

Return to Fertility after Discontinuation of Modern Contraceptive Methods in Rwanda

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ABSTRACT

Introduction: Return to fertility after discontinuing modern contraceptives is a concern for women. The absence of local evidence on this important issue contributes to rumors and myths associating family planning with infertility. This research aims to study the time it took a woman to get pregnant after discontinuing a method in Rwanda.

Methods: This study uses data collected from Rwanda Demographic and Health Survey 2020. Data cleaning was conducted, and appropriate sample weights were applied. Statistical analysis was conducted using the Cox proportional hazard model.

Results: Twelve-month pregnancy probability was 94% for women who used barriers and traditional methods, 92% for IUDs, 88% for pills, 83% for implants, and 81% for women who used injections. The age of women and the number of children were associated with the time to return to fertility (HR=0.95, CI: 0.94-95, P<0.0001, and HR=1.15, 95CI: 1.09-1.2, p<0.0001, respectively). The duration of contraceptive use and body mass index were not associated with the time to return of fertility.

Conclusion: This research revealed a strong association between the type of contraceptive method and the time until fertility returns.

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INTRODUCTION

Modern contraceptive methods have contributed to more than 30% reduction in maternal mortality in developing countries. Additionally, family planning contributes enormously to women's empowerment, poverty reduction, and environmental sustainability [1]. Over the past few decades, Rwanda has worked to ensure access to sexual and reproductive health services. Family planning services are readily accessible free of charge at all levels of Rwanda's health system, including at the community level through community health workers in each village [2-4]. The return of fertility after using reversible contraceptive methods is a concern for women.

Although infertility is a common condition, any delay in returning to fertility in women who use modern contraceptives is linked to their use of contraceptives [5]. Several African studies have reported the belief that modern contraceptive methods can cause infertility [6]. A study conducted in Ethiopia found that one in two women believed that modern contraceptives might cause infertility, and studies found that this misconception is also common in Rwanda [6-8]. Myths and misconceptions related to contraception lead to lower satisfaction, distrust, and reduced use of family planning services [10], and women with such beliefs are more likely to deny family planning [9].

Evidence related to returns on fertility after family

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planning varies significantly across regions. A worldwide systematic review estimated that the rate of pregnancy within 12 months after discontinuation of modern contraceptives was 83% [5]. A study that analyzed data from 47 Middle- and Lower-income countries revealed the 12-month probability of pregnancy of 87% for women who used pills, 86% for intrauterine devices, and 80% for women who used both injectables and implants. The twelve-month probability of pregnancy was higher among young women aged < 40 years and lower among women aged \geq 40 years [10]. A study in Indonesia reported an even lower probability of pregnancy after discontinuation of modern contraceptives, ranging between 72 and 85% for women who discontinued the IUD, 75% and 81% for pills, 64% and 67% for injectables, and 72% and 76% for women who used implants [11].

With such variations in the available evidence, many clinicians and reproductive health professionals struggle to educate and assure women about the return of fertility after contraceptive use. Fertility is a multifaceted process that depends on several factors[5], including demographic factors such as age; obstetric and medical conditions, such as uterine anomalies or hormonal imbalances; and individual lifestyle factors such as obesity, smoking, and frequency of sexual intercourse [12], [13]. In addition, country-specific factors such as demographics, policies, and culture may play a role [14]. These factors vary significantly between regions and countries, highlighting a need to establish evidence specific to Rwanda tailored to the local context. Therefore, this study aimed to study the return on fertility after using modern contraceptives in Rwanda. Using nationally representative Demographic and Health Survey (DHS) data, we aim to establish credible evidence that may assist clinicians, sexual and reproductive health practitioners, and policymakers.

METHODS

This study used data collected from the 2020 Rwanda DHS. Using the official DHS Recorder, data of women who stopped contraceptive methods to become pregnant were selected. The discontinued methods were divided into five groups: Four types of modern contraceptive methods (pills, injectables, implants, and intrauterine devices), an additional group of

barriers, and traditional methods. Only married women living with their partners were included. Data on contraceptive use were retrieved from the Calendar Part of DHS Dataset. This information was retrieved using string methods in the Python programming language.

Variables: In this study, the dependent variable was the time of pregnancy after discontinuing the contraceptive method. The shortest time to pregnancy was one month for women who became pregnant immediately in the first month after discontinuation. Women still waiting to become pregnant at the end of the study were right-censored.

Independent variables included age, education level, wealth category, urban or rural location, weight, height, and hemoglobin levels.

