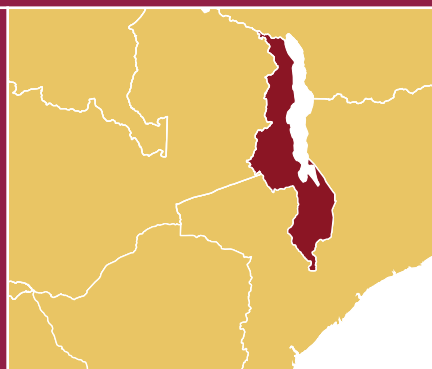


October 2014

## INCONSISTENCIES IN THE TOTAL FERTILITY RATE AND CONTRACEPTIVE PREVALENCE RATE IN MALAWI



This publication was prepared by Aparna Jain, John Ross, Erin McGinn, and Jay Gribble of the Health Policy Project.

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# Inconsistencies in the Total Fertility Rate and Contraceptive Prevalence Rate in Malawi

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**OCTOBER 2014**

This publication was prepared by Aparna Jain, <sup>1</sup> John Ross, <sup>2</sup> Erin McGinn, <sup>2</sup> and Jay Gribble, <sup>2</sup> of the Health Policy Project.

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## ABBREVIATIONS

CPR	contraceptive prevalence rate
DHS	Demographic and Health Survey
HIV	human immunodeficiency virus
HPP	Health Policy Project
IUD	intrauterine device
LAM	lactational amenorrhea method
STI	sexually transmitted infection
TFR	total fertility rate
USAID	United States Agency for International Development
WHO	World Health Organization
WRA	women of reproductive age





# INTRODUCTION

Two commonly used measures of population policy effectiveness and family planning programs are the total fertility rate (TFR) and the contraceptive prevalence rate (CPR). Over the past 18 years in Malawi, CPR increased dramatically from 13 percent in 1992 to 46.1 percent in 2010 among reproductive-age women in union. Surprisingly, this dramatic increase in CPR resulted in only a modest decline in TFR from 6.7 to 5.7 births per woman in the same period. According to international correlations, the increase of 33 points in CPR would have lowered TFR by 2 births.

This study, conducted by the USAID-funded Health Policy Project (HPP), uses available data from the Demographic and Health Surveys (DHS) to explore why the rise in CPR has not translated into significant reductions in TFR in Malawi. It employs the Proximate Determinants of Fertility Model developed by Bongaarts to estimate TFR at the national level and urban and rural levels in 2000, 2004, and 2010. The observed (as calculated from DHS data) and estimated (as calculated by HPP) TFR values are compared and explanations of any differences are explored.

The key findings from this study are presented below, based on the results of the Proximate Determinants Model analysis conducted at the national level and by residence (urban versus rural).

## National Level

- The differences between the estimated and observed TFR values are less than half a child for the three survey years, which falls into a reasonable realm of variation. In 2000, the estimated TFR was lower than the observed TFR by a third of a child. The observed TFR and the estimated TFR are exactly the same in 2004 at 6.0. Although the 2010 DHS estimate of TFR is 5.7, the HPP calculated estimate of TFR is 5.2.
- The estimated TFR remained the same from 2000 to 2004. This is likely due to a decrease in the duration of postpartum insusceptibility, coupled with small increases in contraception use and abortion use. That is, the reduction in the mean duration of postpartum breastfeeding and abstinence offset the slight rise in contraceptive use (and/or shift to more modern and effective contraceptive methods) and abortion, resulting in no change in the estimated total fertility rate.
- The estimated TFR of 5.2 is lower than the observed TFR of 5.7 in 2010. This is likely due to the dramatic rise in contraceptive use—an increase of more than 13 percentage points in six years coupled with an unchanged duration of postpartum insusceptibility from 2004 to 2010.
- From 2000 to 2010, there was no change in the proportions of women who were married by age 18 and women who were sexually active by age 18. Yet, given the trends in the proportion of women married by age 18 in other East African countries, it was expected that the proportion in Malawi would decrease over time. In Rwanda for example, 20 percent of women ages 25–49 were married by age 18 in 2000. This proportion decreased to 15 percent in 2010. Similarly, in Uganda the proportion of women who were married by age 18 declined from 53 percent in 2000 to 49 percent in 2010.
- Malawi's method mix is highly skewed, with approximately 54 percent of contraceptive users choosing injectables. Female sterilization accounts for 7.6 percent of the method mix, male condoms for another 7.6 percent, and pills for just over 5 percent. A similarly skewed method mix is observed in other countries in the region.
- Among women who are using contraceptives to limit their next birth, the majority are not using long-acting and permanent methods (intrauterine devices [IUDs], implants, female or male sterilization) and instead are relying on short-acting (pill, injectables, and condoms) and

## Inconsistencies in the Total Fertility Rate and Contraceptive Prevalence Rate in Malawi

traditional/folkloric methods (withdrawal, abstinence, and lactational amenorrhea method [LAM,]<sup>1</sup> among others) to prevent all future pregnancies.

- The use of contraceptive methods and postpartum activities of abstinence and breastfeeding provide double protection from pregnancy. This simultaneous use of contraceptive methods and breastfeeding or abstinence during the postpartum period is dwindling in Malawi. The proportion of contraceptive users in Malawi who were breastfeeding, abstinent, or amenorrheic decreased from 35.3 percent in 2000 to 28.0 percent in 2010. Furthermore, unmet need for family planning among women who were in the postpartum period remained high at 26.2 percent in 2010.

## Urban-Rural Differences

- The rural estimated TFR trends are reflected in the overall estimated TFR trends because for all three surveys, more than 80 percent of all women interviewed resided in rural areas. The differences in the estimated and observed TFR in rural areas are small: less than 0.4 births per woman in 2000, 2004, and 2010.
- There are differences in the estimated TFR in urban areas compared with the observed TFR. The estimated TFR is larger than the DHS observed TFR and ranges from 1.7 births per woman in 2000 to 2.2 in 2004 to 1.5 in 2010. Approximately 20 percent of respondents lived in urban areas, so these differences may be due to measurement error. The Proximate Determinants Model is limited in its scope and does not account for other factors that may influence fertility rates in urban areas such as HIV prevalence, rates of sexually transmitted infections (STIs) that can lead to sterility, or migration patterns.

## DATA

The DHS estimate rates of fertility and infant and child mortality among the population, and measure maternal and child health. In Malawi, four DHS were conducted in 1992, 2000, 2004, and 2010. These cross-sectional surveys are representative at the national, regional, and district levels, and are implemented by the National Statistical Office in partnership with the Ministry of Health Community Sciences Unit and Macro International. The weighted sample sizes of interviewed women of reproductive age were 4,849 in 1992; 13,538 in 2000; 11,698 in 2004; and 23,020 in 2010.

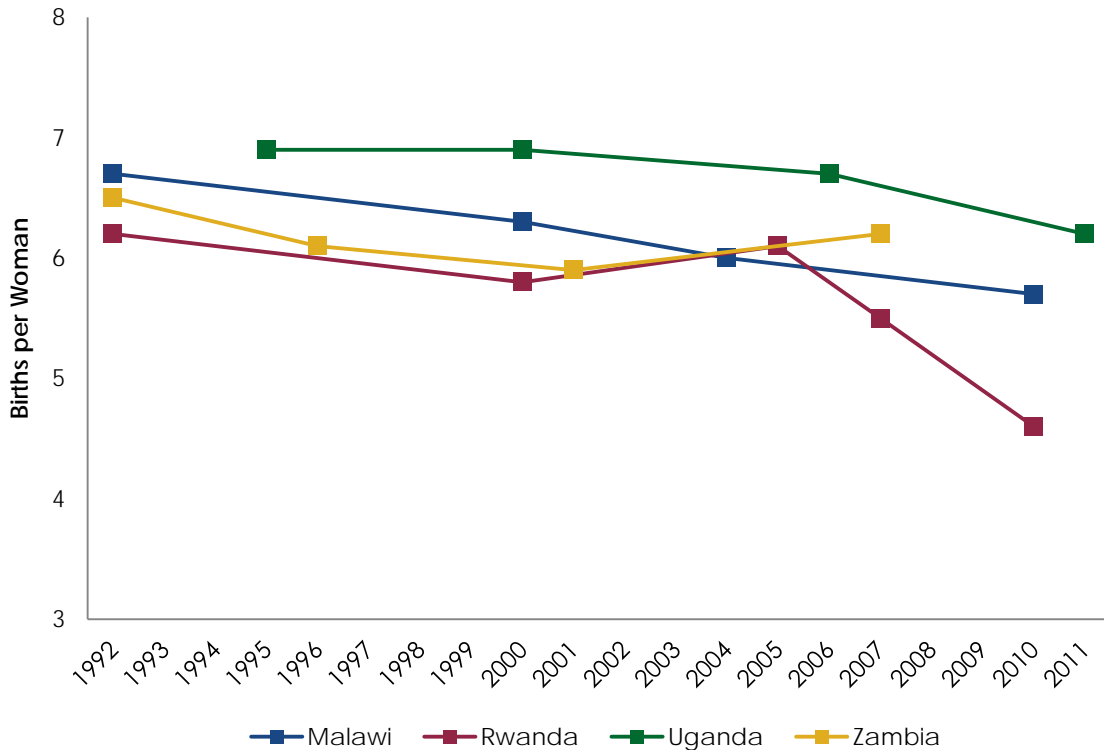
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<sup>1</sup> The use of an LAM as a conscious contraceptive method depends on the country contexts. For LAM to be an effective contraceptive method, women must continuously and consistently breastfeed. In many countries, women are using an LAM as a contraceptive method. In Malawi, however, use of LAMs for preventing unwanted pregnancy is low: 0.3 percent in 2000 followed by no use in 2004 and 2010. For this reason, an LAM is classified as a traditional method in this study.

