Determinants of Burundi fertility differentials: Evidence from the 2016-17 Burundi Demographic and Health Survey.

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Abstract

Background

Although fertility control remains a major priority for the Burundian government and most of its partners, few studies on Burundi's fertility determinants are available to guide interventions. Our study aims to examine factors influencing Burundi's fertility differentials using the latest Burundi Demographic and Health Survey data.

Results

In our weighted sample size of 17,269 women aged 15–49, the total number of children ever born ranged from 0 to 15 children by women with a mean of 2.7 children (Standard deviation = 2.8). Factors such as residence in rural or in Central-Eastern, western and Southern regions, illiteracy/low level of education of both husband and women, women and husband agricultural professions, household poverty, male headed households, previous experience of infant mortality, early marriage and early childbearing, lack of knowledge of any contraceptive methods, non-use of modern contraceptive methods and desire of a large number of children were identified as factors associated with a high fertility rate in Burundi.

Conclusion

The results of this study suggest that actions aimed at promoting education, especially female education, and improving child survival, women's socioeconomic status, agriculture mechanization and increasing number and scope of family planning services could help reduce Burundi's fertility rate.

Background

Several studies indicate that Sub-Saharan Africa (SSA) countries are in demographic transition [1, 2]. Some countries in this region are slow to engage in this transition and their fertility rate remains high [3, 4]. Burundi, one of the smallest countries in east Africa, is one of those countries where the fertility rate is still high. According to World Population Prospects by the United Nations [5], Burundi's total fertility rate (TFR) is estimated at 5.45 children by women between 2015 and 2020. This TFR is just over 1.5 times higher than that of Kenya (3.52), 1.3 times higher than that of Rwanda (4.10), 1.1 times higher than that of Tanzania (4.92) and a little higher than that of Uganda (5.01). Burundi remains also one of the most densely populated countries in east Africa. The population density in Burundi is estimated at 463 persons per square km in 2020 [5]. This density is about 7 times higher than that of Tanzania (67.4), about 5 times higher than that of Kenya (94.5) and 2 times higher than that of Uganda (228.9).

Numerous consequences linked to this high fertility are observed throughout the country. These include land conflicts, which are sometimes bloody and deadly. The latter currently account for 80% of

complaints at the judicial level [6]. Burundi also ranks among the poorest countries in SSA. According to the results of the Household Living Conditions Survey in Burundi [7], 64.9 % of Burundians live below the national poverty line of 1,744 Burundian francs per day (or 1.27 US dollars) and 38.7% live in extreme poverty. Various organizations express their concern about this poverty [8, 9]. Moreover, Burundi is expected to become the world poorest country in 2030 and the seventh largest contributor to poverty in the world [10]. Several studies claim that high fertility negatively affects mother and child well-being [11–13]. According to the final report of the latest Burundi Demographic and Health Survey (2016-17BDHS), the maternal mortality ratio (MMR) is estimated at 334 maternal deaths per 100,000 live births and the infant mortality rate (IMR) is estimated at 47 deaths per 1,000 live births [14]. These MMR and IMR remain among the highest in SSA [15].

It is important for the government to seek to reduce the fertility rate due to limited resources of such a poor and densely populated country. With an average annual rate of population change of 3.15%, Burundi's population density will increase from 463 to 614 persons per square km by 2030 [5]. This increase represents about 33% of people per square kilometer in 10 years. Controlling this high fertility remains a major challenge for the Burundian government and most of its partners [6, 8, 9]. To try reducing this high fertility, some measures to promote family planning (FP) services were carried out by the latter. These include the introduction of acting reversible contraceptive methods, the creation of secondary health posts in inaccessible areas and increasing the awareness of men's involvement in FP [6]. Beside the influence of FP services, several studies indicate that women's fertility are influenced by various socio-economic [2, 16], demographic, cultural and biological factors [17, 18]. Sociopolitical conflicts [19, 20] and local environmental factors [21] can also influence women's fertility. Moreover the influence of these factors on fertility may vary from one country to another [16, 22].

In Fig. 1, we used TFRs available in three Burundi Demographic Health and Survey (BDHS) reports [14, 23, 24] to determine fertility trends in Burundi. The findings indicate that over a period of more than 30 years, the fertility is trending downward, albeit slowly. At the national level, the TFR decreased from 6.9 in 1987 to 6.4 in 2010, a decrease of only 0.5 children per woman over 23 years. However, starting in 2010, the pace of this decline accelerated slightly. The TFR decreased from 6.4 in 2010 to 5.5 in 2016/2017, a decrease of 0.9 children per woman over approximately seven years. According to a report by the Burundi Ministry of Health [6], this decline in fertility is primarily the result of family planning (FP) services promotion. Beside FP services, other factors may also have influenced this fertility transition process still underway in Burundi.

