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ARTICLE

The Cause and Trend of Contraceptive Discontinuation in India: A Comprehensive Analysis Employing a Multiple Decrement Model[1]

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Abstract

The usage of contraceptives and family planning are hot issues of conversation due to the growing population. Here authors have done a comprehensive study on contraceptive discontinuation in India. This article describes the trend in contraceptive discontinuation in India and the multiple decrement concept is used to determine the probability of contraceptive discontinuation in India. Data used in this research were taken from the country's National Family and Health Survey. The contraceptive discontinuation trend reveals that from NFHS 1 to NFHS 5 there is a decline of 15.25% in contraceptive discontinuation in India. It was realized that in NFHS 1, the highest discontinuation was due to fertility-related causes, and in NFHS 5, it was due to method-related causes. The age groups where the highest discontinuation occurred were 40-49 and 25-29 in NFHS 1 and NFHS 5, respectively.

Keywords: Multiple decrements, Probability of discontinuation, Probability of continuation, Force of discontinuation, Contraceptive.

1. Introduction

At the conference of the United Nations International Conference on Population and Development (ICPD), it was declared that "all couples and individuals have the basic right to decide freely and responsibly the number and spacing of their children and to have the information, education, and means to do so" (UN, 1994) (Khan, S. (2009)). In 1952, India was the first country to introduce a family planning program primarily focusing on couples' contraception. Contraceptives are well-known as birth control because they are designed to put a stop to pregnancy.

Promoting the use of contraceptives through the family planning program has played an important role in reducing fertility in many countries. In the early stage of the family planning program implementation, its main focus was to provide knowledge and to motivate couples to adopt contraceptive methods to control birth. Birth control methods are broadly classified as traditional and modern methods. Traditional methods included periodic abstinence (of any kind), and withdrawal and

modern methods included pills, IUDs, injections, vaginal methods, condoms, female sterilization, male sterilization, and implants, etc.

Investment in family planning offers various benefits, including benefits to individuals, families, and society as a whole in terms of demographic, health, and socio-economic factors. Access to the usage of family planning services is increased, which increases child survival, lowers the number of undesired pregnancies and abortions, and enhances maternal and child health (Agrahari *et al.* 2016; Gipson *et al.* 2008; Kavanaugh and Anderson, 2013). At the social level, more people using contraception speeds up development and lessens regional inequality (Agrahari *et al.* 2016). Unintended pregnancies are largely caused by the discontinuance of contraception owing to method failure and the abandonment of contraception while in need (Cleland & Ali, 2004). When compared to women who did not suffer any violence, DWSIN was higher among women who experienced emotional violence (Upadhyay *et al.* 2022). According to the literature, factors that were significant predictors of discontinuation were age at the time of discontinuation, family size, reproductive preferences, prior method use, the contraceptive method selected, and past experience with the method (Agrahari *et al.* 2016; Ali & Cleland, 1999; Arifin, 2003; Bradley *et al.*, 2009; Curtis & Blanc, 1997; Fathonah, 1996). Inadequate counseling and a spouse who objected to the use of the method increased the likelihood that the method would be abandoned (Agrahari *et al.* 2016; Cotten *et al.*,1992). Women who stop using contraceptives for reasons like their husband's resistance, fatalistic thinking, disliking the procedure, and inconvenience should get counseling. If these women receive high-quality treatments, they are more likely to stick with the method (Agrahari *et al.* 2016). The likelihood of stopping owing to a side effect was greatest but Jain *et al.* (2021) argued that only side effects cannot decide on discontinuation as lots of women continue to employ the technique (Agrahari *et al.* 2016). Several reports/ studies in the past have focused on the levels and reasons couples discontinue the use of contraceptives. An analysis using Demographic and Health Survey (DHS) data reveals that the rate of contraception discontinuation among women is increasing (Khan, S. (2009)). Moreno and Goldman (1991) estimated the contraceptive failure rate for 15 developing nations using DHS 1986-1989 data. Samosir (1994) identified factors associated with contraceptive switching in Indonesia. Fathonah (1996) calculated various rates of contraceptives for Indonesia using the life table technique. A study conducted in the rural area of Nepal reveals that poor knowledge and misconceptions are important reasons for the low use of family planning (Sturley 1998).