# TRENDS IN TOTAL FERTILITY RATE AND CONTRACEPTIVE PREVALENCE RATE

Figure 1 shows the TFR for four East African countries: Malawi, Rwanda, Uganda, and Zambia. Overall, Malawi's TFR falls in the middle of the other East African countries' TFRs. Uganda's TFR has been consistently greater than Malawi's TFR over time. While the last DHS in Zambia showed a slight increase in TFR that surpassed Malawi, Rwanda's TFR declined dramatically after 2005.

Figure 1: Trends in Total Fertility Rate: Malawi, Rwanda, Uganda, and Zambia, 1992–2011



Source: StatCompiler, accessed on April 10, 2014.

In Malawi, TFR has declined by 1 birth per woman from 6.7 in 1992 to 5.7 in 2010 (see Figure 2). This decrease has occurred incrementally over time, as shown by the smooth line for total fertility. In urban areas, the greatest decrease in TFR occurred between 1992 and 2000,—from 5.5 to 4.5 births per woman, while a smaller decline of 0.5 births per woman is seen over the next 10-year period (2000–2010). The TFR in rural areas was greater than the total TFR for all four survey years, and it decreased by less than 1 birth per woman over the 18-year period.

Figure 2: Trends in Total Fertility Rate by Urban and Rural Areas, Malawi, 1992–2010

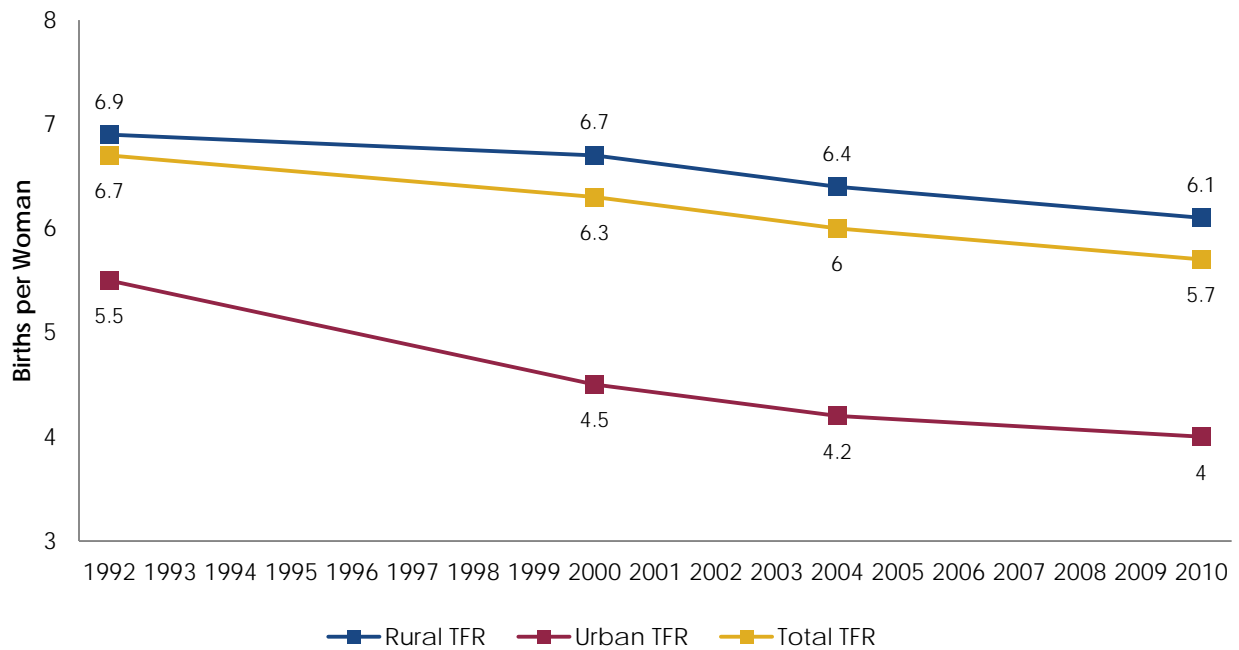
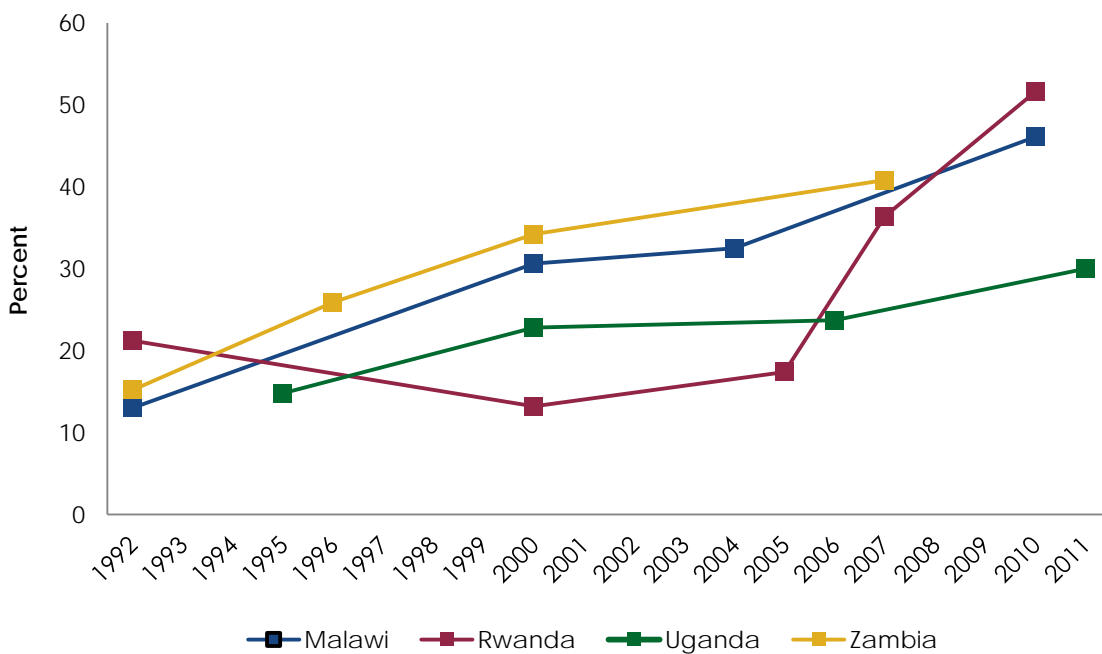


Figure 3 compares the CPR trends in Malawi to those in Rwanda, Uganda, and Zambia. Malawi has one of the higher contraceptive prevalence rates over time, just below that of Zambia. In 2010, however, Rwanda’s contraceptive prevalence surpassed Malawi’s, increasing to 51.6 percent.

Figure 3: Trends in Contraceptive Prevalence Rate, Malawi, Rwanda, Uganda, and Zambia, 1992–2011

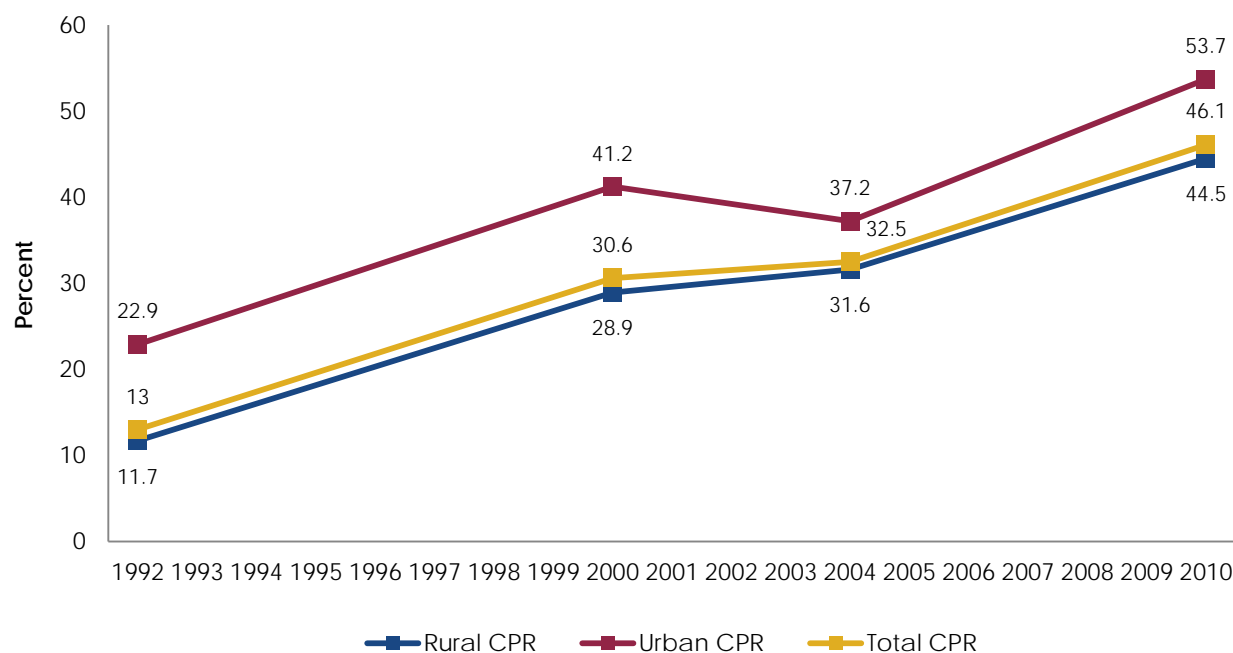


Source: StatCompiler, accessed on April 10, 2014.