Although fertility control remains a major priority for the Burundian government and most of its partners [6, 8, 9], few studies on fertility are available in Burundi to guide their interventions. With funding mainly from the United States Agency for International Development (USAID),but also from other organizations working in Burundi, the Demographic and Health Surveys program (DHS program) is responsible for the collection, analysis and dissemination of accurate and nationally representative data on population, health, Human Immunodeficiency Viruses (HIV) and nutrition, currently in more than 90 developing countries [25]. The BDHS are part of this program. From 1987 to 2017, only three BDHSs were conducted

in 1987 [23], 2010 [24] and 2016/2017 [14] respectively. The results of these three BDHSs remain purely descriptive and do not reveal the complex reality of factors influencing fertility in Burundi. To our knowledge, very few analytical studies on fertility are available in Burundi. To address this gap, our study aims to examine factors influencing fertility differentials in Burundi by using the latest BDHS data.

(Insert Fig. 1here): Trends of fertility in Burundi (Data Sources): The 1987, 2010 and 2016-17 Burundi Demographic and Health survey reports.

Methods

Data sources

We used data from the 2016-17 BDHS [14] which is the latest Demographic and Health Survey conducted in Burundi. The 2016-17 BDHS data are freely available and the public can access it upon a formal application. We submitted an abstract to DHS program seeking permission to use these data and the required access was subsequently permitted [26]. Four types of questionnaires were used to collect 2016-17 BDHS data: the household questionnaire, the individual women's questionnaire, the individual man's questionnaire, and the biomarker questionnaire. In this study, only the individual women's questionnaire was used. Women aged 15–49 years were asked about their birth histories and this provided information on the total number of children ever born (CEB). The 2016-17 BDHS is a nationally representative survey with a sample based on a two-stage cluster sampling procedure. In the first stage, 554 clusters were drawn by systematic sampling with probability proportional to the cluster size. In the second stage, a sample of 30 households per cluster was drawn using equal probability sampling in both urban and rural areas. A total of 16,620 households, including 3,180 in urban areas and 13,440 in rural areas were selected. Any woman aged 15–49 years present in these selected households was eligible to be surveyed. A total of 17,475 women were eligible of whom 17, 269 agreed to be interviewed representing a response rate of around 99 %. Our study involved a weighted sample size of 17,269 women aged 15 to 49 years. A detailed description of this survey is presented in the 2016-17 BDHS final report [14].

Variables

Dependent variable

Our dependent variable is the total number of CEB to a female respondent in the 2016-17 BDHS. The total number of CEB is a measure of the reported number of children born to a woman up to the moment at which the data were collected [27]. Two approaches such as the current and cumulative approaches are used to measure fertility. The current fertility approach is based on the number of living children in a given population in a calendar year [28]. The TFR and general fertility rate (GFR) can be used to measure the current fertility [29]. The TFR is an age-period fertility rate for a synthetic cohort of women. It measures the average number of births a group of women would have by the time they reach age 50 if they were to give birth at the current age-specific fertility rates. The TFR is expressed as the average number of births per woman [29]. While the GFR refers to the average number of children currently being

born to women of reproductive age in the period, typically 1–36 months preceding the survey, expressed per 1,000 women age 15–49 [29]. It then measures the general reproductive performance of the women per year. It does not take into account the fact that within the range of the childbearing years for females of 15 to 49, there are differences in the extent to which the women produce children [27]. Moreover, both the GFR and TFR rely on current fertility behavior (generally last 3 or 5 years), unlike the CEB. On the other hand, the cumulative fertility approach considers past fertility history of CEB to each cohort of women by age. In this study we used CEB as our dependent variable because the CEB for women belonging to the cohort of 15 to 49 years (lifetime fertility) reflects both current and past fertility behavior [28]. In addition, because this study applied a Poisson regression model that deals with count outcomes such as the number of children, we found CEB to be a more suitable outcome.

Independent variables

Based on a prior literature review, eighteen variables divided into three groups (sociodemographic, environmental and cultural variables) were selected for analyses. Some variables were recoded to align with other previous studies. For instance, the variable «region» had eighteen categories corresponding to eighteen Burundi provinces. Based on the 2010 BDHS final report [24], this variable has been recoded into five categories as follows: 1) The northern region includes the provinces of Kayanza, Ngozi, Kirundo and Muyinga; 2) the central-east region includes the provinces of Muramvya, Gitega, Karusi, Ruyigi and Cankuzo; 3) The western region includes the provinces of Cibitoke, Bubanza and Bujumbura Rural; 4) The southern region includes the provinces of Mwaro, Bururi, Rumonge, Rutana and Makamba and finally province of Bujumbura Mairie, which forms a separate region given its urban specificity.

