

Measuring the success of family planning initiatives in Rwanda: a multivariate decomposition analysis

Dieudonne Ndaruhuye Muhoza¹ · Pierre Claver Rutayisire¹ · Aline Umubyeyi²

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Abstract Rwanda has experienced a dramatic increase in contraceptive use and concomitant fertility decline between 2005 and 2010. The contraceptive prevalence rate has increased from 17 to 52 %. During this period, Rwanda was strongly promoting family planning and making socio-economic progress. This study analyses the shift in contraceptive use by investigating the contribution attributable to the family planning program and that resulting from socio-economic progress. Using data from the 2005 and 2010 Rwanda Demographic and Health Surveys, we apply the Blinder-Oaxaca decomposition technique to separate the increase in contraceptive use due to population composition change, which result mostly from socio-economic and attitudinal developments, from the increase attributable to changes (improvement) in contraceptive behaviour. The contraceptive increase is mainly attributable to contraceptive behavioural change (78 %). Factors that show a significant contribution are women's education, experience of child mortality, and place of residence. The contribution of changes in population composition is limited (12 %). Effects are relatively higher for exposure to family planning messages and husband's desire for children compared to that of his wife's. Contraceptive uptake improved mostly in the low socio-economic stratum of the population, among the rural and less educated population. This finding suggests that a strong family planning program supported by political leaders can remove persistent socio-economic and cultural barriers and enable a massive popular contraceptive uptake.

Keywords Family planning · Increase · Fertility decline · Rwanda

✉ Dieudonne Ndaruhuye Muhoza
dieumu_res@yahoo.fr

¹ Department of Applied Statistics, College of Business and Economics, University of Rwanda, Huye, Rwanda

² School of Public Health, College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda

Introduction¹

Rwanda has experienced an impressive increase in contraceptive use during recent years. The contraceptive prevalence rate (CPR) increased three-fold, from 17 % in 2005 to 52 % in 2010. The increase in CPR was accompanied by a large decline in unmet need for family planning, from 38 to 19 %, and a decline in the total fertility rate (TFR), from 6.1 to 4.6 births (National Institute of Statistics of Rwanda [NISR], Ministry of Health [MOH] and ICF Macro 2012). These achievements went far beyond the national objectives for 2010, which were fixed at 26.3 % for the CPR and 5.5 births for the TFR (MOH 2006). This dramatic increase, which is uncommon in Sub-Saharan Africa, has drawn attention to and has raised curiosity about the mechanisms that have driven the change in demographic behaviour and outcomes.

Theoretically, the increase in contraceptive use is a result of either a rise in the demand for family planning associated with rapid socio-economic development or better access to improved family planning services, or both (Mwaikambo et al. 2011; Vahidnia 2007; Richey and Salem 2008; Gertler and Molyneaux 1994). The socio-economic development theory of contraceptive use stipulates that individuals use birth control means because they strongly need them, as a result of expected benefits overtaking the perceived costs. The massive adoption of contraceptives induced by the increase in demand will increase contraceptive prevalence without a strong family planning program, as was observed in Europe in the 19th century (Freedman 1990). Enabled by the increase in education level, health, per capita income and urbanization, this theory assumes that the lack of contraceptives will be remedied through private channels (Demeny 1990).

The family planning program theory highlights the determining role of increasing the availability of contraceptives among the general population and improving the quality of services provision. This supply approach presumes that individuals adopt contraceptive means in large numbers because they can access them easily. Evidence for this theory is offered by the Asian and Latino-America countries, which experienced a strong contraceptive uptake and fertility decline without significant socio-economic development (Sinha 2005; Freedman 1990; Schuler et al. 1995). Other researches, however, combine both theories (Jain and Ross 2012, Lapham and Mauldin 1985) to explain the success of family planning in many settings. Gertler and Molyneaux (1994), for instance, established that the rise in contraceptive use that lowered Indonesian fertility was motivated by increased demand for contraception, which in turn was induced by the improvement in female education and females' wages. Yet Bongaarts (2014) has demonstrated that a family planning program in itself can, paradoxically, raise the demand for family planning.