In Malawi, CPR among married women of reproductive age increased from 13.0 percent in 1992 to 46.1 percent in 2010 (see Figure 4). From 2000 to 2004, CPR increased by 1.9 percentage points (30.6% to 32.5%). This change is primarily due to a CPR reduction observed in urban areas, where it dropped from 41.2 percent to 37.2 percent. By 2010, however, the urban CPR bounced back to 53.7 percent. In rural areas, the CPR trends follow a similar pattern to the observed total CPR trends.

Further research is necessary to understand why CPR dropped in urban areas, though it may be due to measurement error or small sample size. The 2000 urban CPR may also be an overestimate given that the rise in CPR from 1992 to 2000 is especially high (approximately 2.5 percentage points each year).

Figure 4: Trends in Contraceptive Prevalence Rate by Urban and Rural Areas, Malawi, 1992–2010



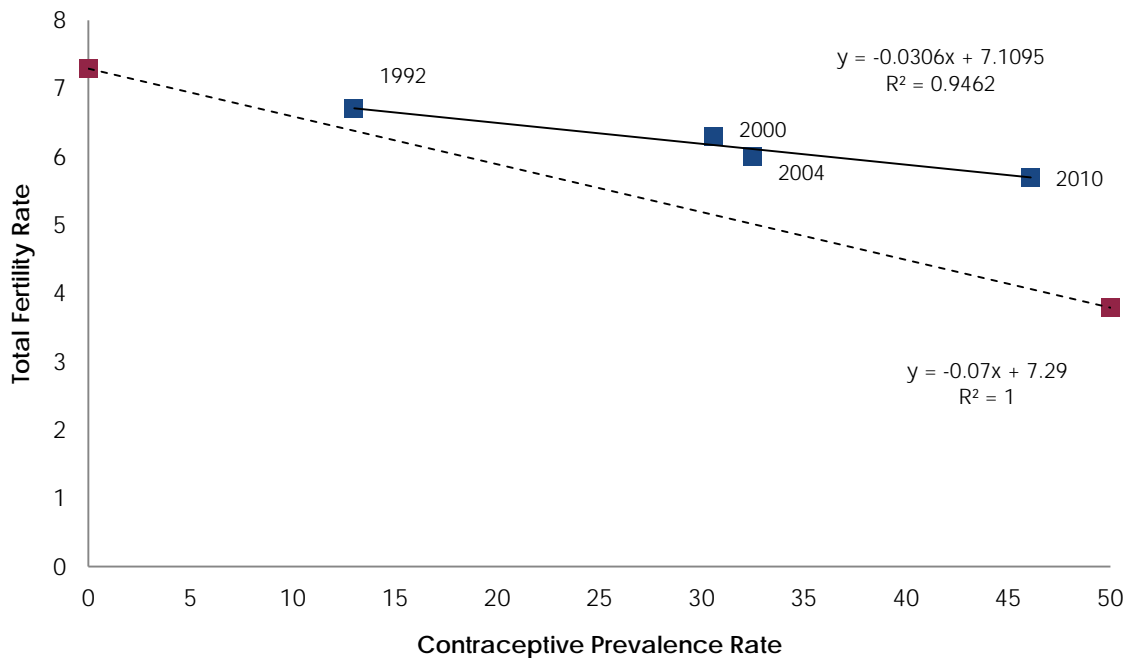
## RELATIONSHIP BETWEEN TFR AND CPR

Several studies have shown a strong linear relationship between contraceptive prevalence and total fertility (Ross and Maudlin, 1991; Jain, 1997). Using national and subnational estimates in developing countries, one study demonstrated that an increase of 15 percentage points in contraception among married women reduces TFR by 1 birth per woman (Tsui, 2001). This relationship, which represents a developing country average, is shown as a dotted line in Figure 5. Total fertility is represented on the y-axis and contraceptive prevalence on the x-axis, and the solid line shows the TFR-CPR relationship for Malawi in 1992, 2000, 2004, and 2010.

Movement along the x-axis shows that while CPR rose over time, there was little change in TFR. The solid line passes closely to the intermediate data points of 2000 and 2004, indicating little variation from the line and good agreement. The equation of the regression line is as follows:  $TFR = -0.0306(CPR) + 7.1$ . According to this equation, TFR would be 7.1 births per woman if there was no contraceptive use (CPR = 0). In addition, a 1 percentage point increase in CPR correlates to a 0.03 decline in TFR. The variation in TFR is explained largely by CPR with an  $R^2$  value of 0.95.<sup>2</sup>

Both the constant term and the coefficient are lower in the TFR-CPR relationship in Malawi compared with the developing country average, suggesting that the contraceptive effectiveness and method mix has less of an effect on TFR in Malawi. *If the developing country correlation were applied, the TFR would decline from 6.7 in 1992 to 4.4 in 2010—matching to an increase in CPR of 33.1 percent.*

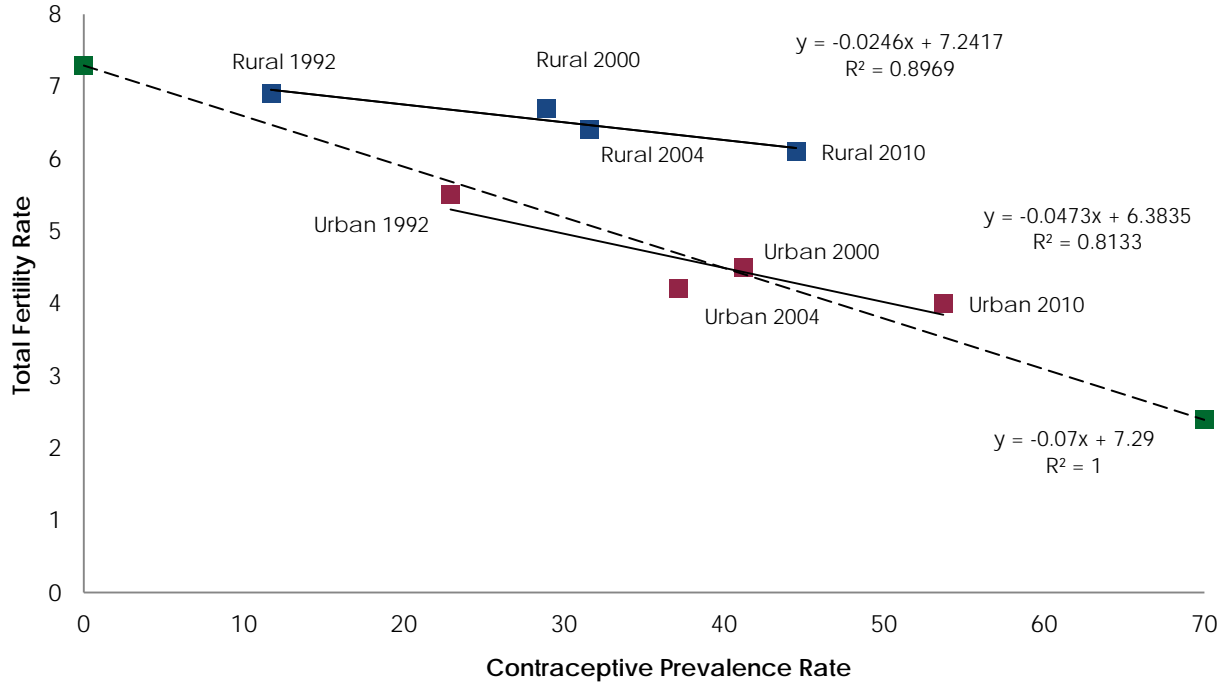
Figure 5: TFR and CPR Relationship, 1992–2010



<sup>2</sup>  $R^2$  is the coefficient of determination and measures how well the data fit the model; the closer  $R^2$  is to 1, the more perfectly the data fit the model.

Figure 6 shows the TFR-CPR relationship disaggregated by residence. The average TFR-CPR relationship observed in developing countries is shown as a dotted line. As shown above, the intermediate data points in 2000 and 2004 for both urban and rural areas are close to the regression lines. CPR explains much of the variation in TFR for rural areas ( $R^2 = 0.89$ ) but slightly less so in urban areas ( $R^2 = 0.81$ ). Even with a decrease in urban contraceptive prevalence from 2000 to 2004, there was a decrease in total fertility. This could be the result of measurement error or the influence of other determinants that may reduce fertility, such as a lower proportion of married women ages 15–49, higher postpartum amenorrhea and higher postpartum abstinence rates, and/or a higher abortion rate.