Similarly, with reference to Zah's study [2], the “occupation” variable had thirteen categories but it was recoded into three categories as follows 1) unemployed; 2) agricultural occupation and 3) modern occupation. We defined "modern professions”, as individuals who work in: commerce, industry, services, armed forces, transportation, administration, and clergy. The “agricultural” professions include individuals who obtain income from agricultural work including agricultural, salesmen, manual workers and assimilated workers. Finally, the "unemployed" are individuals of working age who reported that they had no job activity in the six months preceding the survey. The advantage of this categorization is that it minimizes the variability in response due to job transition [2]. The latter is very common in low-income countries such as Burundi.

Statistical analysis

Data analysis was conducted using STATA software, version 13. The data were first weighted using the women’s individual sample weight variable to ensure representativeness of the sampled data. We also used the Svyset command to take into account the complex sample design used in the DHS data (the weight variable, the Primary sampling unit variable and the sample strata for sampling errors variable). The use of this command allowed us to have parameter estimates and standard errors that are adjusted according to the aspects of the survey design. We first conducted a descriptive analysis by calculating frequencies, percentages, means and standard deviations (SD) to describe the sociodemographic

characteristics of the sample. To identify factors influencing fertility differentials, bivariate and multivariate analyses were performed. In bivariate analysis, one-way analysis of variance (ANOVA) was performed to observe differences in mean number of children ever born (MCEB) across the categories of all independent variables selected. To examine the net effect of each of predictors, all factors for which the p-value was ≤ 0.2 in bivariate analysis were included in multivariate Poisson regression model offset by the natural logarithm of the women's current age. For ease of the results interpretation, the coefficients were exponentiated to yield Incident Rate Ratio (IRR). In addition, we adjusted for marital status since marital status is strongly associated to the number of CEB. Indeed, married or formerly married women are more likely to have more CEB than single women. For all analyses, the significance level used was $p < 0.05$.

Results

Sociodemographic characteristics of the sample

The sociodemographic characteristics of the sample are summarized in **Table 1.** The weighted sample size was 17,269 women aged 15-49, with an average age of 28.26 years (standard deviation = 9.48). The findings indicate that slightly more than two out of five women (41.1%) were in the 15-24 years range. Most of these women (87.1%) lived in rural areas and more than half (55%) lived in the northern and central-eastern health regions. Analysis of marital status revealed that 56.6% were officially married or in a common-law relationship and 34.6% were single. Regarding education, slightly more than three out of four women (75.4 %) were either illiterate or had only a primary school education and only 1.2 % had a higher level of education. Regarding occupations, the results show that 77.5 % of women worked in agricultural occupations and only 4.9% worked in modern occupations. Similarly, regarding wealth index, the findings indicate that about three out of five women (59.1%) were classified either in poorest /poor or middle categories. Our findings also indicate that most of women (57.3%) were Catholic.

(Insert Table 1 here): Sociodemographic characteristics of the sample.

Determinants of fertility differentials

Bivariate analysis

In our sample, the total number of CEB ranged from 0 to 15 children by women with a mean of 2.7 children (SD=2.8). To identify factors influencing these fertility differentials, eighteen independent variables were analyzed at the bivariate level. The findings indicate that out of eighteen variables examined, seventeen are significantly associated with fertility differentials (**See Table 2**).

When analyzed according to the woman's age, the results indicate that the MCEB increases progressively as the woman's age increases. The MCEB goes from 0.07 for women aged 15-19 to 6.55 for women aged 45-49. Furthermore, the MCEB is significantly higher in rural area (2.84) than that of in urban areas (1.84). Regarding health regions, the MCEB is the highest in the western region (2.96) and the

lowest in Bujumbura Mairie (1.64). Similarly the MCEB is significantly higher among married or formerly married women (4.83) than that of single women (0.12). Furthermore, the MCEB varies from 4.25 for illiterate women to 0.75 for women with a higher education. Similarly, the MCEB is higher among women whose husbands are illiterate (4.79) than that of women whose husbands had a higher education level (2.62). Regarding women's occupations, the findings indicate that the MCEB is significantly higher for women in agricultural occupations (3.10) than that of women in modern occupations (1.81). The husband's occupation influences fertility in the same way. The MCEB is higher among women whose husbands are in agricultural occupations than that of women whose husbands are in modern occupations.

Regarding household wealth index, the results show that the MCEB is significantly higher among women living in the poorest households (3.12) than those living in the richest households (2.07). Similarly, the MCEB is higher among women who reported having no religion (4.04) than that of catholic (2.67), protestant (2.76), Adventist (2.97), Muslim (2.50) or women from others religions (2.51). The MCEB is also significantly higher among women from male headed households (2.89) than that of women from female headed households (2.24). On the other hand, the findings indicate that the exposure to FP messages is not significantly associated with fertility differentials. Women who had already lost at least one child have a significantly higher MCEB (5.91) than women who had not yet lost a child (1.90). Likewise, the MCEB decreases from 5.07 among women who got married at the age of 15 or earlier to 3.73 among women who got married at least at the age of 20. The women's age at first birth influences fertility in the same direction. The results indicate that the MCEB is significantly higher among women who don't have knowledge of any contraceptive methods (2.79) or who don't use modern contraceptive (3.76) than that of women who have knowledge of any contraceptive methods (0.20) or who use modern contraceptives (2.57). Furthermore, the findings indicate that women who desire three or fewer children as the ideal number of children have a significantly lower MCEB (2.39) than those who desire four or more children (3.00).