In Rwanda, the sharp increase in contraceptive use occurred in a context of remarkable socio-economic progress and family planning promotion. Enrolments in education at all levels were increasing, especially for girls. At higher education level, for instance, the number of students grew by 37 % per year between 2002 and

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2011. Females constituted 43 % of the students (Ministry of Education [MINE-DUC] 2012). Similar improvements were noted in the health sector, with a significant decline in infant and maternal mortality (NISR et al. 2012), resulting in a faster achievement in this field relative to the Millennium Development Goals. Parallel to these improvements, Rwanda experienced steady economic growth. The Gross Domestic Product per capita nearly doubled between 2005 and 2010 and the percentage of extremely poor people dropped by 33 %, from 36 to 24 %, in the same period (NISR 2012). The question raised is the extent to which these changes have contributed to the contraceptive behaviour change.

Using the extensive data on family planning in the 2005 and 2010 DHS datasets, this paper describes the levels of and changes in contraceptive use in Rwanda and investigates factors that have contributed to the dramatic increase in the CPR over the period. Findings from this study will contribute to understanding the drivers of the successful Rwandan family planning program that may guide policymakers to further improve the ongoing program in Rwanda and provide lessons to others countries.

Background

Renewed family planning attention in Rwanda

Despite the fact that rapid population growth, with its unfavourable effects on the economy and living conditions of the population, was recognized as a problem in Rwanda from the colonial period, family planning activities did not start until 1981, with the creation of the *Office National de la Population* (ONAPO) (Ndaruhuye et al. 2009). The fertility level declined slightly in the first decade following the ONAPO creation. During and after the 1990s civil war and Rwandan genocide, which resulted in mass population movements, family planning activities were suspended, and ONAPO was dissolved in 2000. The issue of rapid population growth did not resurface until after the results of the 2002 census and the 2005 DHS. Restoring peace, the reconstruction of society and rebuilding the country's infrastructure had higher priority. The census and 2005 DHS revealed an increase in fertility from 5.8 to 6.1 births per woman between 2000 and 2005 and a further increase in population density, the highest in Africa. These results triggered renewed attention to the population issue among policy makers. The measured high level of unmet need for family planning (37 %) in 2005 and an actual fertility rate of 1.5 children per woman above the desired number of children indicated that responding to the high unmet need for family planning could contribute to fertility decline.

In accordance with the international development debate on the Millennium Development Goals, a significant campaign against population growth and towards improvement of reproductive health services began in 2006.

Strategies to promote family planning

Recognizing that population growth is the major barrier to achieving the ambitious vision for development aiming to transform the country into a middle-income country by the year 2020 (Ministry of finance and Economic Planning [MINECOFIN] 2000), since 2007 the Rwandan Government has supported and encouraged family planning with a high level of commitment² (Madsen 2011). To enact this commitment, various actions have been taken (MOH 2006) including a massive public family planning campaign to strengthen the demand for family planning, an improvement in the quality of services and an increase in access to family planning services.

Strong political commitment with a massive family planning campaign

Since 2007, family planning has been a stated priority program to help reduce the high rate of population growth that compromises government development efforts. Thus, an intensive public education campaign was launched to raise awareness of the need to reduce the population growth rate. All key personnel and leaders, including local administrators and health staff, were sensitized (MOH 2009). The Rwandan Parliamentarians' Network on Population and Development, created in 2003, has played a determining role by going up to lower administrative units. Various media channels were used including television and radio and monthly talks after "Umuganda", community service performed on the last Saturday of every month. In order to increase family planning coverage, the Rwandan Government increased the budget for family planning activities and extended the number of partners, initially represented only by USAID and UNFPA (MOH 2009).

Providers' capacity strengthened and quality of family planning services improved

To ensure the quality of services and to expand the use of long-acting contraceptive methods requiring expertise at health facilities, the systematic training of providers was undertaken. In 2010 a program was started to train selected medical doctors as master trainers on how to perform non-scalpel vasectomy (MOH 2011). Also in the same year, a scheme was initiated to train trainers in the community-based distribution of contraceptives, a new approach aiming to reach more people (USAID-Rwanda 2008).

In addition to staff training, great efforts were made to increase the availability of a range of modern contraceptive methods and to promote long-acting methods, including male sterilization. Access to condoms was increased by making them more available in public areas and workplaces, as well as in family planning clinics and health facilities. By 2009, the distribution of family planning commodities had reached almost all public health facilities and district hospitals; and the district

² In 2007 the President of the Republic declared family planning a national priority. Created in 2003, the Rwandan Parliamentarians' Network for Population and Development engaged in several grassroots campaigns at district and sector level.

hospitals offering long-acting methods grew enormously from 7 to 76 % for implants and from 1 to 36 % for IUDs (MOH 2009; USAID-Rwanda 2009).

