

# **Regional Variations in Contraceptive Use in Rwanda: A Multilevel Analysis of Readiness, Willingness and Ability**

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## **Abstract**

*Rwanda has shown a dramatic increase in contraceptive use between 2005 (17%) and 2010 (52%). However, the overall increase hides striking regional differences. Hence, this study aims to assess the role of regional-level factors to identify persistent barriers to contraceptive use. The research uses the Coale/Lesthaeghe framework that identifies three preconditions for the use of contraceptives: readiness, willingness and ability. These preconditions are measured at district level using the 2010-Rwanda Demographic and Health Survey and the 2007 Rwanda Service Provision Assessment. A multilevel logistic model is applied to regress the use of modern contraception on these factors.*

*The analysis shows that the overall regional variance is substantial and accounts for more than 50% of the combined effects of readiness, the need to limit or postpone births, willingness, the norms and attitudes toward contraception use. Ability in terms of access to and quality of family planning services does not add to the explanation. This should, however, be seen as a result of the improvement in access to services provision across the country. The study concludes that the regional differences in contraceptive use are due to the differences in readiness and willingness for family planning. The repositioning of family planning program has raised contraceptive uptake at national level but failed to address the regional variations. Both regional economic development and targeted family planning campaigns are vital to increase use of contraceptives in regions that are still lagging behind.*

## **Keywords**

*Regional development; variation; contraceptive; multilevel; Rwanda*

## **Introduction**

The use of contraceptives in Rwanda has increased exponentially in the last decade. In 2000, the contraceptive prevalence rate (CPR) was 10% and it increased to 17% in 2005 and 52% in 2010, making Rwanda one of the most successful countries in Africa for progress in reproductive health (Abbott, Sapsford & Rwigirahira, 2015). However, this national success hides conspicuous regional differences. The CPR is 29% in the District of Rubavu and 76% in Muhanga. Regional variations are not limited to contraceptive uptake as other demographic indicators show similar patterns. The Total Fertility Rate (TFR) ranges/varies between 2.9 births in Nyarugenge and 5.4 births in Nyaruguru (National Institute of Statistics of Rwanda [NISR], Ministry of Health [MoH] & ICF International, 2012). Understanding the causes of these regional differences could help improve effectiveness of Rwanda's reproductive and family planning program.

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Literature review shows that the differences in contraceptive use are due to various factors. According to studies, contraceptive behaviors are due to differences in socio-economic status of the population (Kimani, 2007; Cammack & Heaton, 2001). The process of development which results in rising cost of living encourages couples to have fewer children and to use contraceptives to reduce their family size (Bongaarts, 1997). Bongaarts and Watkins (1996) argue that development facilitates channels of communication and use of social networking sites to promote the adherence and uptake of contraception. The cultural explanation points to different societal tradition and culture on the use of contraceptives. The third explanation is related to differences in the implementation of family planning programs. Some regions may run more strongly and more efficiently a program than others resulting in difference in access, costs and acceptability of contraceptive services and therefore, a difference in contraceptive uptake. Such programs not only help to satisfy unmet needs (Bongaarts & Watkins, 1996), but also lead to the increase of demand for contraception (Mahmood & Ringheim, 1997).

The three explanations can be linked to Coale's preconditions for using contraception: readiness, willingness and ability (Coale, 1973; Lesthaeghe & Vanderhoeft, 2001). Readiness measures effects of socioeconomic development; willingness indicates the influence of socio-cultural factors and their weight while ability is linked to family planning program's capacities and accessibility. The three preconditions are sequentially hierarchical. Readiness is the first condition that should be present to be able to evaluate the other two others while ability can only 'work' if there is willingness.

The aim of this research is to examine these preconditions in explaining the regional variations in modern contraceptive use in Rwanda using a multilevel model that captures both individual-level and regional-level effects. Research has shown that the variation in contraceptive use is due to both individual and regional factors (Elfstrom & Stephenson, 2012; Stephenson, Baschieri, Clements, Hennink & Madise, 2007). The specific objectives of this paper are:

- 1) To examine how individual and regional factors result in differences in the use of modern contraceptives in Rwanda.
- 2) To evaluate regional variance attributable to each regional factor, namely readiness, willingness and ability.
- 3) To identify the barriers which cause some regions to lag behind others in contraceptive use.