(Insert Table 2 here): Variations in MCEB by Sociodemographic, environmental and cultural variables selected.

Multivariate analysis

Out of a total of eighteen predictors variables introduced into this model, sixteen variables remained significantly associated with fertility differentials after controlling for the current women age and marital status. Women's religion is no longer associated with fertility differentials. Exposure to family planning messages remains not significant at the multivariate level (**See table 3**).

Women living in urban areas have a significantly lower fertility rate (IRR=0.769) than their rural counterparts. Results indicate that women in the southern region have the highest fertility rate (IRR = 1.129), followed by women from the western region (IRR=1.094) and central-eastern region (IRR= 1.062). Similarly, our results show that women with only a primary, secondary or higher education have significantly lower fertility rates (IRRs of 0.940; 0.767 and 0.718 respectively) compared to illiterate

women. Similarly, women whose husbands have only primary, secondary or higher education have significantly lower fertility rates (IRRs of 0.948; 0.876 and 0.729 respectively) than women whose husbands are illiterate. Our findings indicate that women in agricultural occupations have a significantly higher fertility rate (IRR= 1.521) than those in modern occupations. Women whose husbands are in agricultural occupations have a significantly higher fertility rate (IRR= 1.294) than women whose husbands are in modern occupations.

Regarding household wealth index, the findings show that women living in the households classified as poorest, poor or middle have significantly higher fertility rates (IRRs of 1.117; 1.094 and 1.054 respectively) than those living in the richest households. Women from female headed households have a significantly lower fertility rate (IRR= 0.969) than those from male headed households. Furthermore, women who reported that they had not yet lost a child have a significantly lower fertility rate (IRR= 0.722) compared to women who reported having already lost at least one child. Our findings also show that fertility level significantly decreases with an increase in age at first marriage or at first birth. Women who got married at the age between 16 and 19 or at least at the age of 20 have significantly lower fertility rates (IRRs of 0.967 and 0.864 respectively) than those who got married at the age of 15 years or earlier. Similarly, women who reported having their first birth at the age between 16 and 19 or at least at the age of 20 have significantly lower fertility rates (IRRs of 0.900 and 0.812 respectively) than their peers who reported having their firth birth at the age of 15 years or earlier. The effect of knowledge or the use of contraceptive methods remains significant after controlling for other variables. Our findings indicate that women who reported not having knowledge of any contraceptive methods or not using modern contraceptive have significantly higher fertility rates (IRRs of 1.502 and 1.583 respectively) than those who reported having knowledge of any contraceptive methods or using modern contraceptive. Furthermore, the findings indicate that women who provided a non numeric response or who desire at least four children have significantly higher fertility rates (IRRs of 1.090 and 1.059 respectively) than those who wanted three or fewer children.

(Insert Table 3 here): Result of multivariate Poisson regression model of factors influencing fertility differentials in Burundi.

Discussion

Our study aimed to analyze factors influencing fertility differentials in Burundi by using the latest BDHS data. To identify these factors, bivariate and multivariate analyses were performed. According to our findings, urban residence was found to be associated with low fertility. The negative impact of urban residence on Burundi fertility could be explained by couples using more modern contraceptive methods to reduce family size due to the increased cost of raising a child in urban setting (i.e. food, schooling etc). This association was also demonstrated in several previous studies [2, 28, 30]. However, with an annual urbanization rate of 13.7% in 2020, Burundi remains the least urbanized country in eastern Africa [31]. The central-eastern, western and especially the southern regions are associated with a higher fertility than that of Bujumbura Mairie. The latter was the political capital of Burundi before becoming the economic

capital in 2019. This implies that it has many advantages over other regions (availability of family planning services, high rate of female schooling, urbanization etc.) in favor of a smaller family size by residents. These findings therefore highlight the need for the Burundi government and its partners to focus more on those three regions to accelerate fertility transition. In addition our results are consistent with those reported in the 2016-17 BDHS final report [14].

Our study showed the importance of the male, but especially female education in reducing fertility level. Education is widely known to strongly influence women's fertility by delaying age at first marriage and adoption of favorable behaviors towards the use of family planning services. According to Zah's study [2], women with at least seven years of education were distinguished from their illiterate counterparts by low fertility. Roy and his colleague [32] justify this strong relationship between a woman's education and low fertility by asserting that women with a high education tend to have their first birth at an advanced age. In Burundi, the school attendance rate has increased somewhat over the last decade. However the overall level remains low both for women and men [9]. According to the results of the latest BDHS report [14], 36% of women and 26% of men are illiterate. While 50 % of women and 57 % of men have only a complete or incomplete primary level education. Our results emphasize the need for Burundi policy makers to ensure access to education for all, especially for girls, to accelerate the fertility transition in Burundi.