Geographical barriers reduced and community mobilisation

A particular challenge of the Rwandan health system in regard to family planning is that many health facilities (40 % in 2001) are ‘faith-based’ and as a consequence do not offer modern contraceptives. To overcome this barrier, the government decided to construct “*secondary posts*” not far from religious-affiliated health facilities to meet the needs of clients in those areas. By reducing the geographic distance, this innovative solution increased access to health facilities for many clients. To serve other regions that had been without services, new hospitals and health centres were constructed (USAID-Rwanda 2009).

In addition to direct initiatives towards family planning support, family planning program implementation has benefitted from various system reforms that may have had indirect effects on family planning success. This includes (1) the 2006 Administrative Decentralization reform that permitted community mobilization and participation; (2) a partnership with religious and traditional leaders whose support is valuable for the success of the program; (3) a performance-based financing system of health facilities and performance-based contracts for staff, as well as (4) a universal health insurance scheme that has increased the use of health facilities.

It is a combination of all these initiatives and their subsequent effects that seem to explain the Rwandan family planning success story. On one hand, a strong awareness campaign run on the ground by different leaders, from the government to the village level would have strengthened the high latent demand and created new demand by reducing socio-cultural barriers and increasing acceptance of mass contraception. On the other hand, the government’s financial efforts and donors’ mobilization have improved the quality of service delivery by sustaining stocks of contraceptives and expanding service provision through the construction of new health facilities. The first intervention reinforced demand while the second improved supply.

Data and methods

Data

This research uses the 2005 and 2010 Rwanda DHS (RDHS) women’s datasets. The study population concerns all married women (i.e. in union) interviewed. We excluded unmarried women for two reasons. First, we wanted to comply with the widely-used definition of contraceptive prevalence, which considers only married women (Alkema et al. 2013; WHO 2013), since unmarried women are less sexually active and therefore less in need of family planning. Second, while the proportion of unmarried women (never married and formerly married) is important in constituting half of all women 15–49 years in Rwanda, their contribution to overall fertility is small (14.6 %). In addition, the proportion of teens (15–19 years) that have started

childbearing is small (5 %). Thus, including the category of unmarried women in the study would hide the observed change in contraceptive prevalence.

The RDHS sample of married women was 5510 women in 2005 and 6897 in 2010. The two datasets were pooled for the decomposition analysis. The outcome variable is “current use of contraception,” with two categories: *yes* if the respondent is using any method of contraception, and *no*, if otherwise. Explanatory variables are grouped in four categories:

- Demographic variables: age, number of living children, child mortality experience.
- Socio-economic factors: education, religion, place of residence, health insurance.
- Exposure to family planning messages: visited family planning worker, told about family planning at health facility, media messages (radio, television or newspapers).
- Husband’s fertility attitude: husband’s desire for children compared with his wife’s.

Statistical analysis

To evaluate the contribution of each factor, both descriptive and multivariate analysis will be applied.

Descriptive analysis

We start the analysis with descriptive results. First, in Table 1, we provide the number of respondents in each category for each independent variable and each survey, and show, in percentage points, the changes between surveys indicating improvements or otherwise in the characteristics of the sample population. In Table 2 we indicate the proportion of respondents using contraception, showing the changes in contraceptive practice between 2005 and 2010.

Multivariate decomposition model

Widely known as ‘Blinder-Oaxaca’ (Oaxaca-Blinder) decomposition (Blinder 1973; Oaxaca 1973), or as multivariate decomposition, component analysis, shift-share analysis or regression decomposition as detailed by Powers and Yun (2009), this approach provides a method of analysing the outcomes of two different groups. The differences between two groups could be explained either in the composition or characteristics of the groups (endowments) or by the effects of those characteristics (coefficients). This means that the Oaxaca-Blinder technique will reveal the real contribution of each independent variable to the total difference in characteristics or in the effects of characteristics. Multivariate decomposition techniques were used in the 1970s by many researchers for linear regression models and later extended to

Table 1 Distribution of married women by selected variables and changes in these variables, RDHS 2005 and 2010