Sampling: This study used data retrieved from the Rwanda Demographic and Health Survey 2020. Participants in DHS were selected using a two-stage sample design, and the survey was intended to provide estimates at a national level. In the first stage, 500 clusters were selected using a sampling frame generated from the fourth Rwanda Population and Housing Census. The second stage selected households in each cluster using systematic sampling.

All women participants in DHS who met our inclusion criteria were selected for the analysis. Initially, we included women who reported at least one episode of stopping the contraceptive method due to wanting to become pregnant. In addition, only women who were married and living with their male partners were selected. During analysis, sampling weights were adjusted to obtain national estimates.

Survival Analysis: This study used survival analysis to understand the time to fertility return after modern contraceptives in Rwanda. Survival analysis involves studying time-to-event data. This study examined the time taken to conceive after discontinuation of the contraceptive method, using the Cox Proportional Hazard Model to determine whether the type of contraceptive method used impacts the time it takes for fertility to return. In addition, we examined the association between the age of women, body mass index, hemoglobin, education, wealth, and the time until return on fertility. The Cox proportional hazards model is a

regression model that can be expressed as follows:

$$h(t)=h_0(t)\times\exp(b_1x_1+b_2x_2+\dots+b_px_p)$$

Where t is the time, x_i are the covariates, b_i are the coefficients of the covariates. $h(t)$ is the hazard at that time, t . $h_0(t)$ is the baseline hazard. This is a hazard value when all covariates are equal to zero. The hazard ratio (HR) is an important measurement in the interpretation of the Cox Model, which measures the relative risk of experiencing an event between the two groups. If the hazard ratio is greater than one, an increase in the value of the covariate increases the hazard of an event.

$$\text{Hazard ratio} = \frac{h_k(t)}{h_{k'}(t)} = \frac{h_0(t)e^{\sum_{i=1}^n \beta x}}{h_0(t)e^{\sum_{i=1}^n \beta x'}} = \frac{e^{\sum_{i=1}^n \beta x}}{e^{\sum_{i=1}^n \beta x'}}$$

Ethical considerations: Data used in this study were obtained from publicly available DHS Dataset. The 2020 Rwanda Demographic and Health Survey protocol was reviewed and approved by the Rwanda National Ethics Committee. Written authorization to access and use data was obtained from the DHS Program. All dataset were anonymized and de-identified. No personal identifiable was accessed and/or utilized in this research. Data were stored and processed on secure University of Rwanda servers, and only authorized personnel had access to the dataset.

RESULTS

The analysis was conducted on 1117 women data retrieved from the DHS 2020 [17]. The average age was 32. Most women (82%) lived in rural areas and had a primary education level (68%). The average number of children per woman was three. The mean body mass index was 23.8, and the mean duration of contraceptive use was 26 months. On average, it took a woman three months to become pregnant after stopping the contraceptive method. Table 1 provides the detailed descriptive characteristics of the study sample.

Survival Analysis: Initially, the univariate Cox Model was fitted. Women's age, type of contraceptive method, and the number of children were significantly associated with time until the return of fertility ($P < 0.05$).

Table 2 shows the results of the univariate Cox Model analysis.

Table 1: Socio-demographic characteristics of the study population

Characteristics	N = 1,117
Participants' Age	32.0 (28.0, 37.0) ¹
Type of Residence	
Rural	912 (82%)
Urban	205 (18%)
Body Mass Index	23.8 (21.8, 26.4) ¹
Number of Children	3.00 (2.00, 4.00) ¹
High Level of Education	
No Education	97 (8.7%)
Primary	765 (68%)
Secondary	188 (17%)
Higher	68 (6.1%)
Wealth Category	
Poorest	180 (16%)
Poorer	196 (18%)
Middle	259 (23%)
Richer	240 (21%)
Richest	243 (22%)
Time used contraceptive months	26 (15, 38)
Method Stopped	
Barrier & Traditional	221 (20%)
Implants	149 (13%)
Injection	524 (47%)
IUD	31 (2.8%)
Pill	194 (17%)
Time to Pregnancy (Months)	3 (2, 7)

¹Median (Interquartile Range)

Multivariate Cox Model: In addition to significant variables (age, contraceptive method, and number of children) in the multivariate Cox proportional hazard model, we added "Time contraceptive method used" in the multivariate analysis since existing literature associated it with the return to fertility.