In line with the results of Zah [2] and Bongaarts et al. [3], our study showed that agricultural profession is associated with a high fertility. Such an association could be due to Burundi agricultural production systems that remain traditional and thus require a larger family workforce. As agriculture is the main source of income for more than 90 % of Burundians [6], most families want to have a large number of children because of their important contribution to their parents' agricultural activities. Agricultural mechanization could help reduce Burundi fertility level. Similarly, our findings showed that household poverty is associated with high fertility. Our findings are consistent with those reported in several studies [28, 33]. 64.9 % of Burundians live below the national poverty line of 1,744 Burundian francs per day (US$1.27) and 38.7% live in extreme poverty [7]. Moreover, Burundi is expected to become the poorest country in the world by 2030 and the seventh largest contributor to poverty in the world [10]. Our results consistently showed that women from male headed households have the highest fertility. A similar result was reported in the study by Ariho and his colleague in Uganda [34]. Women's previous experience of infant mortality was found to be strongly associated with a high fertility. Our results support those of many researchers [16, 35, 36] who argue that high infant mortality rates are generally associated with high fertility especially in SSA context. In Burundi, such an association could be justified by the fact that the death of a child leads most Burundian couples to have a new birth to replace the deceased child. Moreover, Burundi remains among the countries with the highest infant mortality rate in SSA [15]. Ensuring child survival should be a priority for the Burundi government and its partners in trying to accelerate fertility transition.

Our results also showed that both early marriage and early childbearing are associated with a high fertility. Similar results had been reported in several studies [28, 37, 38]. According to these authors, early

marriage not only provides a longer reproductive life but also leads to early childbearing resulting in high fertility. For instance, adolescent girls and young women in Ethiopia are responsible for more than 45% of total births [39]. In the study conducted by Nahar and Zahangir in Bangladesh [28], the women having their first birth at age of 15 or younger had a higher rate of having more children (IRR = 1.188) than their counterparts who gave birth at least at the age of 20. Additionally early initiation of childbearing is a major determinant of large family size and rapid population growth, particularly in countries where contraception is not widely practiced [40]. Burundi is inhabited by a population of over 12 million people and could reach 14.9 million inhabitants in 2030. The population is characterized by its extreme youth, with 65% under the age of 25 and almost a quarter of the populations (23%) are adolescents [41]. Moreover, 8% of women aged 15–19 have already begun childbearing, including 6 % who have had at least one live birth and 2 % who are pregnant with their first child [14]. This underscores the need for the Burundi government to further promote sex education in all schools in an attempt to limit Burundi's population growth.

According to our findings, the knowledge and the use of modern contraceptive methods are associated with low fertility. Our results are consistent with those reported in several studies [22, 28, 30, 42]. Nevertheless modern contraceptive prevalence remains low (23%) and a high proportion of women in union (30%) still have unmet need for FP in Burundi [14]. Significant efforts must be made by the Burundi government and its partners to ensure equitable access to FP services. Mass media (radio, TV, newspaper articles, internet) should also be more involved in disseminating FP messages. This is because our study has shown that their contribution has no effect on fertility reduction. whereas their influence on fertility transition has been proven in several studies [28, 34, 37]. Our study revealed that as the number of children desired by the family increases so does the risk of high fertility. Our results are consistent with the result of Ariho and his colleague [37] who considered that family size preferences affect the fertility behavior of individuals, particularly decisions about whether or not to use contraceptive methods.

In our study, we included all women of childbearing age. Some studies on fertility only include women who are currently married and women who have ever been married. By focusing on currently married and formerly married women, these studies exclude non- marital and premarital fertility, the prevalence of which has been increasing steadily in recent times especially in SSA. In our sample, 1.5 % of children were born to women who were still single. Similarly, by including in our analyses certain variables directly or indirectly involving spouses (education and occupation of husband, age at first marriage or at first birth), we witnessed numerous cases of missing data. In fact, women who were divorced/separated, widowed or still single at the time of the survey did not answer the questions relating to the education and occupation of husband. Similarly, women who were single did not answer the question on age at first marriage. Women who had not yet given birth also did not answer the question on age at first birth. However, all of these women answered the question about their total number of CEB (Our dependent variable). To try to overcome this problem of missing data especially in the multivariate analysis, we created a modality called "Not Applicable (NA). However, the inclusion of this modality when analyzing the MCEB with ANOVA (in bivariate analysis) risks biasing the fertility differentials between the modalities of each of these four predictors variables and consequently the results of the ANOVA test (F-values and p-

value), which is a limitation of our study. In addition, since our analysis relied on a cross-sectional survey, we found only associations and not causal relationships. The strength of our study is that this study would be among the first ones to use an analytical approach to identify the determinants of fertility differentials in Burundi. In addition, our study analysis is based on nationally representative survey data. As a perspective, given the fertility differentials that exist between the health regions/provinces of Burundi, further studies using multilevel regression models are needed to better understand the determinants of the fertility differentials in Burundi.

