and program score, respectively, were multiplied by the observed mean education level and program score for each country, using data at the time of the latest survey. These results are summarized in Figure 3 which plots estimates of women’s educational attainment and program components of the mCPR in each country at the time of the latest survey (ordered from lowest to highest mCPR). The program impact exceeds 30% in Zimbabwe, Malawi, Kenya, Rwanda, Zambia and Ethiopia.

The two components vary widely in size with one dominating the other in several countries. For example, the program effect is substantially larger than the women’s educational attainment effect in Malawi, Rwanda and Ethiopia, while the reverse is observed in Cameroon, Nigeria and DR Congo. Effects are approximately equal in Kenya, Uganda, Tanzania and Ghana.

To examine trends in effects we calculated the recent pace of change in the impacts of women’s education and program score. Figure 4 plots the annual changes in the program effect and in the women’s education effect by country. These pace estimates were calculated for the period between the first and last DHS survey. For example, for Ethiopia the program impact rose from 7% in 2000 to 33% in 2016, yielding an annual pace of 1.6% points per year. (To avoid large sampling errors in pace estimates only countries with at least 10 years between the first and last survey were included in Figure 4). Burundi, Congo DR, Sierra Leone are therefore excluded.

The most rapid increases (above 1% point per year) have occurred in Rwanda, Zambia, Malawi, Ethiopia, Madagascar, and Burkina Faso.

In contrast, in half of the countries the pace of program improvement was slow or negligible (<0.5% point per year). The pace of improvement in the impact of women's education showed less variation among countries and was on average lower than the pace of improvement in program impact.

## Discussion

The findings of Figure 4 are of interest to policy makers because they indicate that expanding FP programs can have a rapid effect on the mCPR. The improvements in program impact in six countries (Rwanda, Zambia, Malawi, Ethiopia, Madagascar and Burkina Faso) stand out because they are larger than the effects of improving education. How did these countries achieve such rapid progress, and can this success be replicated elsewhere? These accelerations in program impact are directly traceable to government actions:

- *Rwanda's* FP program has been hailed as “a phenomenal success,” due to strong political will, rebuilding of the health system and community mobilization starting in the early 2000s<sup>19</sup>. President Kagame saw the need to address population growth as part of the country's development strategy<sup>20</sup>. All ministries are responsible for developing action plans for FP, and the government emphasizes the need for high quality services.
- *Zambia*. Progress on FP was slow until the early 2000s, but the government then accepted FP as a key strategy for contributing to the country's ambitious development goals<sup>21</sup>. The government's family planning program focuses on expanding method mix, reaching rural and hard to reach populations, reducing barriers for youth and increasing domestic resources for commodities<sup>22</sup>.
- *Malawi*. Since the early 2000s, Malawi's government has provided high-level support to the expansion of the FP program.<sup>19</sup> Malawi has expanded the method mix, increased service options and strengthened financing and accountability for the program. With a slogan of “no parenthood before adulthood,”

Malawi has also focused attention on meeting the needs of youth<sup>23</sup>. At the 2017 Family Planning Summit, Malawi pledged to “involve all key [stakeholders] through a robust multi-sectoral approach and achieving declined fertility paramount for the development of Malawi”<sup>24</sup>.

- *Ethiopia*. The rapid increase in mCPR in Ethiopia after 2005 shows the effect of strong government commitment coupled with expansion in access to FP through improved health services and community-based programming<sup>25</sup>. In 2005, with full support from the Prime Minister, FP was widely implemented<sup>26</sup>. Family planning was included in the package of essential services in Ethiopia's Health Extension Plan, provided through paid female health extension workers (HEW) assigned to rural health posts and supported by volunteer Community Health Workers<sup>27</sup>.
- *Madagascar*. Since the early 2000s, Madagascar's FP program has enjoyed presidential-level support, with FP considered a national priority for development. Access to services has been expanded, including through community-based distribution of FP<sup>28</sup>. A new law recognizes FP as a basic human right of all individuals, regardless of age, and overturns a 1920 law prohibiting promotion of FP<sup>29</sup>.
- *Burkina Faso* hosted a landmark 2011 conference, attended by 12 francophone West African countries that resulted in the Ouagadougou Call to Action and a partnership to enhance FP in the region<sup>30</sup>. The Reproductive Health Law passed in 2005 propelled the program forward as it overturned a 1920 law banning FP and guaranteed the right to health<sup>30</sup>. Over the past decade and a half, FP in Burkina Faso has enjoyed a strong policy environment, expanding service access, a growing method mix and attention to contraceptive security, reaching rural areas, and serving youth.

The common theme among these successful countries is that they all have exhibited political

will and commitment to FP from the highest to lowest political leaders, thus creating a chain of responsibility and accountability. Changes in the laws have removed obstacles to FP promotion and provision. Although these countries are dependent on donor funding, they have worked to increase domestic expenditures on FP and to ensure that contraceptives are reliably available, including long acting and permanent methods. FP services have expanded through community-based services. Demand creation and social behavior change have also been given priority, as has meeting the needs of young people. Program documents, including FP Costed Implementation Plans developed to reach goals set as part of the FP2020 partnership, reinforce FP as a human right.

## Conclusion

Our analysis leads to three conclusions. First, women's educational attainment and program score are the main determinants of levels of contraceptive prevalence in sub-Saharan African countries. FP programs can increase mCPR at all levels of female education. Second, the very rapid increases in prevalence in several countries since the 1990s are mainly due to the rapid strengthening FP programs and much less to rising education levels. Third, the improvements in FP programs are directly traceable to increases in government actions including stronger commitment from political leaders and increased funding.

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## Contribution of Authors

JB and KH designed the study together. JB collected and analyzed the data and wrote the first half of the first draft of the manuscript. KH wrote the second half of the manuscript and prepared the final version for submission.

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