Hence, identifying regional-level predictors of contraceptive use will help explain why family planning programs are less successful in some areas and might indicate ways to improve their performance.

## Repositioning of Family Planning in Rwanda

Since 2007, curbing the high population growth has been recognized as a condition for poverty reduction, improving the quality of life and implementation of the Millennium Development Goals. As consequence, family planning has been declared a government priority program with expectation that family planning would "streamline population growth with the country's economic development and suppress the main causes of mortality" (MoH, 2006, p.41).

The 2006 family planning policy was based on the 2005 Demographic and Health Survey (DHS) results which indicated an increase in fertility and a high unmet need for family

planning (37%, the highest in Africa). Targets included a CPR of 26% and a TFR of 5.5 for 2010 (MoH, 2006 p.15). The 2010 targets have been surpassed with a TFR of 4.6 and a CPR of 52%.

Strategies to achieve those targets include carrying out advocacy with all potential actors to promote awareness of family planning, mobilization of communities, and mainstreaming family planning program in all health services providing access to the full range of contraceptives (MoH, 2006).

Advocacy was launched by the President of Republic in February 2007 when he suggested three children as an ideal figure for a Rwandan family (Ndaruhuye, Broekhuis & Hooimeijer, 2009). The Parliamentarian's Network for Population and Socioeconomic Development took leadership in the advocacy by taking family planning down to district and sector level. District and sector leaders were made responsible in their respective administrative units, to put into action the "number one program". Family planning was included in their performance contracts. The objective of the public campaign was to raise and reinforce the readiness and willingness of the population by addressing social and cultural barriers. These sensitization campaigns produced result as the reported average family size declined from 4.3 children in 2005 to 3.3 in 2010 (NISR & ORC Macro, 2006; NISR, MoH & ICF International, 2012).

Community mobilization was reinforced through three activities: increasing knowledge to change attitudes about modern contraception, particularly among youths; involving men in reproductive health activities; and conducting dialogue with religious leaders.

Mainstreaming family planning was done by strengthening the capacity of health facilities through a training of family planning service providers and the provision of a full range of contraceptive methods, especially those with long term effects, such as injections, implants, intrauterine devices (IUDs). Besides efforts to improve the quality of services, special attention was given to areas covered by faith-based health facilities that do not offer modern methods. To overcome this problem, secondary facilities have been constructed near faith-based health facilities. The improvement of service provision was expected to increase the ability of the population measured by access, affordability, and credibility. The next step was to implement community-based family planning services and distribution of contraceptives to relieve pressure on district health facilities.

All those initiatives benefited from a strong coordination of efforts headed by a national committee called *Family planning Technical Working Group* (FPTWG), a partnership with donors that contributed to financial resources, a decentralization reforms that brought service delivery closer to the population and from the introduction of a community-based health insurance scheme that facilitated access to health facilities (MoH, 2006; Abbott, Sapsford & Binagwaho, 2007).

## Framework and Hypothesis

This study applies Coale (1973) and Lesthaeghe and Vanderhoeft (2001) framework of readiness, willingness and ability to the regions of Rwanda.

*Readiness* refers to a subjective need to postpone births or cease childbearing altogether (Cleland, Ndugwa & Zulu, 2012). The assumption is that couples balance benefits against costs ascribed to the *nth* child to determine whether they want this child. The use of contraception must be advantageous to couples. This is generally linked to higher levels of economic development and urbanization. However, previous studies have shown that in

Rwanda, family size is not very markedly different between urban residents and rural dwellers or between the rich and poor. Poverty Malthusianism has been put forward as an explanation (Ndaruhuye, Broekhuis & Hooimeijer, 2009). Given the lack of land, having an extra child would dilute rather than strengthen household's resources, and rural regions provide few other employment opportunities apart from farming. Hence, this study expects the same desire for family planning in poor and rural regions as in urban and more developed regions.

