TITLE

FERTILITY AND FAMILY PLANNING IN KENYA

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A thesis submitted in part fulfilment of the requirements for the degree of Master of Science in Population Studies at the Population Studies and Research Institute (PSRI), University of Nairobi.

(February 1982)

DECLARATION

This thesis is my original work and has never been presented for a degree in any other university.

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ACKNOWLEDGEMENTS

To complete this thesis I received help from several people at each of the many stages involved. I am now taking this opportunity to acknowledge such help. First, I would like to thank Professor S.H. Ominde, Director of the Population Studies and Research Institute, University of Nairobi, for the great effort he made to secure the scholarship which enabled me to pursue post-graduate studies at the Institute.

Some of the data needed for this research was obtained from the National Family Welfare Centre. There I am grateful to Mr. Petterson, then Head of Research and Evaluation Department, whose co-operation enabled me to obtain the data I needed.

The analytical work was carried out at the Institute of Computer Science, Chiromo Campus. There, I again received help from several people. I would particularly like to thank Mr. Mackoningo, a Systems Programmer, for his invaluable help. Also at the Institute of Computer Science, I would like to extend my thanks to Mr. Muremwa, for his assistance. My thanks also to Ms. Linda Werner of Central Bureau of Statistics for her assistance during the editing of the analytical programs.

My most profound thanks, however, are to my supervisors, Dr. Otieno, Dr. Oyuke and particularly to Dr. Mosley who guided me at each stage of my work. I would also like to thank Dr. Mosley for efforts made to secure the analytical programs from the Population Council. Both Drs. Oyuke and Otieno offered invaluable help, particularly in the mathematical aspects of the study.

I received help from several other people. It is, however, not possible to mention all by names. To them all I am also very grateful.

ABSTRACT

This study had three objectives: to assess the impact of the Kenyan Family Planning Program on fertility during 1969-1979; estimation of contraceptive users and acceptors during 1969-1979 period required to achieve the demographic goal in 1979; and estimation of acceptors and users of contraceptives during 1979-1989 required to achieve the demographic goal in 2000.

According to this study the Kenyan National Family Planning Program had some measurable effect on fertility during 1969-1979 period. The study, however, further showed that this was small and thus, fertility was not sufficiently reduced to achieve the demographic goal in 1979. Since fertility continued to rise during this period the small reduction in fertility only slowed the rate of increase of population growth rate.

To achieve the demographic goal in 1979, the study showed that the level of contraceptive use and acceptance needed between 1969 and 1978 was much higher than the actual levels during the same period. The analysis in Chapter VI shows, for instance, that in 1978, the required contraceptive acceptance rate among married women was 18.78 percent whereas the actual acceptance rate was estimated as only 3.3 percent. The required acceptance rate would, however, have been much lower (11.33 percent) if the acceptance rate of discontinuation were low. Further analysis in the same chapter shows that the level of contraceptive use in Kenya was also low [illegible] estimated that about [illegible]

percent of married women of reproductive age users would have been required in 1978. Actual use in 1978 was estimated as only 5.2 percent.

In Chapter VII, the level of contraceptive use and acceptance needed to achieve the demographic goal in 1989 was estimated. The analysis in this chapter reveal that to achieve the demographic goal both the contraceptive acceptance and use rates among married women, would need to be much higher than during the 1969-1979 decade. The analysis further shows that the acceptance rate can be reduced substantially if acceptor discontinuation rates are low.

In the concluding chapter it is recommended that the acceptors recruiting staff and supplies of contraceptives would need to be increased substantially if the program is to achieve its demographic goals. The information supplied by this study is also useful for planning at the national level.

CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Introduction

Since World War II, many countries particularly in the developing world, have been experiencing high rates of population growth. Such high growth rates retard both social and economic development. Many countries are now aware of this and have, therefore, adopted policies aimed at slowing their rates of population growth. Such policies are usually implemented through the national family planning programs. These programs provide information, supplies and services of modern methods of fertility control. The number of countries with such programs has, thus, increased in recent years.

Like many developing countries, Kenya's rate of population growth is high. In fact, the recorded growth rate of nearly 4 percent per annum for Kenya in 1979, was the highest for any country in the world (Mosley, 1980). Earlier censuses and demographic surveys reveal that the population growth rate has been high since early 1960's. The Government of Kenya has been aware of the development problems created by such a high growth rate. Thus, in 1963 after the revelation by one such survey that the population growth rate was over 3 percent per annum, the Government officially recognized the importance of family planning (World Bank, 1980). In 1967 the National Family Planning Program was, thus, established. The details of this program will be given in Chapter II.