Several types of contraceptive discontinuation are often studied; namely, method failure, switching, abandonment, etc. and studies have consistently found that the major reason for contraceptive discontinuation is different for different kinds of contraceptives. Based on the findings, approximately half of individuals utilizing pills, 25% of condom users, 3% of those employing older methods, and 5% of IUD users discontinue their chosen contraceptive within the initial year of adoption. Notably, condom usage diminishes with higher economic status. Factors such as age, number of children, duration of usage, type of contraceptive, religious affiliation, and intention to use contraception were strongly associated with discontinuation of contraceptive methods (Agrahari *et al.* 2016). According to Bongaarts and Bruce (1995), geographic access to services is still an issue in many areas, but the main causes of nonuse are ignorance, fear of adverse effects, and social and familial rejection. Sedgh and Hussain (2014) provided precise data on the most common excuses for nonuse, which included worries about negative consequences or health hazards and infrequent sex. According to Davis and Blake, contraceptive use and its continuation are considered as important determinants of fertility and fertility transition. Hence, the study of contraception continuation and discontinuation for different reasons has its own importance.

A multiple decrement model is an old tool widely used in human actuarial science to examine the frequency of occurrence for the cause of decrements. The multiple decrement model is an extended concept of standard mortality models. In standard mortality models, it is assumed that in a well-defined cohort, membership of a person is terminated only by a single cause i.e. death but in the multiple

decrement model, there are multiple reasons for the termination of membership. A standard mortality model answers "What is the probability that a person from a cohort will die before reaching age x", while a multiple decrement model answers, "What is the probability that a person from a cohort may die due to a certain cause before reaching age x".

If we have a well-defined cohort of professional cricket players, then in the case of the standard mortality model, death is the only event when a player stops playing while in the multiple decrement model, there are many events such as career-ending injury, or retirement, death would cause a player to stop being a member of the cohort of professional cricket players. The conventional life table shows that the probability of survivorship of an individual is subject to one undifferentiated hazard of death. In multiple decrement tables, the individual is subject to several mutually exclusive hazards such as disease, and predator parasites.

In this study, an attempt has been made to determine the trend of contraceptive discontinuation in India. Here, the authors have also introduced the concept of the multiple decrement technique to determine the probability of contraceptive discontinuation due to different causes and to find out the change in contraceptive discontinuation in major states of India from 1992-2020 and the structure of this article is as follows. The necessary data and the methodology are provided in Section 2, the study's results and discussion are provided in Section 3, the study's conclusion is provided in Section 4, and the limitation of the study is given in Section 5.

2. Materials and Methods

2.1 Data

To monitor and evaluate the success of family planning and health programs, the Government of India depends on the country's National Family Health Survey (NFHS). Five rounds of NFHS have been conducted to date. The first NFHS was conducted in 1992-1993, briefly giving family and health-related data. After that NFHS-II was conducted in 1997-98 providing more rigorous information about family planning and child health. The most recent was conducted in 2019-20. The data used in this research are obtained from all rounds of NFHS. Along with other information, NFHS also provides data on reasons for the discontinuation of contraceptive methods. Women were questioned about their "main reason for ceasing contraceptive use" in the NFHS questionnaire. In the current study, cases where women are stopped for only one reason—i.e., the causes are independent are taken into consideration.

In this study, authors have considered those causes of discontinuation (which are common causes causes of discontinuation in NFHS 5 and all other previous rounds of NFHS) by which currently married women of age group 15-49 do not intend to use any contraceptive method in the future and those causes are the fertility-related cause, method-related causes, and opposition to use-related causes. The following common sub-causes are included in above mentioned causes.

Fertility-related causes

1. Not having sex/ infrequent sex
2. Menopause/ had a hysterectomy
3. Fatalistic

Method-related causes

1. Fear of side effects

2. Lack of access/too far
3. Cost too much
4. Inconvenient to use

Opposition-related causes

1. Husband opposed
2. Other opposition

2.2 Methodology

It is apparent that there are issues underlying an attempt to deal with multiple causes of discontinuation. The multiple decrement model provides a solution to this problem. In proposing a multiple decrement model for the discontinuation of contraceptives, it is necessary to take into consideration the cause of discontinuation. Since there are many causes of discontinuation, it is common practice to look at one cause (or a combined set of specific causes) at a time. For each of the causes of discontinuation recognized in a multiple decrement model, it is possible to define a single decrement model that depends only on the particular cause of discontinuation. In this study, we depend only on a particular reason that causes decrement.

General Notations

General notations of functions used in a multiple decrement model are as follows

$q_x^{(j)}$ = Probability of discontinuation of contraceptive due to jth cause in age x.

$p_x^{(j)}$ = Probability of continuation of contraceptive due to jth cause in age x.

$p_x^{(\tau)}$ = Probability of continuation of contraceptive due to all the cause in age.

$q_x^{'(j)}$ = Net probability of discontinuation of contraceptive due to jth cause in age x.

$p_x^{'(j)}$ = Net probability of continuation of contraceptive due to jth cause in age x.

$q_x^{'(\tau)}$ = Net probability of discontinuation of contraceptive due to all causes in age x.