Variable	Category	2005 (%)	2010 (%)	Change (% points)
Woman's age	15–24	19.0	15.8	–3.2
	25–24	42.9	46.8	3.9
	35+	38.1	37.4	–0.7
Number of living children	0	6.1	6.2	0.1
	1	15.5	16.6	1.1
	2	18.5	19.3	0.8
	3	17.1	16.3	–0.8
	4	14.4	14.6	0.2
	5	10.0	11.5	1.5
	6+	18.4	15.5	–2.9
Woman's educational level	No education	29.8	19.7	–10.1
	Primary	61.5	69.8	8.3
	Secondary	8.1	9.0	0.9
	Higher	0.6	1.5	0.9
Residence	Urban	13.5	13.4	–0.1
	Rural	86.5	86.6	0.1
Religion	Catholic	46.1	41.9	–4.2
	Protestant	36.5	40.4	3.9
	Adventist	13.2	14.3	1.1
	Others	4.2	3.4	–0.8
Child mortality experience	No child death	50.7	61.9	11.2
	Last child died	7.0	3.7	–3.3
	One death, not last	20.8	17.8	–3.0
	Two or more deaths	21.5	16.6	–4.9
Husband desire for children compared with wife's	Same number as wife	36.8	57.9	21.1
	More than wife	13.0	10.2	–2.8
	Fewer than wife	18.5	17.2	–1.3
	Don't know	31.7	14.7	–17.0
Visited by family planning workers	Yes	5.3	30.9	25.6
	No	94.7	69.1	–25.6
Told about family planning at health facility	Not told	26.2	27.1	0.9
	Told	15.5	44.8	29.3
	Not been at health facility	58.3	28.1	–30.2
Heard family planning message on radio, television, or newspaper	Yes	46.1	70.4	24.3
	No	53.9	29.6	–24.3
Have health insurance	No	53.4	24.0	–29.4
	Yes	46.6	76.0	29.4
Total	–	100.0	100.0	–
Total number of women	–	5510	6897	–

nonlinear models with an in-depth discussion on how to address the related weaknesses (Fairlie 2005; Powers and Pullum 2006).

We have chosen to use the decomposition technique for this study for two main reasons. The first is related to the study, which compares two time periods, 2005 and 2010. The second is that this technique allows us to separate the difference in contraceptive use between 2005 and 2010 into components attributable, first to changes in composition, second to changes in the effects of the selected explanatory variables, and third to the interaction between them.

The model can be presented as follows:

$$\Delta Y^{2010-2005} = (X^{2010} - X^{2005})\beta^{2010} + X^{2005}(\beta^{2010} - \beta^{2005}) + [(X^{2010} - X^{2005})(\beta^{2010} - \beta^{2005})]$$

where ΔY is the difference in mean prediction between 2010 and 2005, X_1, \dots, X_k are different characteristics and β_1, \dots, β_k are estimated regression coefficients;

$(X^{2010} - X^{2005})\beta^{2010}$ represents the difference due to endowments;

$X^{2005}(\beta^{2010} - \beta^{2005})$ represents the difference due to coefficients; and

$[(X^{2010} - X^{2005})(\beta^{2010} - \beta^{2005})]$ represents the difference in interaction between endowments and coefficients.

The Blinder-Oaxaca decomposition outputs provide details on endowments, coefficients, and interaction between the two time periods:

- Endowments: the part of the change in contraceptive use that is due to differences in characteristics.
- Coefficients: the part of the change in contraceptive use that is due to effects of explanatory variables.
- Interaction: the part of the change in contraceptive use that is due to interactions between characteristics and effects of characteristics.

To apply the above model, we have used Oaxaca STATA command, which provides the effect of each independent variable and each category of that independent variable.