Figure 6: TFR and CPR Relationship by Urban and Rural Areas, 1992–2010

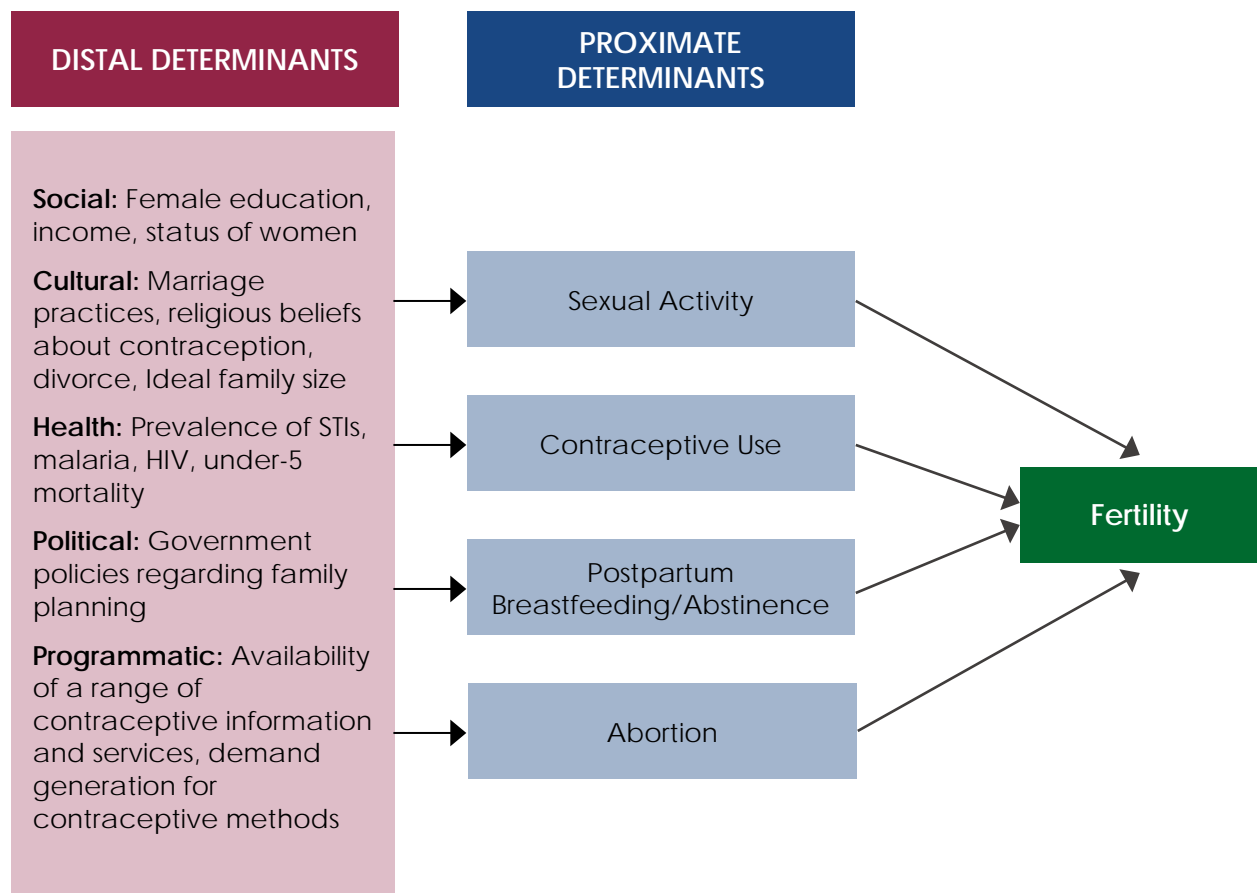


## PROXIMATE DETERMINANTS

Bongaarts (1978, 1982) developed the Proximate Determinants of Fertility Model, which is the most commonly used model to relate selected determinants to the TFR. The model was updated by Stover in 1998. It specifies four main proximate determinants of fertility: (1) proportion married; (2) postpartum insusceptibility related to breastfeeding and abstinence; (3) contraceptive use; and (4) induced abortion. Several minor factors also contribute to changes in total fertility, including fecundability, natural sterility, and spontaneous intrauterine mortality that can occur at any point throughout a pregnancy. These factors have relatively small fluctuations over time, are linked less to behavioral influences and are more biological in nature, and contribute less to TFR changes than the major proximate determinants. This model explains why women have fewer children than their biological potential.

Figure 7 is a model of the distal and proximate determinants of fertility. In this model, distal determinants move through the proximate determinants to affect fertility levels. For example, increases in female education may lead to greater use of modern contraceptives and/or delay in sexual debut, which both reduce fertility levels. Another example is when under-five mortality remains high and couples may choose not to use contraceptive methods or women may not seek abortions, thus increasing fertility levels.

Figure 7: Distal and Proximate Determinants Model of Fertility



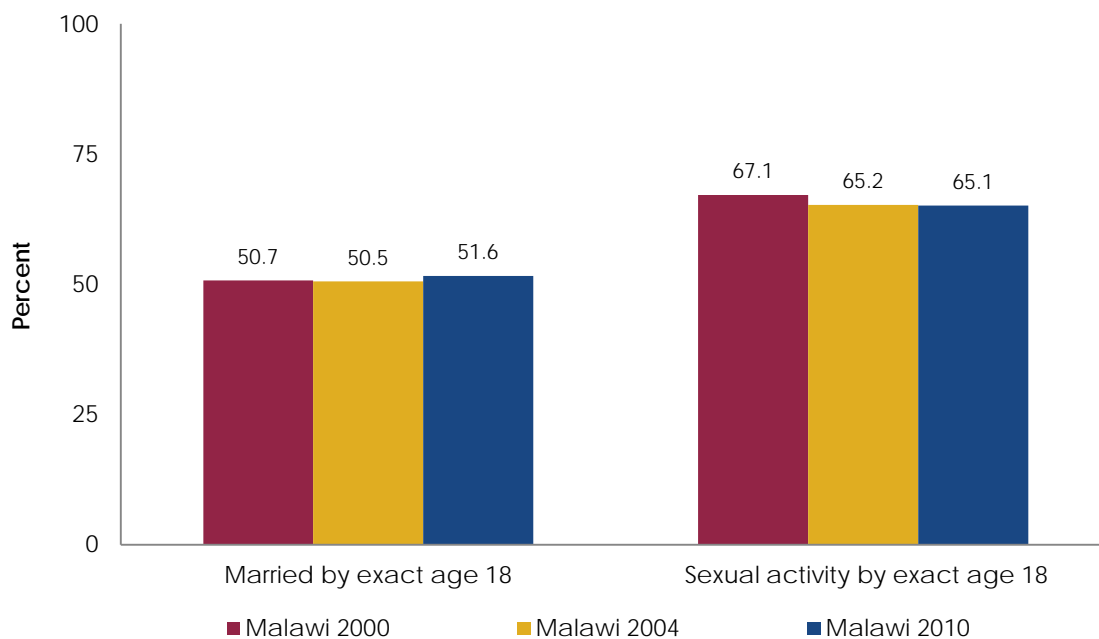


## Marriage

In calculating the index of marriage, the proportion of women who are married is used to establish exposure to regular sexual intercourse and thus risk of pregnancy. In many countries, including Malawi, sexual intercourse occurs outside of marriage. In Malawi, approximately 5.6 percent of women who have never been married but have been sexually active (MDHS, 2010) would be excluded from the marriage index if exposure to intercourse is restricted to married women. This limitation can be addressed by calculating the proportion of women of reproductive age (15–49 years old) who were ever sexually active instead of the proportion who were ever married.

Fertility reductions occur when the age of marriage and/or the age of sexual debut increase over time. Figure 8 illustrates the trends of marriage by exact age 18 and sexually active by exact age 18 among women ages 20–49. On average, a greater proportion of women were sexually active by age 18 than were married by age 18 across all three surveys. A slight increase in the proportion of women who were married by age 18 occurred between 2000 and 2010, while a slight decrease occurred in the proportion who were sexually active by the exact age of 18. *Overall these changes are minimal and based on the trends in marriage by age 18 in other East African countries, it was expected that this indicator would reduce over time.* In Rwanda, for example, 20 percent of women ages 25–49 were married by age 18 in 2000. This proportion decreased to 15 percent in 2010. In Uganda, the proportion of women who were married by age 18 declined from 53 percent in 2000 to 49 percent in 2010.

**Figure 8: Percent Married by Exact Age 18 and Sexual Activity by Exact Age 18 Among Women Ages 20–49, 2000–2010**



The proportions of currently married women, ever married women, ever sexually active women, and currently sexually active women were also calculated by five-year age groups for all four Malawi surveys. The results of the most recent Malawi DHS are presented in Table 1 to illustrate the patterns that were

observed in the earlier DHS.<sup>3</sup> More women were ever sexually active than were currently married, ever married, or currently sexually active across every age group as seen in the last row of Table 1. All four of these groups included menopausal women. While the currently sexually active group includes women who were sexually active in the past four weeks and women who were not sexually active in the past four weeks but were postpartum, the ever sexually active group also includes women who were not sexually active in the last four weeks and were not postpartum. Therefore, the proportion of women who were ever sexually active was selected for use in the index of marriage because it best represents women who are exposed to the risk of pregnancy.