$p_x^{'(\tau)}$ = Net probability of continuation of contraceptive due to all causes in age x.

$d_x^{(j)}$ = Total number of discontinuations due to cause j cause at age x.

We define a general single decrement model function as follows

$$p_x^{'(j)} = \exp[-\int_0^t \mu_x^{(j)}(t)dt] \qquad (1)$$

where $p_x^{'(j)}$ is the net probability of contraceptive continuation, $\mu_x^{(j)}(s)$ is the force of decrement due to cause j, and s is time period in the interval.

The net probability of contraceptive discontinuation is given as

$$q_x^{\prime(j)} = 1 - p_x^{\prime(j)} \tag{2}$$

The net probability of contraceptive discontinuation can be calculated by

$$q_x^{\prime(j)} = 1 - (p_x^{(\tau)})^{q_x^{(j)}/q_x^{(\tau)}} \tag{3}$$

The probability of decrement due to cause j, $q_x^{(j)}$ is given as

$$q_x^{(j)} = \frac{d_x^{(a)}}{d_x^{(z)}} \tag{4}$$

where, $d_x^{(a)}$ = number of discontinuations due to a cause of age group a.

$d_x^{(z)}$ = Total number of discontinuations for all age groups

Since the causes are independent, they are additive in nature so the probability of contraceptive discontinuation due to all causes is given by

$$q_x^{(\tau)} = q_x^{(1)} + q_x^{(2)} + q_x^{(3)} + \ldots\ldots\ldots + q_x^{(j)} \tag{5}$$

Therefore, the probability of contraceptive continuation is given as

$$p_x^{(\tau)} = 1 - q_x^{(\tau)} \tag{6}$$

The force of discontinuation is obtained by

$$\mu_x^{(j)}(t) = \frac{1}{{}_n p_x^{\prime(\tau)}} {}^{d}\!/_{dn}\, {}_n q_x^{(j)}(t) \tag{7}$$

$$\mu_x^{(j)}(t) = \frac{q_x^{(j)}}{{}_n p_x^{\prime(\tau)}} \tag{8}$$

The equations mentioned above are used to calculate the net probability of contraceptive discontinuation, net probability of contraceptive continuation, probability of discontinuation, and force of contraceptive discontinuation.

3. Results and Discussion

The change in the pattern of discontinuation over time from 1992-2020 is represented in figure 1. From the figure, it can be inferred that over the period a significant shift in the percentage of contraceptive discontinuation can be seen and a similar shift can be seen in the age group of contraceptive discontinuations. In NFHS 1 and NFHS 2, the highest discontinuation occurred at age 45-49 but in other NFHSs this contraceptive discontinuation pattern was not followed and from NFHS 3 onwards the highest discontinuation is occurred at age 25-29.

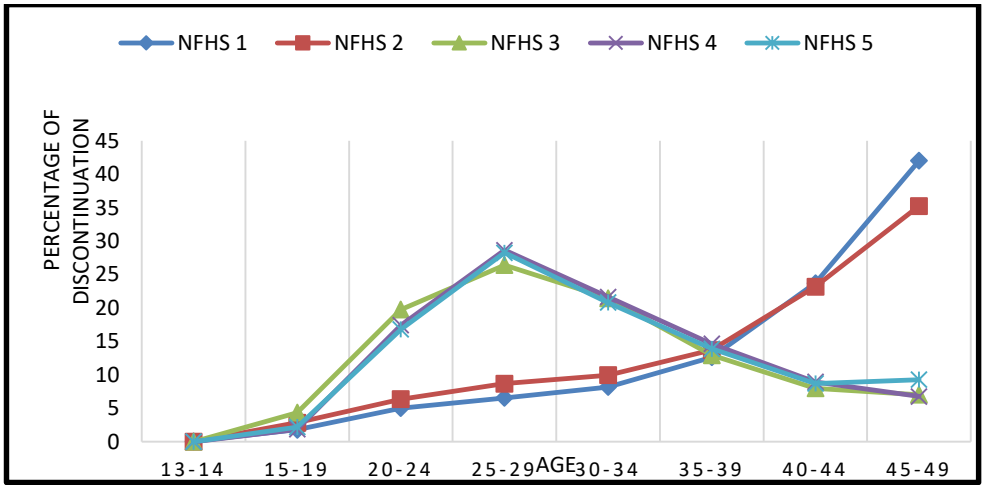


Figure 1. Age-wise Discontinuation Pattern in India.