*Willingness* is an attitude in favor of contraception or certain contraceptive methods grounded in traditional beliefs, culture, ethical considerations, codes of conduct, religious prescriptions, and legitimacy. Research in Africa (Bawah, Akweongo, Simmons & Phillips, 1999; Castle, Konate, Ulin & Martin, 1999; Hulton, Cullen & Khalokho, 2000) has documented resistance to the use of modern contraception, despite the awareness of the need to limit the number of children. In Rwanda, legitimacy will not be a problem as the legislation is the same throughout the country. However, religious opposition may occur, particular among some Protestant communities (Ndaruhuye, Broekhuis & Hooimeijer, 2009; Westoff, 2012).

*Ability* refers to the knowledge of contraceptive methods, the supply of services, and access to these services (Cleland, 2012). Knowledge about contraceptives is almost universal in Rwanda (NISR & ORC Macro, 2006; NISR, MoH & ICF International, 2012) and therefore less likely to be a constraint. Access in terms of distance to the nearest health facility also seems to be a minor problem, given the high density of the population (450 people per square kilometer). Contraceptive means are almost free of charge, except in private clinics and few NGOs, but their share in supply is very limited. About 94% of contraceptive users receive their supply in public facilities (NISR, MoH & ICF International, 2012). The last component of ability is availability and quality of reproductive health services. These are still differences across regions, despite the improvement since 2007 in terms of security of contraceptives and staff training. Hence, the study hypothesizes a positive relation between the availability and quality of reproductive health services and contraceptive prevalence.

Readiness, willingness and ability are preconditions at the regional level for the use of contraception at the individual level. In Rwanda, the regional poverty level is expected to raise the demand for family planning due to lack of employment opportunities. Religious communities may stand in the way of acceptance by members of their congregation. Building the health infrastructure is still at its infancy, but it is more advanced in some regions than in others.

## **Data and Methods**

### **Data source and variables**

This research uses data from the 2010 Rwanda Demographic and Health Survey (2010 RDHS) and the 2007 Rwandan Service Provision Assessment (RSPA) (NISR, MoH, & Macro International Inc., 2008). The study population is restricted to women in a marital union, fecund and not pregnant at the moment of survey, i.e. women exposed to risk of becoming pregnant. The Demographic Health Survey individual file provides information on contraceptive use and individual characteristics while the inventory file of RSPA offers information on service provision in terms of availability of contraceptive methods and service quality.

The dependent variable is the use of modern contraceptive methods. These include sterilization, IUDs, implants, injections, pills, lactational amenorrhea method. Condom use is excluded because women may obtain their condoms from shops or other sources that are not included in SPA surveys. Independent variables are individual characteristics and regional-level factors. Individual level variables are limited to demographic and socio-economic characteristics: woman's age, number of living children, woman's education and wealth index of the household.

Regional-level variables are presented according to the three preconditions as mentioned in the framework section and are chosen taking into account the available dataset and the research objective. Readiness is measured by the regional total demand for family planning and the regional percentage of women desiring a large family (four children or more). These indicators evaluate the needs of family planning in the region by assessing the mindset change in regard to family size and the level of needs for contraception, and as such the level of readiness. Willingness is measured by the percentage of women approving family planning and the percentage of the protestant community in the region. These two indicators measure the degree of acceptability of family planning by the population and religious opposition to contraception. In Rwanda, studies have shown that the protestant community which includes Pentecostals is the most religious group which disapproves use of contraception because of their religious beliefs (Ndaruhye, Broekhuis & Hooimeijer, 2009; Westoff, 2012).