Results

Descriptive results

Table 1 presents the percentage of women included in each category of selected variables in 2005 and 2010, and the changes between the two periods. Overall, there were few changes in women's characteristics, such as place of residence, current age distribution, or number of living children. There were small decreases in the percentage of younger women, women with many children, and urban residents compared with older women, women with fewer children, and rural residents. Women's educational attainment increased between 2005 and 2010, particularly for some education (primary) versus none. The category of Protestant religion slightly

Table 2 Married women using contraception by selected variables in 2005 and 2010

Variable	Category	2005		2010	
		%	N	%	N
Woman's age	15–24	12.1	1045	43.5	1087
	25–34	18.7	2366	55.2	3230
	35+	18.4	2098	50.4	2579
Number of living children	0	2.6	337	1.5	428
	1	11.0	853	49.1	1144
	2	16.2	1020	56.6	1333
	3	20.4	940	57.8	1125
	4	21.7	794	58.6	1006
	5	20.3	553	56.0	791
	6+	20.9	1011	51.7	1066
Place of residence	Urban	31.6	743	53.1	926
	Rural	15.2	4766	51.4	5970
Woman's educational level	No education	10.8	1639	43.3	1354
	Primary	17.3	3391	52.6	4815
	Secondary	38.8	448	60.1	621
	Higher	60.0	30	61.0	105
Woman's religion	Catholic	19.4	2539	55.8	2891
	Protestant	13.8	2013	47.1	2784
	Adventist	18.1	728	52.2	985
	Others	23.2	228	51.1	235
Child mortality experience	No death	20.2	2791	57.4	4270
	Last birth died	13.0	386	28.6	259
	One death other than last birth	19.1	1148	54.4	1225
	Two or more deaths	10.3	1184	31.5	1142
Husband's desire for children compared with wife's	Same number	22.2	2027	55.0	3990
	More than wife	12.4	718	47.0	705
	Fewer than wife	22.1	1017	57.0	1185
	Don't know	11.0	1746	34.8	1014
Heard FP messages on radio, television, or newspaper	No	11.5	2972	45.2	2038
	Yes	24.2	2537	54.5	4838
Visited by FP workers	No	17.2	5217	48.9	4765
	Yes	20.9	292	57.5	2132
Told about FP at health facility	Not told	20.0	1446	46.4	1869
	Told	26.1	852	57.3	3088
	Not been at health facility	13.9	3211	47.4	1939
Have health insurance	No	15.3	2938	51.4	1665
	Yes	19.7	2571	51.6	5231
Total		17.4	5510	51.6	6897

increased, while Catholics, Muslims and others decreased. Child mortality decreased. The percentage of women without experience of a dead child rose by 11.2 percentage points compared with a decline among women who had experienced the loss of some children. A convergence of fertility attitudes between spouses occurred over the survey period. Couples who wanted the same number of children rose by 21 percentage points, while the percentage of couples with different views or who did not know the other's fertility preferences declined. The percentage of women exposed to family planning messages, regardless of the source of message, increased significantly, by 25–30 percentage points.

Table 2 indicates that the increase in contraceptive use was higher in rural than urban areas, among less educated than more educated women, and among women with fewer children than women with many children. The difference is striking with regard to women's experience with child mortality. While the percentage of women with no child deaths using contraceptives rose by almost three times, from 20 to 57 %, between 2005 and 2010, contraceptive use among women who lost their last child was lower and increased less, from 13 to 29 %. Contraceptive use was also most common if a husband desired fewer or the same number of children as his wife. Women exposed to family planning messages in the mass media were more likely to use contraception than women with no exposure, but the difference narrowed between 2005 and 2010.

Regression-based decomposition results

Table 3 reports the mean prediction of contraceptive use in 2005 and in 2010 and also shows how much of the difference is attributable to changes in women's characteristics (endowments), how much to the effects of these characteristics (coefficients), and how much to their interaction.

Overall, from 2005 to 2010, there was an impressive increase in contraceptive use. The mean prediction increased threefold, from 0.174 to 0.516, a difference of 0.342. It is clear that the part of the increase explained by the coefficient effects of selected explanatory variables was more important (0.267, representing 77.9 % of the total change) than the part explained by the endowment effects (0.058; 16.9 %). The interaction term (0.018) is not significant at 0.05. This general result indicates that the increase was mostly due to behaviour change, more than to change in the composition of the sample. Women were more inclined to use contraception in 2010 than in 2005.