Of all the women using contraceptives in NFHS 1, 29.40% discontinued using contraceptives whereas in NFHS 5, 14.14% of the total women discontinued using contraceptives. In NFHS 1 there was a discontinuation of 19.02% due to the three causes considered in this study. Table 1 shows, that from NFHS 1 to NFHS 5 there is an increase of 6.24% in contraceptive continuation among all women using contraceptives as total discontinuation in NFHS 5 is 25.26%. Among all the three causes when considered individually, there was a decrease of 58.88% in contraceptive discontinuation due to fertility-related causes whereas there was a 31.45% and 27.44% increase in contraceptive discontinuation due to method-related causes and opposition-related causes respectively. Hence, from NFHS 1 to NFHS 5 there is a decline of 15.25% in contraceptive discontinuation in India, which is a good sign, but it is also evident that from NFHS 4 to NFHS 5 there is a 6.14% increase in contraceptive discontinuation if this increasing pattern continues in the future, which will be a sign of concern because if this pattern continues fertility may increase in the near future.

Table 1. Discontinuation in India (in Percentage) from NFHS 1- NFHS 5

	NFHS 1	NFHS 2	NFHS 3	NFHS 4	NFHS 5
Total Discontinuation	29.40	25.15	11.32	8.005	14.14
Discontinuation due to all considered three causes	19.02	23.72	15.45	20.36	25.26
Discontinuation due to Fertility-Related Causes	65.94	62.07	11.07	6.443	7.05
Discontinuation due to Method-Related Causes	17.64	22.93	70.49	52.66	49.09
Discontinuation due to Opposition-Related Causes	16.41	14.99	18.42	40.88	43.85

Table 2 shows the overall discontinuation in India according to populations background characteristics due to all three causes considered discontinuation in NFHS 1 and NFHS 5. In urban areas there is an increase of 1.21% in women who do not intend to use contraceptives in the future and in rural

areas, women who do not intend to use contraceptives in the future increased to 7.7%. In particular, 67% of urban women who do not intend to use contraceptives in the future cited fertility-related causes in NFHS 1 while in NFHS 5 only 8% of women cited fertility-related causes. 65% of women residing in rural areas mentioned fertility-related reasons as the main reason for contraceptive discontinuation in NFHS 1, while in NFHS 5 it was only 6.7%. In urban areas, the percentage of women who do not intend to use contraceptives in the future because of method-related causes is 50.4% and 19.4% in NFHS 5 and NFHS 1 respectively and in rural area, it is 48.7% and 16.85% in NFHS 5 and NFHS 1 respectively. From NFHS 1 to NFHS 5, there was a 28% and 26% increase in contraceptive discontinuation due to opposition-related causes in urban and rural areas respectively.

From Table 2 it can be inferred that from NFHS 1 to NFHS 5, there was an increase of 6% - 8% in contraceptive discontinuation among all religions. In NFHS 1 women are more likely to not use contraceptives because of fertility-related causes and in NFHS 5 women are more likely to not use contraceptives because of method-related causes. A total of 66.4% of Hindu women discontinued contraceptives due to fertility-related causes in NFHS 1 and 6.5% in NFHS 5. Approximately 60% of Muslim women discontinued contraceptives due to fertility-related causes in NFHS 1 and 7.8% in NFHS 5. 69% of other women discontinued contraceptives due to fertility-related causes in NFHS 1 and 8.6% in NFHS 5. A sharp increase of 30%-35% can be in discontinued due to method-related causes among all religions.

Table 2. Contraceptive Discontinuation (in Percentage) in Different Background Characteristics

	NFHS1				NFHS 5			
Background Characteristics	**Fertility Related**	**Method Related**	**Opposition Related**	**Total**	**Fertility Related**	**Method Related**	**Opposition Related**	**Total**
Residence								
Urban	67.28	19.46	13.25	23.37	8.08	50.44	41.47	24.59
Rural	65.39	16.89	17.71	17.66	6.75	48.72	44.52	25.46
Religion								
Hindu	66.64	17.8	15.44	18.85	6.58	48.22	45.19	24.85
Muslim	59.52	12.55	27.91	19.08	7.83	47.78	44.38	25.85
Others	69.00	22.87	8.11	20.17	8.62	55.15	36.22	27.00
Education								
No primary	67.83	15.91	16.25	19.30	10.73	43.11	46.14	28.89
Primary	35.54	15.76	18.68	19.43	8.46	48.82	42.7	25.61
Secondary	57.84	25.38	16.76	17.09	5.58	51.82	42.59	24.53
Higher	57.26	38.46	4.27	19.37	4.04	50.51	45.44	22.11
Caste								
SC/ST	39.79	32.60	27.61	9.59	7.32	48.63	45.42	24.90
Non-SC/ST	32.85	34.30	32.85	10.03	6.63	47.77	45.60	39.01
INDIA	65.94	17.64	16.41	19.02	11.07	70.49	18.42	15.45