Ability is also assessed by two indices based on the 2007 RSPA inventory file. The first is the regional average number of modern contraceptive methods provided by the health facility and available on the day of survey. A contraceptive method is considered to be provided and available in a facility if the latter reports providing this method and also has the product in stock. The second is the regional average score based on the responses to eight items on reproductive health services. The score is only computed for health facilities that provide family planning services. A facility is given one point for reporting yes to each item and zero if not. The sum of those scores give the total score of a facility ranging from zero to eight and the average of the total score of all health facilities in the region provides a regional family planning service score. The eight items are selected on their relevance to promote family planning and providing reliable and good-quality family planning services:

Family planning counselling

1. Auditory and visual privacy in the family planning counselling areas
2. Family planning visual aids
3. Individual cards or records for clients
4. Written family planning guidelines

Pelvic examination

1. Auditory and visual privacy in the examination room
2. Spotlight for pelvic exam
3. Exam table/bed
4. Vaginal speculum

## Multilevel models

### *Fundamentals of Multilevel Modelling*

Multilevel models, also known as hierarchical linear models, mixed models or random-effects models are statistical models of parameters that vary at more than one level. These

models can be seen as generalizations of linear models although they can also extend to non-linear models. They have become popular in many fields of social research and agricultural sciences after sufficient computing power and software became available (Raudenbush & Bryk, 2002).

Multilevel models are particularly appropriate for analyzing hierarchically structured data with one single outcome or response variable that is measured at the lowest level, and explanatory variables at all existing levels (Tabachnick & Fidell, 2007). The units of analysis are usually individuals, posited at a lower level and which are nested within aggregate units at higher level. The dependent variable must be examined at the lowest level of analysis (Luke, 2004).

Although multilevel models have the same assumptions of *Linearity, Normality, Homoscedasticity, and Independence of observations* as other major general linear models (GLM), they also perform observations for which these assumptions are not respected, especially the independence of observations and homogeneity of variance. Indeed, for hierarchical data (clustered observations), error terms are correlated because individuals are nested within contexts or regions (Garson, 2013).

Ignoring clustering of observations in the choice of analytical method (analysis) leads to biased estimation of parameters, standard errors, and mistakes in the interpretation of the importance of one or another explanatory variable (Garson, 2013). For instance, if observations within clusters are positively correlated, this will underestimate standard errors and as result, variables will appear significant when in fact they are not!

Therefore, when data are nested or cross-classified by groups, which means that individual-level observations from the same upper-level group are not independent but rather are similar, conventional models such Ordinary Linear regression or General Linear Models which assume independence of error terms and equal error variances cannot accurately perform these data. Thus, multilevel models are required.

### *Application of the Model to the Study*

This study uses multilevel regression model for three reasons. First, as discussed in the previous section, multilevel models deal with hierarchical data structures (Garson, 2013). As individuals are nested within regions, they share not only customs, but also various services including family planning services which are organized at district level. Second, the dependent variable, namely use of modern contraception, is measured at the individual level while key independent variables are measured at the regional level. Multilevel modelling is therefore an appropriate approach to handle these hierarchical data since it takes into consideration both individual and regional effects on individual behavior. Third, the multilevel modelling provides information on the proportion of total variation explained by regional-level factors. The modelling allows for random intercepts across regions and assumes fixed effects of individual variables across regions.

In this study, districts are the highest regional administrative units. Rwanda has 30 districts, which might be too small for predictive accuracy, but large enough for explanatory analyses (Hox, 2010).

The model is expressed in two equations: one at individual level and another at the regional level.

Individual level:

$$\text{logit}(C_{ij}) = a_j + \beta X_{ij} + e_{ij}$$

Regional level:

$$a_j = \gamma_0 + \gamma Z_j + u_j$$

$$u_j \sim (0, \sigma_{u0})$$

Where:  $\logit(C_{ij})$ , the dependent variable, is the logarithm of the odds  $C_{ij}$  for the  $i$ th individual in the  $j$ th region to use a modern contraceptive method.  $X_{ij}$  represents individual level variables and  $Z_j$  represents regional level factors.  $a_j$  is a random intercept, which varies across regions, and  $\beta$  a vector of fixed coefficients for individual-level factors. The error term  $u_j$  is the regional variance and is assumed to have a normal distribution with mean zero and variance  $\sigma_{u0}$ . It reflects regional differences that are not explained by the variables in the model.

In order to assess the changes in outcome from the different subsets of regional variables, especially the contribution of each factor or category of regional factors in the variation in contraceptive use, six models are examined sequentially (Table 3). The models show the percentage of regional variation attributable to each category of regional factors. For further reading about estimation procedures see Hox (2010), chapter three.