Conclusions

Our study aimed to analyze factors influencing fertility differentials in Burundi. After bivariate and multivariate analyses using ANOVA and Poisson regression model respectively, factors such as residence in rural or in central-eastern, western and southern regions, illiteracy/low level of education of both husband and women, women and husband agricultural professions, household poverty, male headed households, previous experience of infant mortality, early marriage and early childbearing, lack of knowledge of any contraceptive methods, non-use of modern contraceptive methods and desire of a large number of children were identified as factors associated with a high fertility in Burundi.

Given that reducing fertility rate is a major challenge for the Burundian government and its partners; our findings underline the need for promoting education for all, especially female education, given its influence on the age at first marriage and family planning program success. Greater attention should also be paid to improving child survival, the women's socioeconomic status and the mechanization of Burundian agriculture. Significant efforts must be made to ensure equitable access to FP services. In addition, the mass media (radio, TV, news paper articles, internet) and religious leaders should be more involved in disseminating messages for behavior change in favor of accelerating fertility transition in Burundi.

Abbreviations

- ANOVA : One-way analysis of variance
- BDHS: Burundi Demographic and Health Survey
- CEB: Children Ever Born
- DHS: Demographic and Health Survey
- FP: Family Planning
- GFR: General Fertility Rate
- HIV: Human Immunodeficiency Viruses
- IMR: Infant Mortality Rate
- IRR: Incident Rate Ratio
- MCEB: Mean number of Children Ever Born

- MMR: Maternal Mortality Ratio
- NA: Not Applicable
- RC: Reference Category;
- SD: Standard Deviation
- SSA: Sub Saharan Africa
- TFR: Total Fertility Rate
- USAID: United States Agency for International Development

Declarations

Ethics approval and consent to participate

The 2016-17 BDHS protocol, consent forms, and data collection instruments were reviewed and approved by the National Ethics Committee for the Protection of Human Beings Participating in Biomedical and Behavioral Research in Burundi and the Institutional Review Board of ICF International. They also obtained the Statistical Visa N° VS201505CNIS of the National Council of Statistical Information of Burundi. Moreover, data were collected after taking informed consent and all information was kept confidential. For this specific research, permission was given by the DHS Program to access 2016-17 BDHS data after review of the submitted brief descriptions of this study to the DHS program through its website [26]. The datasets were treated with utmost confidentially.

Consent for publication

Not Applicable

Availability of data and materials

The data that support the findings of this study are available for download upon an formal application from the DHS Program web site https://dhsprogram.com/data/dataset/Burundi_Standard-DHS_2016.cfm?flag=0 but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the DHS Program.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

JCN and NEK conceived the idea and design and contributed in data analysis, interpretation of results, discussion and manuscript drafting. MoC and MiC substantively contributed in discussion and manuscript drafting. SEM was a major contributor in data analysis and interpretation of results. While AB and HA advised on data analysis and substantively revised the manuscript. All authors read and approved the final manuscript.

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Tables

Table1: Sociodemographic characteristics of the sample

Variablescategories	Frequency (n)	Percentage(%)
Age (years)		
15-19	3,859	22.3
20-24	3,244	18.8
25-29	3,002	17.4
30-34	2,443	14.1
35-39	1,967	11.4
40-44	1,545	8.9
45-49	1,209	7.0
Place of Residence		
Rural	15,037	87.1
Urban	2,232	12.9
Provinces		
Bujumbura Mairie	1,304	7.6
North	5,136	29.7
Central -East	4,365	25.3
West	2,686	15.6
South	3,779	21.9
Marital Status		
Single	5,967	34.6
Married/living with Partner	9,782	56.6
Divorced/separated	887	5.1
widowed	634	3.7
Education		
No education	6,259	36.2
Primary	6,775	39.2
Secondary	4,020	23.3
Higher	215	1.2
Occupation:		
Modern	849	4.9
Agricultural	13,386	77.5
Unemployed	2,563	14.8

Other/Don’t know	471	2.7
Wealth Index		
Poorest	3,310	19.2
Poorer	3,432	19.9
Middle	3,456	20.0
Richer	3,370	19.5
Richest	3,701	21.4
Religion		
No religion	172	1.0
Catholic	9,899	57.3
Protestant	5,948	34.4
Muslim	545	3.2
Adventiste	455	2.6
Others	250	1.4

Table 2: Variations in MCEB by Sociodemographic, environmental and cultural variables selected.