Multivariate analysis revealed an increased influence of contraceptive methods on the duration of fertility return. The use of injections was significantly associated with time to return of fertility (HR=0.6, CI: 0.49-0.73, $P < 0.0001$). This indicates that compared to women who used barriers and traditional methods, those who used injections had a 40% increased time until fertility. Similarly, the use of contraceptive implants was also associated with the duration of time to return of fertility (HR= 0.61, CI: 0.48-0.78, $P < 0.0001$).

Table 2: Univariate Cox Proportional Hazard Analysis of Factors Associated with Time to Fertility Return

Characteristics	HR	95% CI	P-value
Women Age	0.98	0.97, 0.99	0.001
Number of Children	1.04	1.00, 1.08	0.032
Time contraceptive method used (months)	1.00	1.00, 1.01	0.14
Grouped Contraceptive Method			
Barriers - Traditional (reference)	—	—	—
Implants	0.72	0.58, 0.89	0.003
Injection	0.64	0.54, 0.75	<0.001
IUD	0.81	0.55, 1.21	0.3
Pill	0.73	0.60, 0.89	0.002
Hemoglobin Level	1.00	0.99, 1.02	0.9
Weight	1.00	1.00, 1.00	0.6
Height	1.04	0.88, 1.23	0.6
Highest Education Level			
No Education (reference)	—	—	—
Primary	1.17	0.94, 1.47	0.2
Secondary	1.30	1.00, 1.69	0.047
Higher	1.50	1.09, 2.08	0.014
Wealth Category			
Poorest (reference)	—	—	—
Poorer	1.34	1.08, 1.66	0.007
Middle	1.15	0.95, 1.40	0.2
Richer	1.19	0.97, 1.46	0.092
Richest	1.26	1.03, 1.54	0.023
Place of Residence			
Rural (reference)	—	—	—
Urban	0.90	0.77, 1.04	0.2
Body Mass Index	1.00	0.98, 1.02	0.9

CI: 95% Confidence Interval, HR: Hazard ratio

This indicates that compared to women who used barriers and traditional methods, those who used implants had a 39% increase in time to return to fertility.

The use of Pills was also associated with the duration of time until pregnancy (HR=0.78, CI:0.63-0.98, p=0.033), indicating that compared to women who used barriers and traditional methods, those who used pills had a 22% increase in the time of return to fertility.

The time that a contraceptive method was used had a significant p-value of < 0.01 with a hazard ratio of 1.01. However, the covariate had a very small

coefficient of 0.00665, making its contribution insignificant. The age of women was associated with the duration of time to fertility return (HR=0.95, CI: 0.94-95, P<0.0001), indicating that an increase in age was associated with a 5% increase in the time to fertility return. An increase of one child was associated with a 15% reduction in the duration of return to fertility (HR=1.15, 95CI: 1.09-1.2, p< 0.0001).

Pregnancy rate after family planning discontinuation: After 6 months, the pregnancy probability was 83% for women who used barriers and traditional methods, 79% for IUDs, 72% for

Table 3: Multivariate Cox Model Analysis of Factors Associated with Time to Fertility Return

	Coefficient	95% CI		HR	Z	P value
Discontinued Implants	-0.49438	0.61	0.48	0.78	-3.90925	0.00009
Discontinued Injections	-0.5133	0.6	0.49	0.73	-4.97262	0.00000
Discontinued IUD	-0.06557	0.94	0.54	1.61	-0.23616	0.81331
Discontinued Pills	-0.24339	0.78	0.63	0.98	-2.12139	0.03389
Women Age	-0.05072	0.95	0.94	0.96	-6.89352	0.00000
Time a Contraceptive Method was used	0.00665	1.01	1	1.01	2.91275	0.00358
Total number of children	0.13551	1.15	1.09	1.2	5.23558	0.00000

CI: 95% Confidence Interval, HR: Hazard ratio, Z: Z-score value

pills, 67% for implants, and 64% for females who used injections.

After 1 year, the pregnancy probability was 94% for women who used barriers and traditional methods, 92% for IUDs, 88% for pills, 83% for implants, and 81% for women who used injections. After 2 years, the pregnancy probability increased to 98% for women who used barriers and traditional methods, 97% for IUDs, 95% for pills, 93% for implants, and 91% for women who used injections.

After three years, the pregnancy probability increased to nearly the same rate: 99.7% for women who used barriers and traditional methods, 99.4 %

for IUDs, 98.5% for pills, 97.4% for implants, and 96.5% for women who used injections.

DISCUSSION

This study aimed to determine the time of return to fertility after discontinuation of the modern contraceptive method. In addition, we studied the association between different factors and the time to return to fertility.