## Results

### Descriptive results of individual-level variables

Table 1 shows the percentage of women aged between 15 and 49 using modern methods of contraception, based on their background characteristics. In general, women aged between 25 and 34 years have a higher prevalence rate for modern contraception than younger or older ones. Women who have three to four children are more likely to use a modern method of contraception than those with fewer children. Women with no children are the least likely to report use of any modern methods. Education appears to have the most significant and consistent relationship with the use of modern methods.

**Table 1:** Percentage of women in union using modern contraceptive methods based on selected background characteristics

Variable	%	n	Variable	%	n
<i>Woman's education</i>			<i>Number of living children</i>		
no education	37.5	1,318	1-2	48.9	2,454
primary	46.8	4,736	3-4	52.6	2,120
secondary	51.0	651	5+	43.6	1,834
higher	56.6	129	0	1.2	426
<i>Wealth index</i>			<i>Woman's age</i>		
poorest	39.2	1,323	15-24	41.6	1,057
poorer	41.8	1,353	25-34	50.4	3,214
middle	47.5	1,352	35+	41.2	2,563
richer	49.3	1,375			
richest	49.9	1,431	Total	45.61	6,834

Source: NISR, MoH & ICF International, 2012).

The percentage of contraceptive use increases progressively with education, from 37.5% among non-educated women to 56.6% among those with higher education. Similarly, the use of modern methods increases with wealth quintiles, but the differences are smaller than for education. The gap between the richest and the poorest quintiles is only 11 percentage points. There is almost no difference between the two highest wealth quintiles.

Table 2 shows the variations based on different regional-level variables and the correlation coefficient of each variable and the contraceptive prevalence. Overall, the demand for family planning (column 2) is relatively high in Rwanda accounting for three women in four (72.4%) who want to cease childbearing or to delay their next birth for more than two years. Across regions, the demand ranges between 62.3% and 85.9%. It is particularly high in the Southern and Northern provinces where in some regions the demand exceeds 80%. Surprisingly, all regions of Kigali City have a demand below the national average. It is the lowest in the Western province. The percentage of women desiring four children or more (column 3) varies widely between 25.8% and 65.9%, with a national average of 48.0%. Larger proportions of those women are found in the provinces of West (54.0%) and East (51.3%) that account for relatively lower demand for family planning. The percentage of Protestants among the population (column 4) ranges from 18.5% in Nyanza to 56.3% in Nyamasheke. Although family planning (column 5) has become a norm among many Rwandese, important variations subsist. With a national average of 85% of women approving family planning, the minimum and the maximum are 68.5% and 97.6% respectively.