Variables/ categories	MCEB	SD	F
Sociodemographic Variables			
Age Group			
15-19	0.07	0.26	
20-24	0.91	1.01	
25-29	2.30	1.51	
30-34	3.93	1.88	5,204.89***
35-39	5.06	2.23	
40-44	6.02	2.55	
45-49	6.55	2.77	
Place of Residence			
Rural	2.84	2.84	
Urban	1.84	2.32	255.89***
Health Region			
Bujumbura Mairie	1.64	2.14	
North	2.87	2.72	
Central -East	2.65	2.73	58.95***
West	2.96	2.90	
South	2.77	3.01	
Marital Status			
Single	0.12	0.50	
Married/living together	4.83	2.54	
Divorced/separated	3.21	2.30	4,930.02***
Widowed	4.12	2.38	
Women's Education			
Illiterate	4.25	2.81	
Primary 2.51	2.58		
Secondary 1.15	1.62		1,708.55***
Higher 0.75	1.49		
Husband's Education			
Illiterate	4.79	2.64	
Primary	3.86	2.39	

Secondary	2.96	2.12	2,372.38***
Higher	2.62	1.71	
Don't know/ **NA**[1]	0.89	1.94	
Women's Occupation			
Modern	1.81	1.22	
Agricultural	3.10	2.83	
Unemployed	1.04	2.04	525.40***
Others/Don't know	0.59	1.47	
Husband's Occupation			
Modern	3.52	2.30	
Agricultural	4.46	2.57	
Unemployed	4.23	2.48	2,703.70***
Others/Don't know/**NA**[1]	0.95	2.01	
Wealth Index			
Poorest	3.12	2.70	
Poorer	2.87	2.79	
Middle	2.83	3.00	72,27***
Richer	2.75	2.84	
Richest	2.07	2.54	
Women's Religion			
No religion	4.04	2.71	
Catholic	2.67	2.73	
Protestant	2.76	2.93	10.17***
Adventist	2.97	2.77	
Muslim	2.50	2.47	
Others	2.51	2.53	
Sex of the Household Head			
Male	2.89	2.86	
Female	2.24	2.57	183.27***
Environmental Variables			
Exposure to FP Messages[2]			
No	2.74	2.81	

Yes	2.66	2.78	2.68
Infant Mortality Experience			
Yes	5.91	2.43	
No	1.90	2.24	8,639.43***
Cultural Variables			
Age at First Marriage			
≤ 15 years	5.07	2.63	
16 – 19 years	4.22	2.62	
≥ 20years	3.73	2.33	5,044.57***
NA[3]	0.12	0.50	
Age at First Birth			
≤ 15 years	5.01	2.65	
16 – 19 years	4.36	2.59	
≥ 20years	3.92	2.34	5,637.98***
NA[4]	0.00	0.00	
Knowledge of any Contraceptive Methods			
Has knowledge	0.20	0.91	401.39***
No knowledge	2.79	2.80	
Modern Contraceptive Use			
Yes	2.54	2.84	
No	3,76	2.29	422.91***
Family Size Preference			
≤ 3 Children	2.39	2.69	
≥ 4 Children	3.00	2.85	101.13***
No Numeric Response	2.39	3.05	

Note: Not Applicable (NA[1]): women who did not provide information about their husbands because of their current marital status (Single/Divorced/separated/widowed , N =7,488), Exposure to FP Message [2] : Obtained by combining the following four variables: Heard family planning on radio, TV , Newspaper/magazine or by text messages on mobile phone in last few months ; **NA[3]** : Not yet married or Single women (N= 5,967) ; **NA[4]**: Still no births (N= 5,910) ; Statistically significant at *** p< 0.001; ** p< 0.01; *p <0.05; **MCEB**: Mean number of Children Ever born; **SD**: Standard Deviation.

Table 3: Result of multivariate Poisson regression model of factors influencing fertility differentials in Burundi.

Variables/ Ccategories	A(IRR)	95%CI
Intercept	0.060	0.042 - 0.085
Place of Residence		
Rural (RC)	1.000	
Urban	0.769**	0.739 - 0.782
Region		
Bujumbura Mairie (RC)	1.000	
North	1.018	0.970 - 1.067
Central -East	1.062*	1.012 - 1.114
West	1.094***	1.042 - 1.148
South	1.129***	1.077 - 1.184
Women's Education		
Illiterate(RC)	1.000	
Primary	0.940***	0.924 - 0.956
Secondary	0.767***	0.735 - 0.801
Higher	0.718***	0.643 - 0.802
Husband's Education		
Illiterate (RC)	1.000	
Primary	0.948***	0.931 - 0.965
Secondary	0.876***	0.842 - 0.911
Higher	0.729***	0.711 - 0.763
Don't know/ NA[1]	0.968	0.748 - 1.254
Women's Occupation:		
Modern (RC)	1.000	
Agricultural	1.521***	1.429 - 1.618
Unemployed	0.970	0.929 - 1.013
Others/Don't know	1.022	0.951 - 1.098
Husband's Occupation		
Modern (RC)	1.000	
Agricultural	1.294***	1.211 - 1.416
Unemployed	0.992	0.944 - 1.042
Others/Don't know/NA[1]	1.026	0.961 - 1.096