As many countries continue to establish family planning programs designed to reduce population growth, through fertility reduction, the need to determine the extent to which these programs affect fertility has also increased. Many methods have been developed for this purpose. Such methods range from simple estimation to advanced computerized models. These will be discussed in detail in Chapter III.

One of the objectives of this study is to assess the impact of the Kenyan national family planning program on fertility during the period 1969-1979. Later the program performance, during this period, needed to achieve the demographic goal in 1979 will be examined. Finally required program effort in terms of contraceptive users and acceptors needed to achieve the demographic target at the end of the century will be estimated for the period 1979-1989. Two computerized models and some of their auxiliary programs will be utilized for the above assessment. The details of these models will be given in Chapter III.

1.2 National Family Planning Programs in Developing Countries

The number of developing countries with national family planning programs has increased since the adoption of the first such program by India in 1951. By 1970, for instance, over half of the developing countries had family planning associations (King, 1974). In 1974 the number of developing countries with such programs, run by governmental departments or volunteer agencies supported by the government had increased to 74 (Watson and Lapham, 1975).

National family planning programs have been established for various reasons in different regions of the world. In Asia,almost all programs have been established to reduce the population growth rate. Most sub-Saharan countries, on the other hand, provide family planning services mainly for health and welfare reasons. Latin America, Middle East and North African countries occupy intermediate positions. Table 1.1 below summarizes positions in different regions of the world.

TABLE 1.1 GOVERNMENT POSITIONS ON POPULATION GROWTH AND FAMILY PLANNING IN DEVELOPING COUNTRIES IN 1979

Region	Countries with official policies to reduce population growth rate	Countries supporting family planning for non-demographic reasons
North Africa	3	2
Rest of Africa	5	15
West Asia	2	2
East Asia & Oceania	11	1
Latin America	9	11
South Asia	5	0
Developing countries	35	31

Source: The Population Council map on government positions on population growth and family planning in developing countries in 1979. Population Council, New York.

Developing countries with national family planning programs for demographic reasons have continued to increase since 1960. In the 1960's twenty-two developing countries adopted policies to reduce the rate of population growth (Mauldin and Johnson-Acsa'di, 1975). As was mentioned earlier, most of such policies are implemented through family planning programs. In 1970-1973 period eight more developing countries established national family planning programs (Mauldin and Johnson-Acsa'di, 1975). Developing countries with national family planning programs aimed at fertility reduction increased to 35 in 1979 (Population Council, 1979).

1.3.1 The Factors Which Influence the Level of Contraceptive Use

As will be discussed in details later, one of the factors which influence the level of fertility in a society is the proportion of fecund women who are protected from the risk of pregnancy. The higher this proportion, the lower the fertility level is expected to be. Bogue et al., [illegible] estimated that about 34 percent of fecund women are protected in a situation where total fertility (TFR) reaches its maximum value of 8.384 live births (corresponding to a crude birth rate of 60) (Teachman, Hogan and Bogue, 1978). Almost all this protection is provided by pregnancy. This proportion may be increased substantially by the use of contraception.

Most users of contraceptives now adopt modern methods such as IUD, abortion, sterilization and oral contraceptives. (See Table 1.2). In many countries such methods are obtained through the national family planning programs. Since most of these programs have been established for demographic reasons, the level of contraceptive use is a key measure of the success of such programs.

It is estimated that about 40 percent of married women of reproductive ages (MWRA), in the world, practice some form of birth control (Nortman, 1980). This proportion reduces to one-third if allowance is made for abortion. There is, however, great variability in contraceptive use. In many developing countries the level of contraceptive use is low. At the other end of the spectrum are most developed countries and outstanding cases in developing countries such as Taiwan and Singapore. In these countries the level of contraceptive use among married women surpasses 60 percent as shown in Table 1.2