However, even though the overall increase explained by the coefficients was higher than the increase explained by the endowments, the contribution of different

Table 3 Mean values of contraceptive use predicted for 2005 and 2010

Mean prediction 2010	0.516***
Mean prediction 2005	0.174***
Total Difference	0.342***
Difference due to Endowments	0.058***
Difference due to Coefficients	0.267***
Difference due to Interaction	0.018

*** $p < 0.01$

Table 4 Contribution of explanatory variables to the difference in contraceptive use between 2005 and 2010

Variable/category	Endowments	Sig.	% (1)	Coefficients	Sig.	% (1)
Woman's age						
15–24	-0.0006064		-0.18	0.0014521		0.42
25–34	-0.0002426		-0.07	0.005008		1.46
35 +	0.0000877		0.03	-0.0073585		-2.15
S/total	-0.0007613		-0.22	-0.0008984		-0.26
Number of living children						
0	-0.0002482		-0.07	-0.0207249	***	-6.06
1	-0.0006721		-0.20	0.016815	***	4.92
2	0.0000552		0.02	0.0158383	***	4.63
3	-0.0003928		-0.11	0.0086856	**	2.54
4	0.0001185		0.03	0.0082561	**	2.41
5	0.0011651	**	0.34	0.0037238		1.09
6+	-0.0027604	***	-0.81	-0.0000154		0.00
S/total	-0.0027347		-0.80	0.032579		9.53
Place of residence						
Urban	-0.0000263		-0.01	-0.006417	***	-1.88
Rural	-0.0000263		-0.01	0.0411162	***	12.02
S/Total	-0.0000526		-0.02	0.0346992		10.15
Woman's educational level						
No education	0.0124773	***	3.65	0.0270427	***	7.91
Primary	-0.0056976	***	-1.67	0.0397708	**	11.63
Secondary	0.0002387		0.07	-0.000106		-0.03
Higher	0.0016176	***	0.47	-0.000844	**	-0.25
S/Total	0.008636		2.53	0.0658635		19.26
Woman's religion						
Catholic	-0.0004701		-0.14	0.0099681		2.91
Protestant	-0.0011034	**	-0.32	0.0052014		1.52
Adventist	-0.000033		-0.01	0.0009569		0.28
Others	-0.000151		-0.04	-0.0017893		-0.52
S/Total	-0.0017575		-0.51	0.014337		4.19
Heard family planning messages in the media						
No	0.0091614	***	2.68	0.0155366	***	4.54
Yes	0.0091614	***	2.68	-0.0132668	***	-3.88
S/Total	0.0183228		5.36	0.0022698		0.66
Visited by family planning worker						
No	-0.0006572		-0.19	-0.0112555		-3.29
Yes	-0.0006572		-0.19	0.0006309		0.18
S/Total	-0.0013144		-0.38	-0.0106246		-3.11

Table 4 continued

Variable/category	Endowments	Sig.	% (1)	Coefficients	Sig.	% (1)
Told about family planning at health facility						
Not told	-0.0000063		0.00	-0.0054041		-1.58
Told	0.009569	***	2.80	-0.0023913		-0.70
Not at health facility	0.0096222	***	2.81	0.0210073	***	6.14
S/Total	0.0191849		5.61	0.0132119		3.86
Have health insurance						
No	0.0002684		0.08	0.0012388		0.36
Yes	0.0002684		0.08	-0.001084		-0.32
S/Total	0.0005368		0.16	0.0001548		0.05
Husband's desire for children						
Same	0.0090485	***	2.65	-0.0033242		-0.97
More	0.0013361	***	0.39	0.0066106	**	1.93
Fewer	-0.0004887	*	-0.14	-0.0009574		-0.28
Don't know	0.0057836	***	1.69	-0.0115666	**	-3.38
S/Total	0.0156795		4.58	-0.0092376		-2.70
Child mortality experience						
No death	0.0010104		0.30	0.0182964	**	5.35
Last birth died	-0.0006141		-0.18	-0.0065585	***	-1.92
One death other than last birth	-0.0002274		-0.07	0.0048696		1.42
Two or more deaths	0.0017383	***	0.51	0.0073354		2.14
S/Total	0.0019072		0.56	0.0239429		7.00
Change in intercept				0.1002634	***	29.32
Total	0.0576469		16.86	0.2665605		77.94

Percentages are calculated out of the overall increase (variable effect/0.3420141)

independent variables varied substantially from one variable to another and according to categories within variables (Table 4).

In regard to the total increase attributable to the changes in coefficients (77.9 %), the most important independent variables that provide significant contributions are women's education level, place of residence, number of living children and child mortality experience, accounting for 19.3, 10.2, 9.5 and 7.0 % respectively. The contribution of women's education is the most important, accounting for 25.2 % (19.3 of 77.9) of changes due to coefficients. This change is principally imputable to the categories of women with no education (7.9 %) and those with primary education (11.6 %). The categories of better-educated women display negative and less significant results relative to the average increase, indicating a lesser increase in contraceptive use than the average. These results show that less educated women have made more progress in contraceptive uptake than their better-educated counterparts.