Table 2 reveals that the overall discontinuation due to all three causes considered increased from NFHS 1 to NFHS 5. The maximum decrease in the percentage of women who are not intended to use contraceptives in the future is for fertility-related causes for no education and primary class, whereas it can be seen in fertility-related causes a minimum decrease of 12% for women belonging to the higher class who did not intend to use contraceptives in the future indicating that women with higher education are most likely to discontinue contraceptives for any reason. From Table 2, it can be inferred that from NFHS 1 to NFHS 5, there is an increase of 15.3% in discontinuation in SC/STs and a 28.9% increase in non-SC/STs. In NFHS 1, 39% of SC/ST women and 32.85% of non-SC/ST women did not intend to use contraceptives due to fertility-related causes. 33% of SC/ST women and 34% of non-SC/ST women do

not intend to use contraceptives due to method-related causes. In NFHS 5, 7% of SC/ST women and 6.6% of non-SC/ST women did not intend to use contraceptives due to fertility-related causes. 47% of SC/ST women and 48% of non-SC/ST women do not intend to use contraceptives due to method-related causes. There is an increase of 17.8% and 12.7% in SC/STs and Non-SC/STs women who did not intended to use contraceptives in the future.

From Table 3 it can be inferred that the state for which women do not intend to use contraceptives belongs to West Bengal for NFHS 1 and for Uttar Pradesh for NFHS 5 when all three causes are considered together, but from NFHS 1 to NFHS 5 there is a 10% decrease in contraceptive discontinuation in West Bengal and a 10.67% increase in contraceptive discontinuation in Uttar Pradesh. In NFHS 1, maximum contraceptive discontinuation due to fertility-related causes is for Haryana, method-related causes for Arunachal Pradesh, and opposition-related causes is for Kerala. In NFHS 5, the maximum contraceptive discontinuation due to fertility-related causes is for Orissa, method-related causes are for Maharashtra, and opposition-related causes is for Bihar.

Table 3. Statewise Contraceptive Discontinuation (in percentage) in NFHS 1 and NFHS 5

State	NFHS1				NFHS 5			
	Fertility Related	Method Related	Opposition Related	Total	Fertility Related	Method Related	Opposition Related	Total
Gujarat	63.37	17.82	18.81	23.14	2.87	37.60	59.53	30.52
Haryana	86.59	8.54	4.88	19.43	10.66	51.33	38.01	21.85
Karnataka	60.80	14.40	24.80	20.53	2.66	50.66	46.68	31.16
Kerala	49.68	13.38	36.94	24.49	6.00	69.00	25.00	10.21
Madhya Pradesh	58.92	21.99	19.09	11.96	7.17	63.05	29.77	20.95
Maharashtra	61.02	20.34	18.64	15.58	5.40	75.23	19.37	19.34
Orissa	61.78	23.55	14.67	17.38	12.76	45.91	41.33	23.60
Rajasthan	63.74	14.04	22.22	16.84	4.56	36.72	58.71	18.07
West Bengal	69.75	13.45	16.81	30.43	12.07	57.24	30.68	20.89
Uttar Pradesh	60.21	18.10	21.69	17.03	4.07	46.84	49.10	32.36
Assam	79.07	9.88	11.05	26.54	11.63	46.55	41.82	29.41
Bihar	68.92	15.32	15.77	15.64	7.51	27.09	65.40	19.62
Arunachal Pradesh	54.55	36.36	9.09	8.64	5.40	57.81	36.79	31.40

Table 4. Net Probability of Contraceptive Discontinuation in NFHS 1 and NFHS 5

Age group	NFHS 1			NFHS5		
x	${}_nq_x'^{(1)}$	${}_nq_x'^{(2)}$	${}_nq_x'^{(3)}$	${}_nq_x'^{(1)}$	${}_nq_x'^{(2)}$	${}_nq_x'^{(3)}$
13-14	0	0.0003	0.0003	0	0	0
15-19	0.0004	0.0070	0.0105	0.0007	0.0133	0.0081
20-24	0.0006	0.0226	0.0276	0.0046	0.0896	0.0816
25-29	0.0041	0.0302	0.0324	0.0081	0.1551	0.1440
30-34	0.0146	0.0375	0.0318	0.0059	0.1133	0.1017
35-39	0.0642	0.0380	0.0293	0.0050	0.0752	0.0642
40-44	0.1903	0.0317	0.0269	0.0136	0.0401	0.0358
45-49	0.3995	0.0204	0.0143	0.0364	0.0303	0.0290

[1] Fertility-related cause, [2]Method-related Cause, [3]Opposition Related Cause

Tables 4,5,6 and 7 show the net probabilities of contraceptive discontinuation, net probability of contraceptive continuation, probability of contraceptive discontinuation, and force of contraceptive discontinuation.