**Table 2:** Descriptive statistics of selected regional variables

Province/ Region	CPR	Readiness		Willingness		Ability	
		% Total demand	% women <sup>3</sup> desire 4+	% of protestants	% appr FP	# contr methods	Quality of FP service
<b>Rwanda</b>	<b>45.1</b>						
Kigali	48.3	71.4	41.2	46.8	85.0	2.8	4.9
Nyarugenge	52.3	71.6	47.2	46.8	91.7	3.1	4.6
Kicukiro	47.3	71.5	46.0	46.5	85.2	2.3	5.3
Gasabo	45.2	71.0	30.5	47.3	78.2	3.0	5.1
South	48.5	74.0	45.5	32.7	90.1	3.4	5.2
Muhanga	62.0	85.9	30.1	19.9	87.8	3.3	5.9
Kamonyi	59.5	81.4	25.8	46.2	92.3	3.3	5.6
Ruhango	52.3	75.7	37.9	20.4	86.1	2.9	5.1
Nyanza	48.1	74.4	48.2	18.5	94.5	3.3	4.7
Gisagara	43.7	70.3	55.2	24.5	95.1	4.0	4.2
Nyaruguru	42.0	68.7	65.7	48.5	88.0	3.3	5.4
Huye	41.1	64.8	62.1	30.1	94.5	4.3	6.2
Nyamagabe	39.4	71.4	37.6	49.1	86.6	2.9	4.1
West	35.5	69.7	54.0	46.3	78.5	3.1	5.1
Ngororero	44.6	73.9	50.8	41.6	68.5	3.2	5.4
Rutsiro	41.4	73.2	39.8	47.7	76.4	3.2	4.1
Nyabihu	41.3	77.4	59.2	44.7	78.7	3.1	4.9
Karongi	40.4	66.4	39.3	46.3	87.6	2.4	4.9
Rubavu	29.2	62.3	64.1	45.5	64.3	3.4	6.0
Nyamasheke	27.9	68.5	61.0	56.3	82.9	3.6	5.2
Rusizi	23.4	65.0	65.9	42.4	83.3	3.3	5.2
North	51.7	73.8	43.3	34.0	92.1	2.9	5.4
Gicumbi	57.5	81.9	39.7	41.8	95.1	2.8	5.4
Gakenke	55.9	78.6	38.1	29.3	91.9	3.5	5.5
Musanze	50.6	70.1	38.2	32.5	91.1	3.5	6.1
Rulindo	49.4	72.2	34.9	23.1	93.2	2.0	5.3
Burera	45.1	66.1	65.6	42.5	88.0	3.2	5.0
East	46.1	73.7	51.3	42.5	87.2	2.6	4.9
Rwamagana	50.1	75.5	35.9	46.7	90.4	2.4	4.4
Gatsibo	49.7	72.1	44.7	43.0	91.2	2.1	4.3
Kayonza	48.1	75.0	50.0	49.1	97.6	2.8	5.0

<sup>3</sup> Women with non-numerical responses are excluded. They account only for 1% of the total sample.

Ngoma	45.8	70.6	60.7	33.7	90.7	2.8	5.5
Nyagatare	43.2	72.7	63.3	43.3	76.7	2.4	3.8
Bugesera	43.1	70.2	44.0	42.2	86.4	2.8	5.3
Kirehe	42.8	80.0	57.9	39.2	91.4	2.8	5.2
Correlation with contraceptive use	0.114	-0.115	-0.081	0.101	-0.039	0.008	
P.Value	0.000	0.000	0.000	0.000	0.004	0.561	

Source: Computation from NISR, MoH & ICF International, 2012

Table 2 shows the index of contraceptive methods availability and that of service quality (columns 6 and 7). The regional average number of contraceptive methods available varies between 2 in Rulindo and 4.3 in Huye out of a maximum of 8 methods when the family planning service quality index ranges between 3.8 in Nyagatare and 6.2 in Huye out of eight items.

Apart from the family planning service quality score, all regional-level variables are significantly correlated with the use of modern methods and have expected signs. The total demand for family planning is positively associated with the prevalence contraceptive while the percentage of women desiring many children displays a negative correlation. The use of contraceptives decreases with the proportion of Protestants in the population but increases with the proportion of women approving family planning. Unexpectedly, the CPR tends to decrease with the number of available contraceptive methods and does not show a correlation with the quality of family planning service.

### Multilevel Regression results

In this study, the most interesting aspect is regional variation. With only a constant term included (model 1), the regional error variance is 0.356. This value has no direct substantive meaning because the error variance is arbitrarily set to 1.00 in the multilevel model. Attention is drawn to how this variance changes by inclusion of explanatory variables in the model. The model including individual variables reduces the error variance slightly to 0.350, indicating that the regional variance is independent of individual factors.

Looking at the individual factors (model 2), the results are consistent with prior research. As expected, contraceptive use is more prevalent among women who are more educated, or who live in richer households. Women with higher educational level are two times ( $\beta=0.711$ ) more likely to use modern contraception than their uneducated peers. There is a significance difference between poor and richer women: the first two groups display similar pattern as do the three higher quintiles. Younger women are more inclined to use modern contraception than older. The number of living children exhibits a curved pattern with modern contraceptive use. Contraceptive use is higher among women with three to four children than those with fewer or more children.