**Table 1: Proportion of Currently Married, Ever Married, and Ever Sexually Active by Five-year Age Group, 2010**

Age Group	Proportion Currently Married	Proportion Ever Married	Proportion Currently Sexually Active <sup>4</sup>	Proportion Ever Sexually Active
15–19	0.234	0.262	0.277	0.440
20–24	0.762	0.858	0.755	0.939
25–29	0.845	0.969	0.802	0.993
30–34	0.811	0.987	0.776	0.998
35–39	0.809	0.993	0.769	0.998
40–44	0.774	0.999	0.677	1.000
45–49	0.741	0.999	0.604	1.000
<b>Total</b>	<b>0.675</b>	<b>0.803</b>	<b>0.649</b>	<b>0.864</b>

## Contraception

Increased use of contraception, especially of long-acting and permanent methods, influences fertility decline. Furthermore, fertility should decline when contraceptive users shift from traditional methods to more effective modern contraceptive methods.

Table 2 shows the contraceptive method mix among all women for the four Malawi DHS. The contraceptive prevalence rate more than doubled from 1992 to 2000 (from 10.5% to 24.9%). After 2000, CPR stalled and rose only to 25.7 percent in 2004. CPR then increased again to 35.4 percent in 2010. *While use of almost all methods increased over this period, injectables and female sterilization accounted for the majority of the rise in contraceptive use.* In Appendix A, comparisons of contraceptive use among all women are provided for Malawi, Rwanda, Uganda, and Zambia (Table A1). The majority of contraceptive users use the injectable in Malawi, Rwanda, and Uganda, reflecting a trend toward a skewed method mix throughout the region. In contrast, Zambia has a more balanced method mix, with pills being the most commonly used method, followed by injectables. The change in method mix in Malawi is represented in more detail in Appendix B.

<sup>3</sup> The 1992 DHS did not ask respondents about their recent sexual activity so the proportion of women who were ever sexually active could not be calculated.

<sup>4</sup> This is defined as being sexually active within the preceding four weeks of the survey and not sexually active four weeks preceding the survey but postpartum.

**Table 2: Percentage of Contraceptive Users Among All Women by Method, 1992–2010**

	1992	2000	2004	2010
Pill	1.8	2.3	1.5	1.9
IUD	0.3	0.1	0.1	0.2
Injectable	1.2	13.0	13.9	19.2
Male condom	1.4	1.9	1.7	2.7
Female sterilization	1.5	3.8	4.8	7.5
Male sterilization	0.0	0.0	0.0	0.0
Periodic abstinence	1.7	0.7	0.4	0.6
Withdrawal	1.1	1.1	1.5	1.2
Implant		0.1	0.4	1.1
Female condom				0.1
LAM		0.3		
Other	1.6	1.6	1.4	0.9
<b>Total</b>	<b>10.6</b>	<b>24.9</b>	<b>25.7</b>	<b>35.4</b>

In Table 3, the percentages of traditional and modern method users are presented for four DHS years. Modern method use outweighed traditional methods by 19 percentage points in 1992, where 59.5 percent of users used modern contraceptive methods and 40.5 percent used traditional methods. By 2000, a more significant shift to modern method use was observed (86.2% used modern methods), and this increase continued through to the 2010 DHS (92.1% use modern methods).

**Table 3: Percentage of Traditional and Modern Methods Users, 1992–2010**

	1992	2000	2004	2010
Traditional/Folkloric	40.5	13.8	12.8	7.9
Modern	59.5	86.2	87.2	92.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Table 4 shows the fertility intentions (spacing versus limiting) of contraceptive users. Over the 18-year period there was a 14 percentage point shift toward contraceptive use for limiting future births. This shift occurred primarily from 1992 to 2000 and, except for the interruption in 2004, remained relatively constant. Contraceptive prevalence also rose less in 2004. When fertility intentions are to limit future births, it is anticipated that more effective contraceptives are used for longer durations, which reduces fertility.

**Table 4: Percent of Contraceptive Users by Fertility Intention, 1992–2010**

	1992	2000	2004	2010
Use for spacing	56.5	42.6	47.4	42.6
Use for limiting	43.5	57.4	52.6	57.4
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

## Inconsistencies in the Total Fertility Rate and Contraceptive Prevalence Rate in Malawi

The results in Table 5, however, show that *among those who use contraceptives for limiting, the majority of women are not using long-acting and permanent methods (IUDs, implants, female or male sterilization), and instead are relying on short-acting (pills, injectables, and condoms) and traditional/folkloric (withdrawal, abstinence, LAM, among others) methods to prevent future pregnancies.* If short-acting methods are not being used consistently, unintended pregnancies may result even when the fertility intention is to limit, which will contribute to higher fertility. In 2010, use of long-acting methods and permanent methods accounted for 41.8 percent of contraceptive users who are limiting, up from 32.1 percent in 1992, primarily due to the rise in female sterilization.

**Table 5: Percentage of Contraceptive Users Using to Limit by Method Type, 1992–2010**

	1992	2000	2004	2010
Short-acting methods	36.7	59.0	51.1	51.0
Long-acting and permanent methods	32.1	27.6	37.4	41.8
Traditional/folkloric methods	31.2	13.4	11.5	7.2
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Among spacers, the proportion of contraceptive users who are using short-acting methods is more extreme (see Table 6). In 1992, a roughly even split of spacers used short-acting methods (43.7%) and traditional/folkloric methods (53.6%). By 2000, a greater proportion of spacers moved to short-acting methods (81.9%). This trend continued, though at a slower pace, with 88.0 percent of spacers employing a short-acting method in 2010.

**Table 6: Percentage of Contraceptive Users Using to Space by Method Type, 1992–2010**

	1992	2000	2004	2010
Short-acting methods	43.7	81.9	84.1	88.0
Long-acting and permanent methods	2.7	0.5	1.8	3.3
Traditional/folkloric methods	53.6	17.6	14.1	8.7
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

## Postpartum Infecundability

Mothers in the postpartum period may choose to breastfeed or abstain from sexual activity for different periods of time. These postpartum activities have contraceptive benefits, and as such, the time interval between a birth and the termination of breastfeeding or abstinence constitutes the duration of postpartum insusceptibility to pregnancy (often called “postpartum insusceptibility”). Following Bongaart’s model, HPP calculated the mean duration of postpartum insusceptibility for the postpartum infecundability index. *The HPP team found that over a 10-year period in Malawi, the mean duration of postpartum amenorrhea declined by approximately 1.4 months and postpartum abstinence decreased by 0.8 months (see Table 7).*<sup>5</sup> As such, the natural contraceptive benefits of postpartum abstinence and breastfeeding are not being realized for as long a time as they used to be.

<sup>5</sup> Postpartum insusceptibility was not collected in the 1992 DHS.

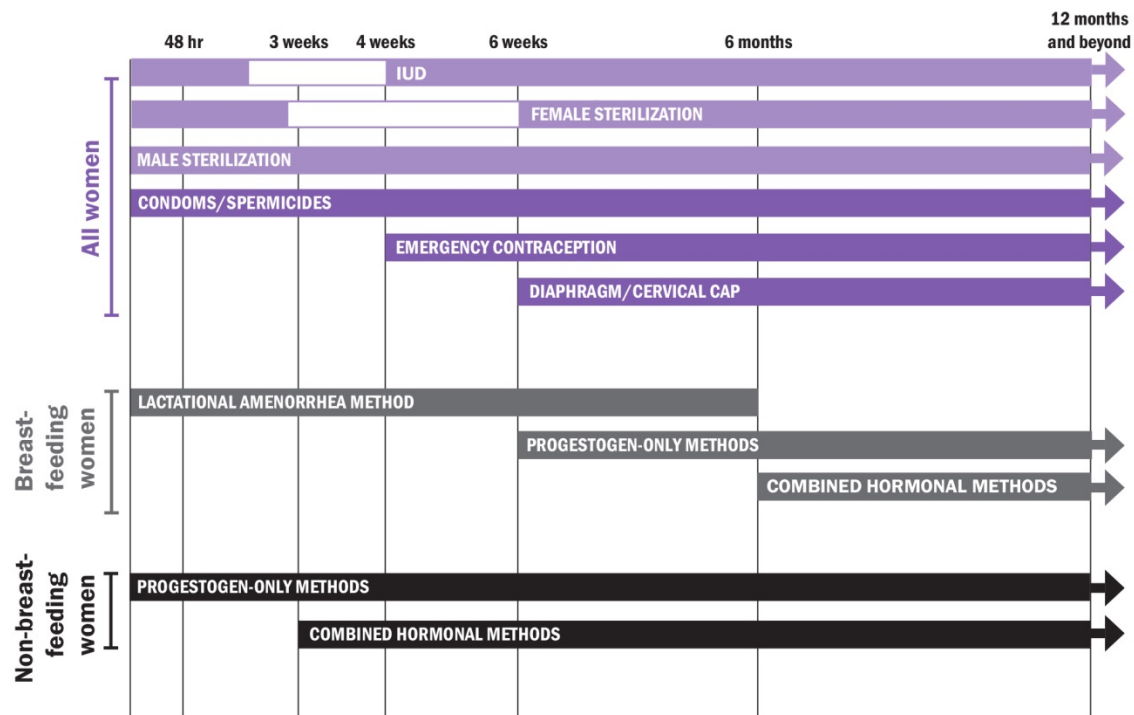
**Table 7: Mean Durations of Postpartum Amenorrhea, Postpartum Abstinence, and Postpartum Insusceptibility**

	Mean Duration (months)		
	2000	2004	2010
Postpartum amenorrhea	14.1	13.1	12.7
Postpartum abstinence	9.0	8.4	8.2
Postpartum insusceptibility	16.1	15.0	14.9

Even with breastfeeding or abstinence, postpartum women often do not know when they will resume ovulation and thus are at risk of an unwanted pregnancy if they resume sexual intercourse without a secondary contraceptive method. The simultaneous use of contraceptive methods and breastfeeding or abstinence during the postpartum period is dwindling in Malawi. *The proportion of contraceptive users who were breastfeeding, abstinent, or amenorrheic decreased from 35.3 percent in 2000 to 29.6 percent in 2004 and 28.0 percent in 2010 (data not shown). Unmet need for family planning among women in the postpartum period remained high at 26.2 percent in 2010.* Offering women family planning services during the postpartum period will help to reduce unwanted pregnancies and abortions (Ross and Winfrey, 2001).