Table 4 reveals that in NFHS 1, the net probability of contraceptive discontinuation is highest for a fertility-related cause which is 0.673. In NFHS 5, the net probability of contraceptive discontinuation for a fertility-related cause is 0.074. In NFHS 5, the highest net probability of contraceptive discontinuation is for the method-related causes which is 0.517 and in NFHS, the net probability of contraceptive discontinuation for method-related causes is 0.188. The lowest net probability of contraceptive discontinuation in NFHS 1 is for the opposition-related cause (0.17) and in NFHS 5 it is for the fertility-related cause (0.074).

It seems that a significant number of couples discontinued contraceptives because of fertility-related causes in NFHS 1 i.e., for every 1000 couples, 673 couples discontinued contraceptives as a result of fertility-related causes whereas this number decreased drastically in NFHS 5, and for every 1000 couples only 74 couples discontinued contraceptives. On the other hand, the number of discontinuations due to method-related causes in NFHS 1 was 188 per 1000 couples which increased to 517 per 1000 couples in NFHS 5. The number of discontinuations due to cause opposition-related causes in NFHS 1 and NFHS 5 were 173 and 464 per 1000, respectively. Table 5 shows the probability of contraceptive continuation for different causes.

Table 5. Net Probability of Contraceptive Continuation in NFHS 1 and NFHS 5

Age group	**NFHS 1**			**NFHS5**		
x	${}_n p_x^{'(1)}$	${}_n p_x^{'(2)}$	${}_n p_x^{'(3)}$	${}_n p_x^{'(1)}$	${}_n p_x^{'(2)}$	${}_n p_x^{'(3)}$
13-14	1	0.9996	0.9996	1	1	1
15-19	0.9995	0.9929	0.9894	0.9992	0.9866	0.9918
20-24	0.9993	0.9773	0.9723	0.9953	0.9103	0.9183
25-29	0.9958	0.9697	0.9675	0.9918	0.8448	0.8559
30-34	0.9853	0.9624	0.9681	0.9940	0.8866	0.8982
35-39	0.9357	0.9619	0.9706	0.9949	0.9247	0.9357
40-44	0.8096	0.9682	0.9730	0.9863	0.9598	0.9642
45-49	0.6004	0.9795	0.9856	0.9635	0.9696	0.9709

[1] Fertility-related cause, [2]Method-related Cause, [3]Opposition Related Cause

Our area of interest is the discontinuation of contraceptives and their pattern among different age groups; the results show that from 1992-2020, the contraceptive discontinuation pattern has taken a shift. In NFHS 1 the age group in which contraceptive discontinuation occurred the most was 45-49 whereas the occurrence of the most contraceptive discontinuation shifted to the 25-29 age group in NFHS 5. In NFHS 1 for the age group, 45-49 where discontinuation is maximum, the net probability of contraceptive discontinuation is 0.24, constituting 24% of total discontinuation. For NFHS 5, the net probability of contraceptive discontinuation is 0.30 constituting 31% of total discontinuation in the age group 25-29. This section of couples comprises of youthful age and maximum discontinuation in this age group leads to an increase in fertility which will eventually increase the population size of the country and affect the economic and development policies of the country. The second highest discontinuation occurs in the age group 40-44 which is 0.13 which is 13% of total contraceptive continuation due to all causes in the given period in NFHS 1 and in NFHS 5 is for the age group 30-34 which is 0.22 which is 22% of total contraceptive continuation due to all causes in the given period.

Table 6. Probability of Contraceptive Discontinuation in NFHS 1 and NFHS 5

Age	NFHS 1				NFHS5			
x	${}_nq_x^{(1)}$	${}_nq_x^{(2)}$	${}_nq_x^{(3)}$	${}_nq_x^{(\tau)}$	${}_nq_x^{(1)}$	${}_nq_x^{(2)}$	${}_nq_x^{(3)}$	${}_nq_x^{(\tau)}$
13-14	0	0.0003	0.0003	0.0007	0	0	0	0
15-19	0.0003	0.0069	0.0105	0.0179	0.0006	0.0132	0.0081	0.0220
20-24	0.0005	0.0223	0.0272	0.0501	0.0042	0.0858	0.0778	0.1679
25-29	0.0039	0.0296	0.0318	0.0655	0.0069	0.1433	0.1323	0.2827
30-34	0.0141	0.0366	0.0310	0.0818	0.0053	0.1073	0.0956	0.2082
35-39	0.0621	0.0362	0.0278	0.1262	0.0047	0.0727	0.0616	0.1391
40-44	0.1850	0.0282	0.0239	0.2372	0.0130	0.0391	0.0348	0.0870
45-49	0.39314	0.015933	0.011153	0.420235	0.035386	0.029321	0.028085	0.092791