The second factor that displays a significant contribution to the increase in contraceptive use is urban–rural residence (place of residence). Women from rural areas exhibit substantially higher contraceptive adoption (12.0 %) while those from urban area experience small and negative changes (−1.9 %) indicating a smaller increase in contraceptive use. The gap between rural effects and urban effects is 13.9 % (12.0 % + 1.9 %). The number of living children comes in the third position to explain the increase in contraceptive use: 9.6 % of the overall increase. Results indicate that higher increase was achieved especially by the category of women with fewer children (1–4 children). The group of women with no children shows a strong and negative change relative to the average, suggesting slower progress in contraceptive use.

Another important factor is women's child mortality experience, which contributes up to 7 % of the overall increase. Women with all their children alive are most likely to have increased contraceptive use (5.4 %), followed by women who lost only one child and not the last (1.4 %) or those who lost more than one child (2.1 %). In contrast, women who lost the last child have progressed slower with contraceptive uptake (−1.9 %) than the average, reducing the overall increase.

It should be noted that the intercept (0.1002634) accounts for 29.3 % of the overall increase (0.342). This suggests that the model fit presented some limitations in explaining the increase in contraceptive use between 2005 and 2010. Other factors would exist that also contribute to the success of family planning program.

The compositional differences in sample groups also provide interesting results in that exposure to family planning messages in the media or at health facilities, husband's desire for children compared with his wife's, woman's education, and the woman's child mortality experience have significant positive contributions. It appears that most (65.1 % = 11.0/16.9) of the contribution of endowments is attributable to the compositional differences for women exposed to family planning messages in the media (5.4 %) or at health facilities (5.6 %). Factors related to family planning are followed in endowment contribution by the fertility attitude of husbands (4.6 %), particularly for women whose husbands desire the same number of children as they do (2.7 %), and women who do not know the fertility preferences of their husbands (1.7 %). Although statistically significant, the compositional effects related to women's educational level and women's child mortality experience are less important, at 2.5 and 0.6 % respectively indicating that the compositional differences are less different from the average.

Discussion and conclusion

Contraceptive use in Rwanda has increased by far more than the Ministry of Health projection for the year 2010. Moreover, progress against other reproductive health indicators, such as women delivering in health facilities and reduction in infant and maternal mortality, has also exceeded expectations.

Comparing the 2005 and 2010 RDHS, this study has described the Rwandan family planning initiatives and identified factors that have contributed most to the increase in contraceptive use between 2005 and 2010. The study used the Blinder-

Oaxaca technique to decompose the contribution of changes in women's characteristics and changes in effects of these characteristics.

Results from the multivariate decomposition technique show that the increase in contraceptive use between 2005 and 2010 is attributable more to the changes in effects of characteristics (coefficients) than to the changes in sample population composition (endowments). Significant contributions in coefficients have occurred for rural women, women with lower educational levels, those with fewer children, and those who have not experienced the death of a child. The contribution of changes in endowments, which is small compared with the contribution resulting from changes in coefficients, is due to the increased proportion of women exposed to family planning messages in the media or at health facilities, and that of women having the same view as their husbands regarding the number of children they want or who do not know their husband's position.

By showing a predominant contribution of changes in coefficients, our findings (could) reflect the impact on contraceptive behaviour change of the family planning initiatives that the government and other stakeholders embarked on some years ago. This is supported by the fact that women in the lower socio-economic stratum of the population (less educated and rural women) show a greater increase in contraceptive use than their counterparts in the higher stratum. A family planning sensitization effect is also observable in the fact that variables related to family planning messages contribute the most to the compositional component.

Of the different factors analyzed in this research, education level, which displays the greatest contribution to the contraceptive increase, shows striking effects. In fact, contraceptive use has always been positively associated with women's education (Gordon et al. 2011; Saleem and Bobak 2005; Ainsworth et al. 1996; Shapiro and Tambashe 1994). However, our results indicate that women with lower levels of education exhibited a larger than average uptake than those with higher education levels. This result would suggest that, with a strong family planning program, the positive relationship between education and family planning use may vanish as less educated women may use contraception to the same extent as more highly educated women. Evidently, poorly educated women were at far lower levels in 2005. Similarly, contraceptive use increased more among rural women than among urban women. This surprising result of higher uptake among rural and less educated women has occurred in few areas. We may cite Iran where the increase in contraceptive use in rural areas has narrowed the rural—urban gap in the total fertility rate from 3.6 in 1977 to 0.6 in 2000 (Vahidnia 2007).