The family planning needs of postpartum women are unique and require special program activities that focus on the feasibility of certain methods in relation to time after delivery. Figure 9 shows the unique options of contraceptive methods for postpartum women (WHO, 2013). Women who breastfeed after delivery can begin progesterone-only contraceptive methods six weeks after delivery, or combined hormonal methods six months after delivery. Women who are limiting and might select female sterilization can undergo the procedure immediately after the birth, up to four days after the birth, or any time after six weeks postpartum.

**Figure 9: Postpartum Contraceptive Options**  
(timing of method initiation and breastfeeding considerations)



Source: World Health Organization. 2013. Programming strategies for postpartum family planning.

Note: For all women, the purple segments for the IUD and female sterilization right after delivery qualify as appropriate times for beginning use of IUD or female sterilization.

## Abortion

Abortion estimates are often difficult to obtain and can be unreliable. Abortions are legal in Malawi only when they can save a pregnant woman's life. There is a lack of abortion rate data in Malawi; however, Levandowski et al. (2013) released an abortion rate estimate of 23 abortions per 1,000 women ages 15–44 for 2009. With the lack of information on this issue, it is not possible to know whether abortion rates in Malawi are increasing, decreasing, or remaining constant over time.

HPP estimated the abortion rates for 2000 to 2010 based on the WHO's regional estimates of unsafe abortions in 2000 and 2008. In East Africa, the WHO estimated a rate of 31 abortions per 1,000 women in 2000 and 36 abortions per 1,000 women in 2008 for all women of reproductive age. Using these data points, HPP calculated the yearly amount of change in abortions from 2000 to 2008, applied this yearly change to the Levandowski abortion estimate, and calculated values for 2000, 2005, and 2010. HPP estimated abortion rates of 19.8 in 2000, 21.6 in 2004, and 23.4 in 2010.

## Proximate Determinants Equation

As mentioned above, Bongaarts' Proximate Determinants of Fertility Model is the most commonly used model to relate selected determinants to the TFR, namely: (1) proportion married; (2) postpartum insusceptibility related to breastfeeding and abstinence; (3) contraceptive use; and (4) induced abortion. Biological factors (rather than behavior) can also contribute to changes in total fertility including

fecundability, natural sterility, and spontaneous intrauterine mortality that can occur at any point throughout a pregnancy. This model explains why women have fewer children than their biological potential.

The model is as follows:

$$\mathbf{TFR} = \mathbf{C}_m \times \mathbf{C}_c \times \mathbf{C}_a \times \mathbf{C}_i \times \mathbf{TF}$$

Where:

- $C_m$  = index of marriage, ranging from 0 to 1 (where 1 is if all women of reproductive age are married and 0 is the absence of marriage)
- $C_c$  = index of contraception, ranging from 0 to 1 (where 1 is the absence of contraceptive use and 0 is when all fecund women are practicing 100% effective contraception)
- $C_a$  = index of induced abortion, ranging from 0 to 1 (where 1 is the absence of induced abortion and 0 is if all pregnancies are aborted)
- $C_i$  = index of postpartum infecundability, ranging from 0 to 1 (where 1 is the absence of lactation and postpartum abstinence and 0 is if the duration of infecundability is limitless)
- TF = Total fecundability rate equal to the total natural reproductive capacity in the absence of lactation. TFR has shown to range globally from 13 to 17.

Lower values on the four determinants mean a lower TFR level.

#### ***Estimation of Marriage index ( $C_m$ )***

The marriage index is calculated from the age-specific fertility rates and the age-specific proportions of ever sexually active women. A weighted average is determined because the effect of marriage on fertility depends on the age distribution of the populations, where women in their central childbearing years are likely to contribute more to the TFR than younger or older women. The formula is expressed as the following:

$$C_m = \frac{\sum f(a)}{\sum f(a)/m(a)}$$

Where:

$f(a)$  = age-specific fertility rates

$m(a)$  = age-specific proportions of ever sexually active

Bongaarts adjusted the calculation of  $f(a)/m(a)$  for the 15–19 age group. The adjustment accounts for the likelihood that respondents who are sexually active are older (age 17 and above) and therefore do not contribute a full five years of experience. The adjustment is  $f(15–19)/m(15–19) = 0.75 * f(20–24)/m(20–24)$ .

#### ***Estimation of Contraceptive Index ( $C_c$ )***

Typically the total fertility rate is calculated for all women while the contraceptive index is calculated for married women only. HPP explored method use for both married and all women and decided to use contraceptive prevalence among all women to align the denominators of the total fertility rate and contraceptive prevalence rate measures.

## Inconsistencies in the Total Fertility Rate and Contraceptive Prevalence Rate in Malawi

The index of contraception is estimated as follows:

$$C_c = 1 - 1.08 \times u \times e$$

Where:

u = proportion of current contraceptive use among all women of reproductive age

e = the average use-effectiveness of contraception (average contraceptive effectiveness) (Trussell, 2011)

1.08 = adjustment factor for sterility<sup>6</sup>

### ***Estimation of Postpartum Infecundability (C<sub>i</sub>)***

The index of postpartum infecundability is measured as:

$$C_i = \frac{20}{18.5 + i}$$

Where:

i = the mean duration of postpartum infecundability caused by breastfeeding or postpartum abstinence

20 = 1.5 months minimum Estimation of Postpartum Infecundability Index (C<sub>i</sub>)

postpartum before ovulation returns + 7.5 months between return of ovulation and conception + 9 months for a full-term pregnancy + 2 months for intrauterine mortality

### ***Estimation of Abortion (C<sub>a</sub>)***

The index of abortion is estimated by:

$$C_a = \frac{\text{TFR}}{\text{TFR} + b * \text{TA}}$$
$$= \frac{\text{TFR}}{\text{TFR} + 0.4 * (1 + u) * \text{TA}}$$

Where:

TA = total abortion rate

b = 0.4(1+u) is the average number of births averted per induced abortion

u = the proportion of women of reproductive age currently using contraception

## Fertility-inhibiting Effects of the Proximate Determinants

Table 8 shows the results of the estimated TFR based on the four indices—marriage (sexually active), contraception, postpartum infecundability, and abortion—from 2000 to 2010.

The index of sexual activity was used instead of marriage to account for the risk of pregnancy exposure outside of marriage. This index decreased marginally over time from 0.938 in 2000 to 0.932 in 2010, which is consistent with the trends observed for sexual activity at exact age 18. *The marginal decline in this index suggests that the age of sexual debut is slowly shifting toward older ages.*

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<sup>6</sup> This is based on the assumption that some contraceptive users may be sterile, such as older female sterilization users.



Table 8: Proximate Determinants Model

	2000	2004	2010
Sexual activity ( $C_m$ )	0.938	0.934	0.932
Contraception ( $C_c$ )	0.754	0.745	0.644
Postpartum infecundability ( $C_i$ )	0.578	0.597	0.599
Abortion ( $C_a$ )	0.955	0.949	0.938
Total fecundity	15.3	15.3	15.3
Estimated TFR	6.0	6.0	5.2
Observed TFR	6.3	6.0	5.7

The index of contraception also decreased, from 0.754 in 2000 to 0.644 in 2010, suggesting that the proportion of women using contraception has increased and they are using more effective, long-acting and permanent contraceptive methods. These changes in  $C_m$  contribute to a reduction in fertility.

TFR is calculated for all live births that occurred in the three years preceding a survey and CPR is calculated at the time of the survey. Thus, there can be a time lag from the TFR estimates to the CPR estimates. To better align CPR and fertility rates, HPP calculated contraceptive prevalence to three years, two years, and one year before the survey. The TFR estimates calculated using the “backed” estimates for CPR were inconclusive and somewhat unstable and did not align well with the observed TFR. The reasons for this unexpected result are unclear, whether due to undetected statistical errors or other reasons. Therefore, the research team reverted to CPR calculations as estimated by the DHS at the time of the survey.

The index of postpartum infecundability increased from 0.578 to 0.599 over a 10-year period. This increase indicates that the duration of breastfeeding and abstinence decreased and women’s resumption to a fecund status after childbearing occurred sooner in recent years, mainly before 2004; there was no change in this index between 2004 and 2010.