Wealth Index		
Richest (RC)	1.000	
Richer	1.011	0.987 - 1.035
Middle	1.054***	1.032 - 1.077
Poorer	1.094***	1.067 - 1.121
Poorest	1.117***	1.080 - 1.155
Women's Religion		
No religion (RC)	1 .000	
Catholic	0.976	0.911 - 1.046
Protestant	1.002	0.935 - 1.075
Adventist	0.953	0.878 - 1.035
Muslim	0.949	0.876 - 1.028
Others	0.925	0.840 - 1.018
Sex of the Household Head		
Male (RC)	1.000	
Female	0.969**	0.946 - 0.992
Exposure to FP Messages[2]		
No (RC)	1.000	
Yes	1.000	0.983 - 1.018
Infant Mortality Experience		
Yes (RC)	1.000	
No	0.722***	0.710 - 0.734
Age at First Marriage		
≤ 15 years (RC)	1.000	
16 – 19 years	0.967*	0.939 - 0.995
≥ 20years	0.864***	0.837 - 0.891
NA[3]	1.000(Omitted)	
Age at First Birth		
≤ 15 years (RC)	1.000	
16 – 19 years	0.900***	0.867 - 0.934
≥ 20years	0.812***	0.781 - 0.845
NA[4]	0.000***	0.000 - 0.000

Knowledge of any Contraceptive Methods		
Has knowledge (RC)	1.000	
No knowledge	1.502***	1.494 - 1.564
Modern Contraceptive Use		
Yes (RC)	1.000	
No	1.583***	1.314 - 1.907
Family Size Preference		
≤ 3 Children (RC)	1.000	
≥ 4 Children	1.059***	1.042 - 1.076
No Numeric Response	1.090**	1.034 - 1.150

Note: A (IRR): Adjusted Incident Rate Ratio; *** p< 0.001; ** p< 0.01; *p <0.05; **RC**: Reference Category; **95% CI**: 95% Confidence Interval. Results adjusted for women current age and marital status.

Figures

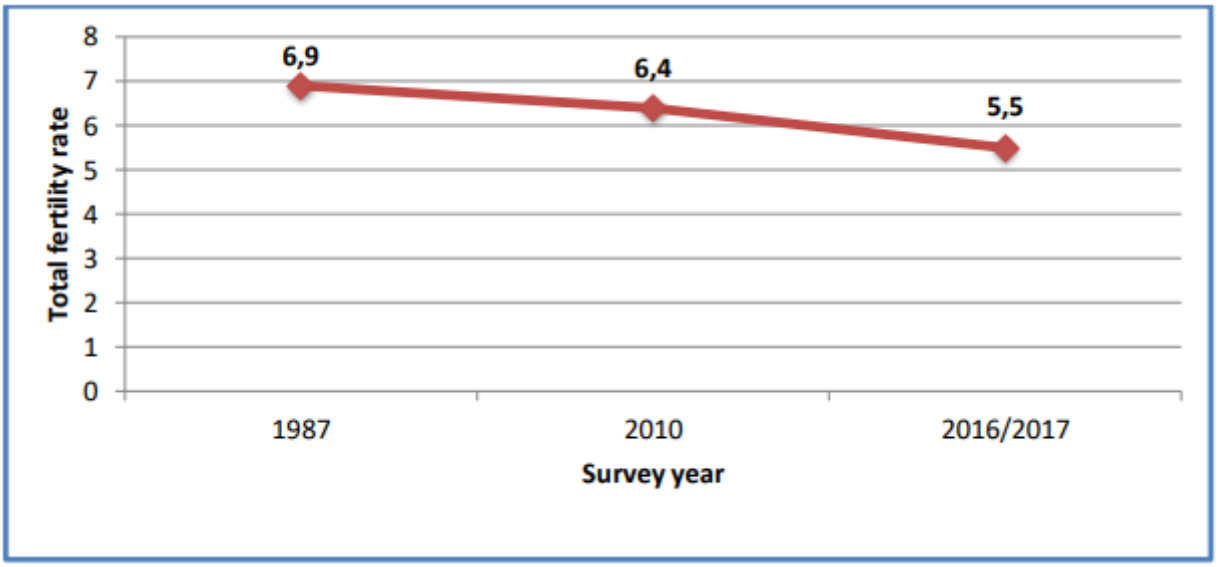

Figure 1

Trends of fertility in Burundi. (Data Sources): The 1987, 2010 and 2016-17 Burundi Demographic and Health survey reports.