Striking also are the results from factors related to family planning messages in the media. They show a limited and reversed contribution in the coefficients component. Contrary to our expectation, women who had heard family planning messages in the media showed a smaller change in contraceptive use than average, while those who had not exhibited an above-average change. This could mean that women who were not exposed to family planning messages in the media had been reached by other means. Because of the massive campaign, communication channels may have been much diversified. For instance, the monthly meeting at the "Umudugudu" level, and social network channels between peers could have been a key source of contraceptive information for many women (Behrman et al. 2002).

Otherwise, supply side factors³ not measured in the RDHS (increased access to family planning services, for example) have been more important determinants of increased contraceptive use. This may be linked to remarkable improvements in terms of contraceptives provision, increased number of health facilities and a mass training of providers. All these efforts may have contributed to the increased contraceptive use.

That family planning messages show an apparent limited contribution indicates the limitation of these variables in capturing the full effect of family planning initiatives which “*generate a whole arsenal of institutions, programs, and infrastructure designed to have multiple effects on contraceptive use*” (Gertler and Molyneux 1994, p. 34). On the other hand, bearing in mind that factors related to family planning messages influence other factors, some of their effects may have been driven by socio-economic and demographic variables. The fact that poor women made much more progress than others supports this assumption.

The contribution of this study is to provide further evidence of the effects of political commitment on contraceptive uptake. It shows that with a large and strong family planning program, socio-cultural and economic barriers so far important among poor people and rural residents may be removed (Tabassum et al. 2014; Najafi-Sharjabad et al. 2013; Hewage 1987). Malawi, Ethiopia and Iran provide additional evidence. In Malawi and Ethiopia, the success of the family planning program was firstly associated with a government commitment that went beyond the health sector (USAID/Africa Bureau and al. 2012). Other factors like notable champions and partner collaboration, community provision of services and scale-up vision, community engagement and the establishment of effective strategies and systems came afterwards and may depend also on the government commitment. In Iran, the support of political and religious leaders for family planning has been the key factor in the contraceptive revolution (Vahidnia 2007). This study supports the recent declaration of African leaders at the 2012 London summit on family planning to renew their commitment to family planning (Osotimehin 2012) as a determinant factor of success.

Yet these outcomes do not mean that the results from Rwanda can be transported directly to other or even neighbouring countries. As stated in the introduction, the level of unmet need was very high in Rwanda in 2005 and the gap between actual and desired fertility of 1.5 children was exceptionally large in this period. Perhaps more important is that women from the lower wealth brackets and with limited education cited ideal family sizes comparable to the more wealthy and better educated. Muhoza et al. (2014) showed this to be very different from Kenya and Tanzania and refer to the low ideal family size among the poorer strata as a case of ‘poverty Malthusianism’. In analysing the socio-economic and cultural determinants of unmet need, they found no evidence of differentiation in demand for family planning, but large differentiation in access to modern means. Many women started using these means the moment they were made available in rural areas. The

³ Even though progress in access to contraceptives is not demonstrated in this analysis, reports from the Ministry of Health indicate an increase in the number of health facilities, an improvement in the quality of service through staff training and provision of health facilities (MOH 2009, 2011).

awareness campaign met with exceptionally fertile soil in which to plant the seeds for an increase in uptake of contraceptives. Sensitizing will certainly help but will only be effective if the population is ready to acknowledge the benefits of having fewer children.

Limitations of the study

This study covers a short period of only five years. It would be preferable to have a longer period to observe appreciable changes. The analysis is further limited in not being able to measure many other important factors, for example, those related to family planning service availability and quality, which also affect contraceptive use. Also, by pooling datasets, the study could not analyse some important variables that were not available in both datasets. While decomposition analysis is a promising tool with which to analyse contributions of various factors to changes in outcomes, our model is constrained by limited data to explain the difference. Further research is needed including alternative methodology to the decomposition analysis.

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