For the index of abortion, HPP applied the rate of yearly change in abortions as reported by the World Health Organization (WHO) for East Africa and obtained an abortion rate that increased over time from 19.8 abortions per 1,000 women of reproductive age in 2000 to 23.4 in 2010. Using interpolation, HPP estimated 21.2 abortions per 1,000 women of reproductive age in 2004. *The index of abortion therefore declined over time, tending to reduce the TFR.*

The last row of Table 8 shows the estimated TFR based on the calculations of the indices, and the observed TFR as reported in the DHS. The estimated TFRs are similar to the observed TFRs, with the greatest variation being half a child in 2010. *In 2000, the estimated TFR was lower than the observed TFR by a third of a child. Compared to the observed TFR, the estimated TFR was exactly the same in 2004 (6.0) and lower in 2010 (5.2).* To understand why these small differences exist between the estimated and observed TFRs, it is important to consider how individual indexes behave over time and in relation to one another.

**Table 9: Changes in Proximate Determinant Indices and Change in Estimated TFR, 2000–2004 and 2004–2010**

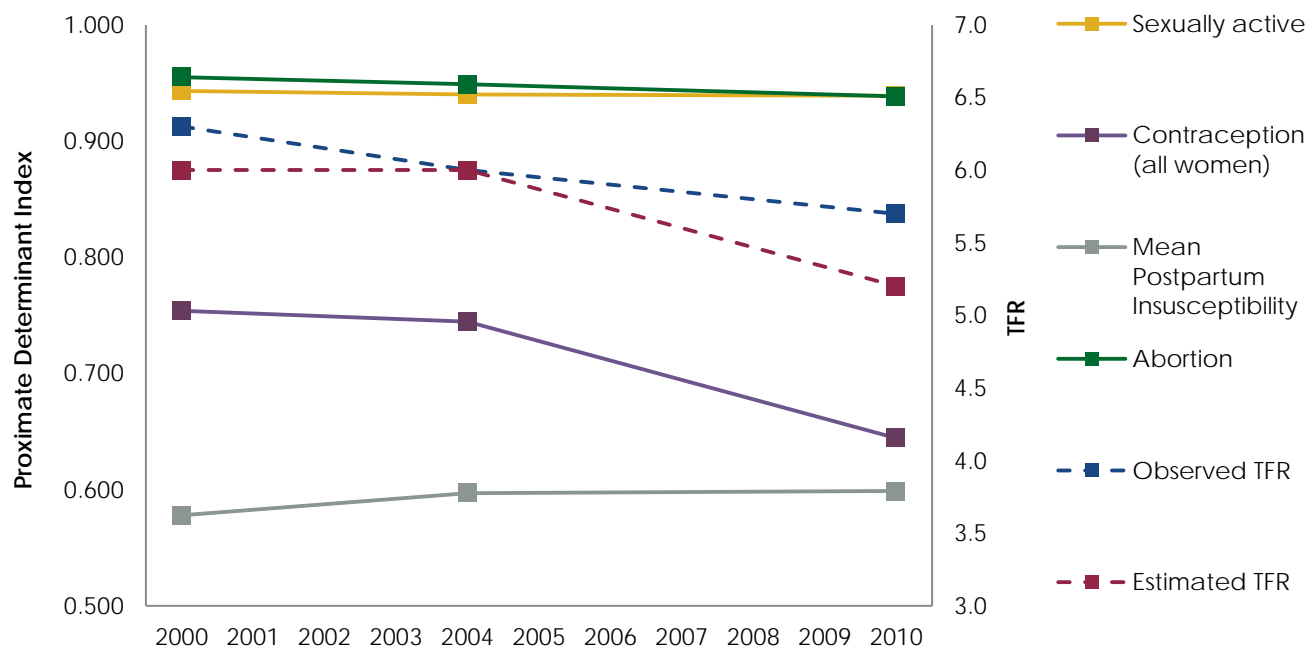
	Change from 2000–2004	Change from 2004–2010	Change from 2000–2010
Sexual activity ( $C_m$ )	-0.004	-0.002	-0.006
Contraception ( $C_c$ )	-0.009	-0.101	-0.110
Postpartum Infecundability ( $C_i$ )	0.019	0.002	0.021
Abortion ( $C_a$ )	-0.006	-0.011	-0.021
Estimated TFR	0.00	-0.800	-0.800

Table 9 shows the change in each index and the change in the estimated TFR for 2000–2004 and 2004–2010. The overall impact of each index on TFR can be seen in the last column, which highlights the change from 2000–2010. The estimated TFR remained the same between 2000 and 2004, likely due to an increase in the index of postpartum insusceptibility offset by small increases in the use of contraception and abortion. *That is, the reduction in the mean duration of postpartum breastfeeding and abstinence canceled the slight rise in contraceptive use and abortion, so there was no change in total fertility.*

Between 2004 and 2010, however, a reduction of close to one child (0.800) is seen in the estimated TFR. This reduction is likely due to the modest rise in contraceptive use as reflected by a change of -0.110 in the index of contraception. *The rise in contraceptive use in 2010 coupled with unchanged postpartum infecundability began to drive the TFR downward between 2004 and 2010.*

Figure 10 presents another way of depicting the changes in the four proximate determinants, estimated TFR, and observed TFR over time. The values of the four indices are on the y-axis and the secondary y-axis (on the right side of the graph) represents the total fertility rate. Most changes in the four proximate determinants moved in parallel with the observed TFR changes. Three proximate determinants (contraceptive use, proportion sexually active, and abortion) reduced fertility, while the index of postpartum insusceptibility increased it. The net of all four proximate determinant time paths parallels the time path of the observed TFR decline.

Figure 10: Time Trend of Proximate Determinants Indices, Estimated and Observed TFR, Malawi 2000–2010



### Urban and Rural Differences

The results of HPP's application of the Proximate Determinants Model to urban and rural areas are presented in Table 10. The differences between the estimated and observed TFR in rural areas are small—less than 0.4 births per woman (as in 2004). The rural TFR trends are reflected in the overall TFR trends because in all three surveys more than 80 percent of women of reproductive age reside in rural areas. In urban areas the TFR and proximate determinant indices may be affected more by sampling error.

Across all three surveys, there are large differences in the estimated TFR in urban areas compared with the observed TFR. The estimated TFR is larger than the DHS-observed TFR and ranges from 1.7 more births per woman in 2000 to 2.2 in 2004 to 1.5 in 2010. Since only 20 percent of the respondents lived in urban areas, these differences may be due to measurement error or factors not accounted for in the proximate determinants model. For example, HIV acquisition may influence a woman's decision to continue childbearing for fear of transmitting HIV to her child. STIs, when left untreated, may cause early onset of sterility, thereby restricting a woman's ability to conceive.

Table 10: Proximate Determinants Model by Urban and Rural Areas

	Urban			Rural		
	2000	2004	2010	2000	2004	2010
Observed TFR	4.5	4.2	4.0	6.7	6.4	6.1
Estimated TFR	6.2	6.4	5.5	6.6	6.8	5.9

## CONCLUSION

HPP hypothesized that Malawi's DHS fertility rates, as measured, may be higher than the true fertility rates and therefore used Bongaart's Proximate Determinants of Fertility Model to estimate the TFRs. The study team found that the differences between the estimated and observed TFRs are less than half a child, which falls into a reasonable range of variation. The estimated TFR remained the same at 6.0 births per woman in 2000 and 2004. This is reflected in the decline in postpartum insusceptibility, which increased fertility that was not compensated by an increase in contraception. Contraceptive prevalence increased by only 2.5 percent in 2004, which was not sufficient to offset the reductions in postpartum insusceptibility. By 2010, however, contraceptive use bounced back, increasing by more than 13 percentage points. This rise, combined with the lack of change in postpartum insusceptibility, resulted in an estimated TFR that was lower than the observed TFR. The greater observed TFR may be due to a lagged effect of increases in contraceptive use occurring right before the implementation of the 2010 survey.

Estimations of fertility in rural areas follow the patterns observed in the total fertility estimates. In urban areas, the TFR estimates were found to be far above the observed TFRs. This may be due to a combination of factors that are not fully accounted for in the Proximate Determinants Model. Abortion may be more commonly used in urban areas than in rural areas. The Maternal and Neonatal Program Effort Score conducted in Malawi 1999 (POLICY Project, 2002) for example, showed that the rating of access to abortion services, while low overall, was different in urban and rural areas (26 versus 13). If the true abortion rates in urban areas are higher than the rates used in the Proximate Determinants Model calculations, this may provide some explanation as to why the estimated TFR was considerably higher than the observed TFR for urban areas.

Another factor that may influence why the estimated TFR is greater than the observed TFR in urban areas is the role of STIs and HIV. When STIs like chlamydia and gonorrhea go untreated, infertility may result and cause a direct inhibitory effect on fertility. In addition, a woman's desired number of children may decrease if she is HIV-positive. The prevalence of HIV in Malawi is around 17 percent in urban areas and 9 percent in rural areas (Government of Malawi, 2012). Furthermore, spousal separation due to migration influences the frequency of sexual intercourse and thus reduces exposure to the risk of pregnancy. Couple separation due to migration may also influence contraceptive use behaviors.