The results are presented sequentially from the first precondition to the last based on hierarchical order. The readiness indicators (model 3) exhibit significant coefficients after controlling for individual variables. The coefficient is negative for the percentage of women desiring a large family (4 or more) indicating that the presence of a high proportion of women wanting a large family reduces the likelihood to use modern contraceptive methods. In contrast, the presence of a high proportion of women in the region desiring contraception either to limit their family size or to postpone their next birth increases the log odds of adopting contraception. Readiness appears to be a substantially differential factor. Controlling for readiness, the remaining regional variance drops to 0.225. Readiness captures about 36% of the total regional variance. The effects of individual factors remain stable.

The willingness factors are also significant. The coefficient is negative for the percentage of Protestants and positive for the percentage of women approving family planning. The parameters of individual factors are not affected by the inclusion of the regional willingness variables. The regional variance declines by 31% to 0.261. This means that the regional differentiation is partly due to differences in willingness. The inclusion of variables related to ability hardly changes the regional variance, which declines only from 0.356 to 0.344, indicating that indicators of family planning supply do not play a differentiating role in contraceptive use. The effects of individual factors remain unchanged.

By combining both readiness and willingness in the same model, (ability indicators excluded because they are not significant), the results of individual variables and regional factors remain unchanged compared with the previous models. However, the combination of readiness and willingness in the same model diminishes the regional variance by more than half (58%) from 0.356 to 0.151. This means that the lower contraceptive use level in some regions is due to lower readiness and lower willingness.

**Table 3:** Multilevel random coefficients of selected variables on use of modern methods

Variables	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5	Mod 6
Constante	0.289***	-0.027	-1.678*	-1.230	-0.167	-1.920**
<u>Regional-level factors</u>						
<i>Readiness</i>						
Desire 4 child + (%)			-0.012**			-0.010***
Demand FP (%)			0.031***			0.022**
<i>Willingness</i>						
% women app FP				0.021***		0.014***
% of Protestant				-0.014**		-0.011**
<i>Ability</i>						
Aver. Cont. Meth					-0.110	
FP Enviro index					0.093	
<u>Individual-level characteristics</u>						
Woman's education (ref. No educ)						
Primary	0.185**	0.181**	0.173**	0.186**	0.165**	
Secondary	0.251**	0.248**	0.244*	0.252**	0.237*	
Higher	0.711***	0.687***	0.717***	0.710***	0.685***	
Wealth index (ref. Poorest)						
Poor	0.168*	0.156*	0.175*	0.165*	0.163*	
Middle	0.487***	0.473***	0.495***	0.483***	0.481***	
Richer	0.585***	0.571***	0.592***	0.581***	0.577***	
Richest	0.543***	0.528***	0.566***	0.538***	0.552***	
Woman's age (ref. 15-24)						
25-34	-0.098	-0.104	-0.106	-0.097	-0.116	
35 +	-0.391***	-0.400***	-0.401***	-0.391***	-0.416***	
N# children (ref. 1-2)						
3-5	0.144*	0.150**	0.142*	0.144*	0.151**	
6+	-0.097	-0.087	-0.094	-0.096	-0.081	
No child	-3.918***	-3.911***	-3.919***	-3.917***	-3.911***	
/lnsig2u	-2.064	-2.102	-2.983	-2.814	-2.135	-3.780
Sigma_u	0.356	0.350	0.225	0.245	0.344	0.151
Rho	0.037	0.036	0.015	0.018	0.035	0.007

\*  $p < 0.10$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

## Discussion

Family planning program in Rwanda has undoubtedly been a success. Previous research has shown that unmet needs have significantly decreased between 2005 and 2010, in particular among the rural population and lower educated segment of society with high levels of unmet needs (Muhoza, Rutayisire & Umubyeyi, 2016). In this paper we looked at both individual and regional determinants of contraceptive use in 2010 and tried to identify the barriers that cause some regions to lag behind others in contraceptive use.

Results show that, despite the improvement since 2005, poverty and low education are still important determinants of not using modern contraceptives in 2010. At the regional level, the variations in contraceptive use are mostly attributed to the differences in readiness, differences in the demand for children, and willingness, attitude towards and approval of modern contraception. A further reduction of cultural barriers is called for and the new policy on community-based health care may bring services closer to the disenfranchised part of the population to discourage their persistent pronatalist attitude and increase approval and acceptance of contraception. The importance of regional (community) factors in determining contraceptive use is not the sole case of Rwanda. In Zambia, Ngome and Odimengwu (2014) found that "*both individual and community characteristics were important predictors of adolescent contraceptive use*".