This study found that the type of contraceptive method used was strongly associated with the time to fertility return. The time to return to

Table 4: Pregnancy rate after family planning discontinuation

Time (months)	Barrier & Traditional*		Injections*	Pills*	IUD*
	Implants				
1	0.2692668	0.1781813	0.1659855	0.2046651	0.2439657
2	0.4718963	0.3292659	0.3088522	0.3725236	0.4340147
3	0.6202828	0.4543219	0.4289368	0.5067981	0.5782158
6	0.8297782	0.6696526	0.6410112	0.7254160	0.7937221
12	0.9444036	0.8359489	0.8121076	0.8786779	0.9239300
24	0.9857052	0.9298553	0.9143704	0.9549844	0.9773354
36	0.9970710	0.9739779	0.9657785	0.9858478	0.9944844

IUD: Intrauterine device, *Rate calculated in percentages by dividing by 100

fertility was higher in women who received injections, followed by Implants and Pills. The time to return to fertility was lower in women who used intrauterine devices, barriers, or traditional methods. This trend was consistent with the results of previous studies [5,15,16].

The twelve-month pregnancy probabilities were 94% for women who used barriers and traditional methods, 92% for IUDs, 88% for pills, 83% for implants, and 81% for women who used injections. These results can be compared with a study that analyzed data from 47 African countries. In that study, 12 months of pregnancy probabilities were 90% for traditional methods, 87% for pills, 86% for IUDs, and 80% for both implants and injections [10].

Low twelve-month pregnancy usage probability for injectables has been documented in previous studies. A study conducted in Ethiopia revealed a 12-month pregnancy rate of 75% for Depo-Provera, a type of contraceptive injection used in Rwanda [16]. A meta-analysis also reported a lower pregnancy rate among injectable and implant users [15]. In many studies, pregnancy rates after IUD use were higher than those after Injectables and Implants [11,15,16]

An association between parity, number of children, and time to return to fertility was also observed in this study. An additional child reduces the time to fertility returns by 15%. This finding is consistent with research on the return on fertility across Africa [17]. The effect of the women's age on the time taken to return to fertility was also observed in this study. An increase in age was associated with a 5% increase in time until fertility returned. This is consistent with previous studies that have documented delayed fertility returns in older women [5,10,15,16].

In this study, the duration of contraceptive use was not significantly associated with an increase or decrease in time to return to fertility. This finding has also been documented in previous meta-analyses [5,15]. Other covariates, such as body mass index, weight, height, hemoglobin levels, education, wealth, and urban residence, were not associated with the time to return to fertility.

There are some limitations to consider. This study used data collected from the Rwanda Demographic and Health Survey, a robust,

standardized cross-sectional survey. However, the study's retrospective nature and reliance on self-reported information may introduce the potential for recall bias. Women who participated in DHS may not adequately remember the specific timing of contraceptive discontinuation, leading to an imprecise estimate of the time to pregnancy. This limitation could impact the validity and reliability of the findings, especially if the ability to recall varies by sociodemographic factors such as education.

Another limitation of this study lies in grouping contraceptive methods into major categories. All modern methods were categorized into Injections, Pills, Implants, and IUDs. However, each category has different formulation, dosage, and types. In Rwanda, two main types of Implants exist, Jadelle and Implanon, which last five and three years, respectively. Contraceptive pills can also be divided into oral combined pills and progesterone-only pills. The former contains two hormones, estrogen and progesterone. Different types of intrauterine devices also exist. While this simplification may facilitate analysis and interpretation, it may hide important details. An in-depth analysis that examines each singular type of contraceptive method may provide a more comprehensive understanding.

CONCLUSION

Fertility returns differ considerably between contraceptive methods. Injections were associated with delayed fertility return, while the time to return to fertility after an intrauterine device was comparable to that of condoms and traditional methods. An increase in age increases the time of return to fertility, whereas an increase in the number of children reduces the time of return to fertility.

The results of this study provide foundational evidence for return to fertility in Rwanda. There is a need to strengthen family planning counseling to combat myths and misinformation. Healthcare providers should provide personalized family planning education. Return to fertility should be discussed, especially for women above 40 years who want to become pregnant immediately after discontinuing a family planning method.

Data Access Statement: Research data supporting this publication are available from the GitHub

repository at located at <https://github.com/hirwa94/fertility-return-in-rwanda>

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of the results and the writing of the manuscript. Rwema Valens contributed in inception of the research, design and data analysis.

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