The subtleties of why TFR in Malawi has not declined proportionately to CPR increases cannot wholly be determined using the DHS data and applying the Proximate Determinants of Fertility Model. Questions that could be answered by additional qualitative and quantitative research to supplement understanding of these issues may include

- What role does discontinuation<sup>7</sup> of contraceptive methods play in why TFR is not lower than expected? What is the duration of non-permanent method use?
- Why has age at marriage remained virtually unchanged over the past 10 years? Have early marriage beliefs evolved over time?

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<sup>7</sup> Discontinuation data were only collected in the 2004 DHS, so trends in discontinuation could not be analyzed. The authors discussed the theoretical role of discontinuation in the TFR-CPR relationship, including reaching out to John Stover for his thoughts on the matter. *The team concluded that discontinuation can have an impact on depressing CPR, but this is different from having an effect on the CPR-TFR relationship itself.* If discontinuation is high, it is challenging for an FP program to both replace dropouts and attract new users, and CPR rates may be lower than program effort might deserve. However, the relationship to the TFR is undisturbed; the depressed CPR leaves a higher TFR but the degree of association is not affected by the discontinuation rate. There is no clear mechanism by which discontinuation would influence the CPR-TFR relationship itself.

- What are client preferences and health system factors that result in a method mix skewed toward injectables?
- How are migratory patterns of urban men affecting fertility? That is, do urban men leave their spouses for long periods when they work in other areas, which would reduce sexual frequency and risk of pregnancy?

## RECOMMENDATIONS

The results of this study suggest several recommendations for strengthening family planning programs in Malawi.

- **Strengthen the integration of family planning counseling and services into maternal and child health services.** HPP's calculations of the index of postpartum insusceptibility using the Proximate Determinants Model of Fertility suggested that women are breastfeeding or remaining abstinent for shorter durations of time. Therefore, their resumption of ovulation is occurring sooner than in previous years. The antenatal and postpartum periods are times when women have multiple contacts with service delivery outlets. To capitalize on this and build on the Directorate of Reproductive Health's (DRH) efforts to offer family planning to mothers at child immunization clinics, information should be given about the risk of pregnancy with inconsistent breastfeeding, and a range of contraceptive methods to reduce unwanted and mistimed pregnancies should also be offered to women when they seek antenatal services.
- **Explore the feasibility of increasing family planning options and choices for women in the postpartum period.** The family planning needs of postpartum women are unique and require special program activities that focus on the feasibility of certain methods in relation to time after delivery. For example, according to the WHO, women who breastfeed after delivery can begin progesterone-only contraceptive methods six weeks after delivery, or combined hormonal methods six months after delivery. Those who choose female sterilization can undergo the procedure immediately after birth, up to four days after birth, or any time after six weeks postpartum. The DRH is currently strengthening its family planning program to provide postpartum IUD insertions. Providers should receive training in the different contraceptive options available to postpartum women so they can effectively counsel postpartum women.
- **Promote the availability of contraceptive methods to both married and unmarried youth.** Data from the ever sexually active index of the Proximate Determinants Model showed that 45 percent of all 15–19-year-olds had been sexually active, and one in five were sexually active in the four weeks preceding the survey in 2010. Of those who had been sexually active, more than half were unmarried and 18 percent had an unmet need for family planning. Furthermore, in Malawi, reproduction begins at an early age: 25 percent of young women ages 15–19 had begun childbearing (DHS, 2010). Increasing access to and use of contraceptives among youth is critical if they are to have healthy reproductive lives.
- **Offer more choice of contraceptive methods to all women.** Malawi's method mix is highly skewed, with more than half of contraceptive users choosing the injectable. Recently, additional increases have been observed in female sterilization. Pills, IUDs, and implants, however, each accounts for less than 3.1 percent of all contraceptive use. Increasing contraceptive choice helps women identify a method that fits their general health, lifestyle, relationships, and fertility intentions at points throughout their reproductive lifespan.
- **Increase the availability of long-acting and permanent methods, especially to women who want to limit childbearing.** The results of this study showed that close to 60 percent of women who want to limit childbearing are using short-acting or traditional methods. While using short-acting methods for limiting is acceptable and effective for some women, other methods that require fewer facility visits and offer long-term protection should be made available.

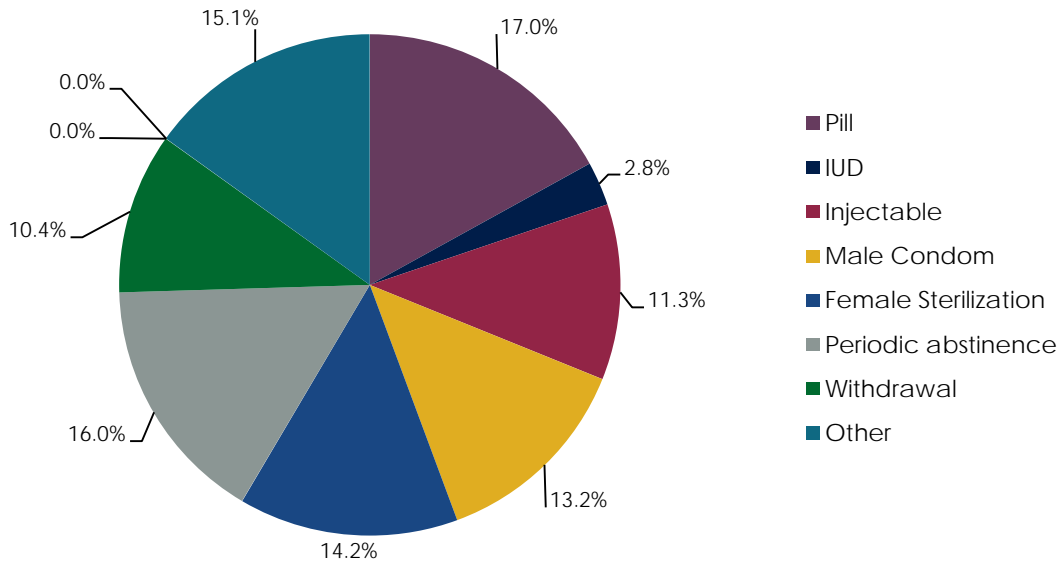
## APPENDIX A.

Table A1: Percentage of Contraceptive Users Among All Women by Method in Malawi, Rwanda, Uganda, and Zambia

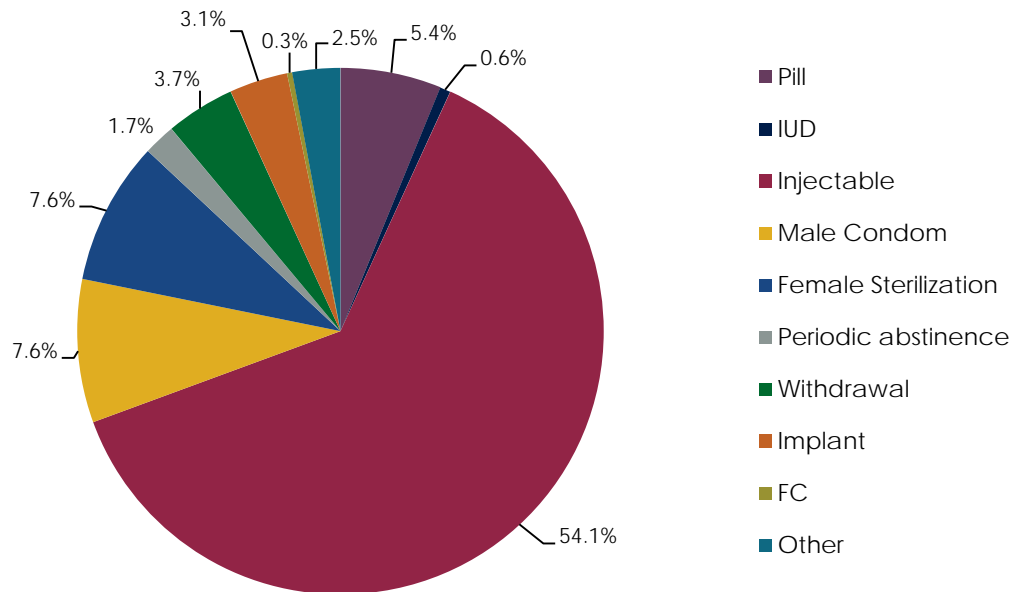
	Malawi 2010	Rwanda 2010	Uganda 2011	Zambia 2007
Pill	1.9	3.9	2.1	7.4
IUD	0.2	0.2	0.4	0.1
Injectables	19.2	14.6	10.7	6.2
Condom	2.7	1.8	3.2	5
Female sterilization	7.5	0.5	2.2	1.4
Male sterilization	0	0	0.1	0
Implant	1.1	3.6	1.9	0.3
LAM	-	0.3	0.1	4.1
Female condom	0.1	-	-	0
Diaphragm	-	0	-	-
Standard Days Method	-	0.3	-	-
Periodic abstinence	0.6	1.6	1.1	0.9
Withdrawal	1.2	1.8	1.5	3.6
<b>Total</b>	<b>34.5</b>	<b>28.6</b>	<b>23.3</b>	<b>29.0</b>

## APPENDIX B.

Malawi FP Method Mix, 1992 (CPR 10.6% among women of reproductive age)



Malawi FP Method Mix, 2010 (CPR 35.6% among women of reproductive age)





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