[1] Fertility-related cause, [2]Method-related Cause, [3]Opposition Related Cause

Table 7. Force of Contraceptive Discontinuation in NFHS 1 and NFHS 5

Age	NFHS 1				NFHS5			
x	$\mu_x^{(1)}$	$\mu_x^{(2)}$	$\mu_x^{(3)}$	$\mu_x^{(\tau)}$	$\mu_x^{(1)}$	$\mu_x^{(2)}$	$\mu_x^{(3)}$	$\mu_x^{(\tau)}$
13-14	0	0.0003	0.0003	0.0007	0	0	0	0
15-19	0.0004	0.0070	0.0107	0.0182	0.0007	0.0135	0.0082	0.0225
20-24	0.0006	0.0234	0.0287	0.0528	0.0051	0.1031	0.0935	0.2018
25-29	0.0042	0.0317	0.0341	0.0701	0.0096	0.1999	0.1845	0.3941
30-34	0.0154	0.0399	0.0338	0.0891	0.0067	0.1355	0.1208	0.2631
35-39	0.0711	0.0414	0.0319	0.1445	0.0054	0.0844	0.0716	0.1615
40-44	0.2425	0.0370	0.0313	0.3109	0.0143	0.0428	0.03816	0.09537
45-49	0.67811	0.0274	0.0192	0.7248	0.039005	0.03232	0.030957	0.102282

[1] Fertility-related cause, [2]Method-related Cause, [3]Opposition Related Cause

Table 7 represents the force of mortality obtained from equation 8 and it is indicated that for the age group 45-49, the force of discontinuation is maximum i.e., 0.72 in NFHS 1 and 0.039 in NFHS 5 for the age group 25-29. The force of contraceptive discontinuation at age x+n due to cause j has a conditional interpretation. From the table, it is interpreted that due to fertility-related causes, an individual in the age group 45-49 years discontinues contraceptives with a probability of 0.67 in NFHS1, and in NFHS 5 due to method-related causes an individual in the age group discontinues contraceptives with a probability 0.199 given that they are using contraceptives before discontinuation. These results imply that the force of discontinuation and probability of contraceptive discontinuation do not deviate much.

Figure 2 and Figure 3, represent the correlation between the force of discontinuation and the probability of contraceptive discontinuation for NFHS 1 and NFHS 5 respectively. Regression analysis indicates that more than 98% of the variations observed in the force of contraceptive discontinuation is explained by the probability of decrement in both surveys. It can be seen that they are linearly positively correlated, which suggests that as the probability of contraceptive discontinuation increases, the force of contraceptive discontinuation increases.

Figure 2. The straight line between probability of discontinuation and force of contraceptive discontinuation for NFHS 1.

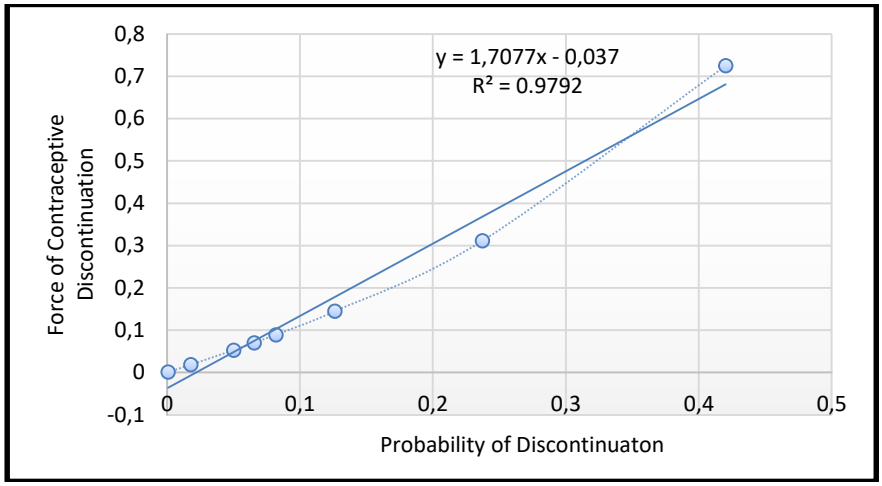
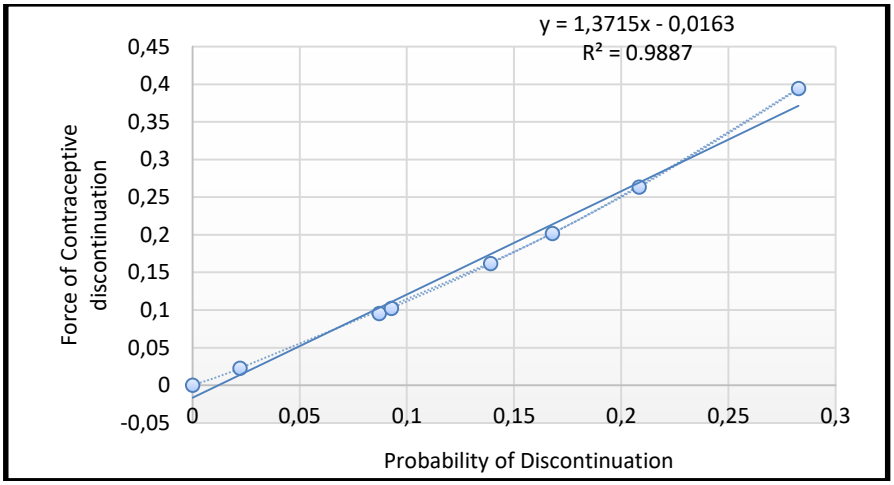