TABLE 1.2 PERCENT OF MARRIED WOMEN OF REPRODUCTIVE AGES (MWRA) USING A SPECIFIED CONTRACEPTIVE METHOD

Country and Year	All methods	IUD	Orals	Sterilization	Others
Egypt, 1975	21	9	11	0	1
Mauritius, 1978	53	2	34	0	17
Tunisia, 1979	17	6	5	6	1
India, 1979	23	1	1	20	1
Jordan, 1976	24	2	11	2	9
Korea, Republic of, '78	49	10	7	17	15
Singapore, 1978	71	3	17	22	29
Taiwan, 1979	66	27	7	16	16
Costa Rica, 1978	64	5	25	15	19
El Salvador, 1978	34	3	9	18	4
Guatemala, 1978	18	1	6	6	5
Panama, 1976	53.9	3.7	17.0	21.6	11.6
Paraguay, 1977	16	2	7	2	5
Belgium, 1975-76	87	3	32	6	46
France, 1978	79	9	31	5	34
Hungary, 1977	73	9	36	0	28
Japan, 1975	61	5	2	3	51
Netherlands, 1975	75	4	50	5	16
U.S.A., 1976	68	6	22	19	21

Source: Dorothy, L.N., 1980. Emperical Patterns of Contraceptive Use: A review of the nature and sources of data and recent findings, Table 2.

Among the factors which influence the level of contraceptive use are the acceptance level and the rate of discontinuation of use. These factors are discussed below.

1.3.2 Acceptors of Modern Contraceptive Methods

The number of acceptors choosing modern methods of contraception has increased in recent years. Table 1.3 shows that acceptors of all methods increased in most countries between 1972 and 1976. The table also shows that in some countries such as Columbia, Indonesia, India, Morocco and Bangladesh increases were substantial.

The number of acceptors by methods are also shown in Table 1.3. This shows that the number of acceptors of various methods increased in most countries. The number of oral contraceptive acceptors, for instance, increased in such countries as Ecuador, Ghana and Morocco. In some countries such as Indonesia and Bangladesh these increases were substantial. The number of acceptors, however, decreased in a few countries such as Philippines.

According to Table 1.3 the number of acceptors of IUD increased in several countries over the same period. Such countries include Taiwan and Indonesia. These increases were, however, not as high as those noted for the oral contraceptive above. In fact, Table 1.3 shows that the number of acceptors of the IUD decreased in some countries such as Thailand and Singapore.

The increase of both male and female sterilization has been a striking development in recent years (Nortman, 1980). Increase has been rapid in most countries of South, East and South-East Asia and in several Latin American countries. The increase of female sterilization in Colombia and Mexico is noteworthy.

Unlike most other methods of birth control, which are available to only one sex, sterilization is available for both sexes. However, in most countries, these services are restricted to one sex and consequently the full potential of this method is not utilized. In Taiwan, Singapore and Philippines, for instance, the number of female sterilizations exceeds those for the males by far, while in other countries such as South Korea there has been an increasing emphasis on female sterilization.

Male sterilization (vasectomy) has recently been accepted as a simple, safe and economical method of birth control in a number of countries (Oldershaw, 1975). In the U.S.A. it is estimated that more than a million vasectomies are performed annually (Oldershaw, 1975). In India about 13 million vasectomies had been performed by 1973 (Oldershaw, 1975).

TABLE 1.3 ACCEPTORS OF GOVERNMENT SUPPORTED FAMILY PLANNING SERVICES BY METHOD IN 1972 AND 1976 IN 13 DEVELOPING COUNTRIES (IN THOUSANDS)