The collaboration between the government of Rwanda and NGOs in mainstreaming reproductive health may have reduced the differences in the supply of a range of contraceptive products and have raised the quality of services post 2007. The fact that the regional differences in supply does not have any role in explaining the regional variation in contraceptive uptake may be due to this improvement. This should however not be understood as the lack of effects of ability-factors on contraceptive increase but as the result of the improvement in access to services provision across the country. Further improving access to these services might help the uneducated poor population to satisfy their unmet need but will not raise the uptake in districts where family planning is less supported.

It has to be emphasized that the policy is much wider than just putting into place reproductive health services. In their sensitizing campaigns both the president and the parliamentary committee have not only advocated the use of modern contraceptives but also tried to establish a new norm of having three children as the ideal family size. Looking at the national average ideal family size of 3.3, it can be concluded that the effort has been successful. Yet, the study found that in 8 of the 30 districts more than 60% of the women still wanted four or more children. In all these eight regions the demand for family planning is below the national average.

Even if there is a national consensus on three children as the ideal family size, approval of the use of modern contraceptives might remain an issue in several districts, especially those with large protestant communities. The larger majority of women in Rwanda approve of the use of modern contraceptives, yet resistance is still strong in some protestant communities, which over the last decades have established many faith-based health institutions. Opening up secondary facilities that provide reproductive services is not enough to counterbalance these effects.

These findings corroborate those found by Brunie, Tolley, Ngabo, Wesson and Chen (2013) in their study on barriers to modern contraceptive use for women in Rwanda that fertility and partner related factors (readiness) and misperceptions about fertility are among the persistent barriers to further contraceptive uptake leading to reach the government target of 70% of contraceptive prevalence (MoH, 2006). In addition, the study backs the conclusions of Emina, Chirwa and Ngianga-Bakwin (2014) that the progress achieved in contraceptive use

in Africa is essentially due to change in behavior (attitude more pro-fertility control) than change in population structure and that, in order to achieve universal access to family planning, further efforts were needed in sensitization and increased access to family planning services using various strategies, including socioeconomic development, household-based sensitization, mobile family planning clinics, and community-based distributors of modern contraceptive methods.

## Conclusion

The study did not aim to test the effectiveness of specific family planning interventions using controlled experiments. In fact, it would have been very difficult to come up with an experiment that would measure the effectiveness of the sensitizing campaigns and of community mobilization, as the campaigns affected all communities in Rwanda. The study, however, attempted to identify relevant regional aspects that may account for the differences in the contraceptive prevalence in the country. The results from the application of multilevel model on the Coale/Lesthaeghe framework of readiness, willingness and ability has confirmed that improving access is not helpful as long as communities are not ready to reduce their family size or are unwilling to use modern contraception to do so even if there is a need.

Findings suggest that increasing contraceptive use in those regions may increase contraceptive use nationally. If the problems of readiness and willingness are addressed, fertility could drop further. Pritchett (1994) has shown that a CPR of 52% projects a TFR of 3.9 births. If the regions lagging behind could increase their CPR to the national level, the national TFR would decline to below 3.8 births as the CPR would be higher than 52%.

This study however has some limitations. First, the disaggregation of a national sample at regional level may show less robust results due to the small size of samples. The regional sample size ranged between 192 and 285 individuals. Second, indicators measuring the three conditions (readiness, willingness and ability) may fall short in capturing the complexity of the phenomena. Each condition is more complex than what has been presented in just two dimensions. However, they are consistent with the findings of other studies that highlight socio-cultural norms and values as barriers to contraceptive use in sub-Saharan Africa (Haider & Sharma, 2012-2013, Williamson, Parkes, Wight, Petticrew, & Hart, 2009).

Despite these shortcomings, findings are helpful in deciding on the future course of the family planning policy in Rwanda. Advocacy in regions that lag behind may be more effective than extending the range and quality of services.

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