Figure 3. The straight line between probability of discontinuation and force of contraceptive discontinuation for NFHS 5.



4. Conclusions

Program managers and policymakers responsible for the development and effective implementation of family planning services need to understand why some couples do not intend to use contraception in the future. This research is an attempt to determine, India's contraceptive discontinuation pattern and different contraceptive discontinuation probabilities using the concept of the multiple decrement model. The study reveals that there is a sharp decrease in the age which contraceptives discontinuation occurs. It is also very much evident that from NFHS 1 to NFHS 5 there is a significant change in the percentage of contraceptive discontinuation. The results from this analysis indicate that in NFHS 1, the probability that women do not intend to use contraceptives due to fertility-related problems is highest but in NFHS 5 it was found that women find non-availability, inconvenience, and high cost of contraceptives to be the greatest barrier to using contraceptives in the future. In NFHS 5 women aged 25–29 are much more likely than women in other age groups to stop using contraceptives while in NFHS 1, the highest discontinuation is in the 45-49 age group. Currently, in India as a whole, approximately 71% of women do not intend to use contraception in the future due to method-related causes. India's family planning program requires special attention from states such as Uttar Pradesh, Assam, Gujrat, and Arunachal Pradesh where the proportion of women reporting contraceptive discontinuation for different reasons is relatively high. The program also needs to pay special attention to women aged 25–29 and to non-SC/ST women. This study also reveals that the probability that an individual will discontinue contraceptives at age x provided that the individual will continue using contraceptives before age x is maximum for the age group 25-29 in NFHS 5 and 45-49 in NFHS 1. This comprehensive contraceptive discontinuation study, accompanying future studies in this area can help government and program managers track family planning program progress and will also be beneficial in discovering the loopholes in program implementation. This study also reveals the major reasons for contraceptive discontinuation among couples in India and from this, policymakers can refocus efforts to reduce contraception discontinuation. More assistance is required because of some states' high contraceptive discontinuation patterns. States should be classified as hot spots or cold spots and given the appropriate priority in family planning programs and policies (Nayak *et al.* 2021). The program can gain from boosting follow-up visits and broadening counselling services provided to contraceptive users because if a woman is content with her technique, perhaps in the first few months of use, she is likely to stick with it for a longer period of time (Agrahari *et al.* 2016). With better information and encouraging campaigns and improvements in the quality of family planning programs, it will be possible for policymakers to convince a large proportion of these women to adopt contraception so that the ultimate goals such as reproductive health for all and reduced population size can be achieved.

5. Limitation

However, given how widely this method is used, certain limitations may also have an impact on the research. This approach will not be appropriately applicable if there are multiple simultaneous reasons for the decrement, i.e., the decrement is not independent. It may also yield inappropriate findings if the respondents fail to provide the suitable cause for the decrease.

Conflicts of Interest

The authors declare no conflict of interest.

Author Contributions

Conceptualization: TIWARI, A.K.; SAROJI, C.; **Data curation:** SAROJI, C. **Formal analysis:** SAROJI, C. **Funding acquisition: - Investigation:** TIWARI, A.K.; SAROJI, C. **Methodology:** TIWARI, A.K.; SAROJI, C. **Project administration:** -**Software:** - **Resources:** SAROJI, C. **Supervision:** TIWARI, A.K. **Validation:** TIWARI, A.K. **Visualization:** - **Writing - original draft:** SAROJI, C. **Writing - review and editing:** TIWARI, A.K., SAROJI, C.

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