Country and Year		All Methods	IUD	Orals	Male Steril.	Female Steril.	Abortion	Other Methods
Colombia	1972	80.4						
	1976	263.8	82.5	150.0	0.8	17.5	4.2	8.8
Costa Rica	1972	26.7	2.4	19.7	0.0	0.0	0.0	4.4
	1976	28.6	1.6	18.3	0.0	0.0	0.0	4.6
Ecuador	1972	17.4	8.3	7.2	0.0	0.0	0.0	1.9
	1976	32.2	11.3	17.1	0.0	0.0	0.0	3.9
Ghana	1972	30.5	3.2	16.1	0.0	0.0	0.0	11.2
	1976	32.0	2.8	18.3	0.0	0.0	0.0	10.8
Hong Kong	1972	30.0	0.6	23.2	0.3	0.1	0.0	7.7
	1976	54.3	1.1	34.6	0.8	0.4	0.0	25.0
India	1972	5899	355		2613	509	24.3	23980
	FY 1976	12456	563	37	6087	2019	275.1	3475
Indonesia	FY 1972	1079	380	607	0.0	0.0	0.0	92
	FY 1976	2213	400	1509	3.5	19.0	0.0	281
Bangladesh	1972	142.5	8.5	4.4	0.3	0.2	0.0	129.1
	1976	1103.1	77.9	454.7	38.6	15.3	0.0	516.5
Morocco	1972	27.5	6.3	19.3	0.0	0.0	0.0	2.9
	1976	78.0	6.0	64.0	0.0	0.0	0.0	8.0
Philippines	1972	622.0	83.0	338.0	0.0	0.0	0.0	201.0
	1976	643.0	43.1	282.0	0.0	0.0	0.0	270.0
Taiwan	1972	272.0	152.0	666.0	0.0	0.3	0.0	53.5
	1976	325.0	181.0	457.0	3.5	37.2	0.0	57.5
Singapore	1972	27.5	0.2	10.2	0.3	5.8	3.7	7.3
	1976	39.2	0.1	9.0	0.4	9.5	11.7	8.6
Thailand	1972	384.0	90.1	334.0	2.6	30.1	0.0	0.0
	1976	527.0	79.1	450.0	10.2	95.1	0.0	0.0

Source: Dorothy, L.N. and Hoffstatter, A., 1978. Population and Family Planning Programs, Ninth Edition, Table 16.

Abortion, both legal and illegal, continues to be a major method of birth control in much of the developing world. In 1974, for instance, it was estimated that about 35 million induced abortions are performed annually both legally and illegally (Thomlison, 1976). Prospects of abortion becoming a major birth control method have continued to improve as many countries legalize it. Abortion has been legalized in developing countries such as Tunisia, Singapore, India and Zambia. Illegal but otherwise safe abortion is available in a number of cities in the developing countries such as China and South Korea.

Various other contraceptive methods, including some traditional ones, are administered in some family planning programs. Table 1.3 indicates that the number of acceptors of such methods increased in many countries between 1972 and 1976.

1.3.3 The Factors which Influence the Acceptance of Contraceptives

The acceptance of contraceptives is influenced by many socio-economic factors such as manpower availability, health infrastructure, literacy levels, general level of development and other factors (Freedman and Berelson, 1976). Acceptance is also influenced by program effort (Freedman and Berelson, 1976). The effect of these factors on acceptance was illustrated by Bernard Berelson for 81 countries. Two indices, one for the program effort and the other for socio-economic setting, were used in this illustration.

The socio-economic setting index was derived by considering three socio-economic factors, infant mortality, per capita gross domestic product and female adjusted educational enrolment ratio. Thus, the 81 countries were classified into high, middle and low socio-economic classes.

The program effort index used is that which was originally developed by Lapham and Mauldin. This index is based on 15 "programmatic criteria". The 81 countries were then classified into strong, moderate and weak program effort classes.

The findings of Berelson's study are summarized in Table 1.4. According to this table both program effort and socio-economic setting influence acceptance. Acceptance rates are highest in countries of high socio-economic setting and strong program effort and lowest in countries of low socio-economic setting and weak program effort. Countries in the former category had a mean acceptance rate of 14.8 percent while countries in the latter category had a mean acceptance rate of 2.5 percent. The other countries had acceptance rates between the two extremes above as shown in Table 1.4.

1.3.4 Discontinuation of Contraceptive Use

Some acceptors of reversible methods of contraception such as the pills and IUD, discontinue use for various reasons such as desire to be pregnant or due to side effects. The rate of discontinuation of use for a method is measured by the proportion of original acceptors of that method who are still using the method at any future time. Rates of discontinuation vary with method and age of acceptor. Below, continuation rates of some methods are discussed.

TABLE 1.4 CONTRACEPTIVE ACCEPTORS AS PERCENT OF NON-USERS BY SOCIO-ECONOMIC SETTING AND PROGRAM EFFORT, 1973

Program effort	Socio-Economic Setting: High	Middle	Low
Strong	Singapore 24.6 Costa Rica 18.2 Taiwan 15.7 Hong Kong 14.9 South Kore 13.4 Jamaica 10.0 Fiji 7.0 Mean 14.8		
Moderate	Trinidad & Tobago 10.0 Chile 7.0 Mean 8.5	Philippines 11.2 Thailand 9.5 Mauritius 8.8 Sri Lanka 8.0 Columbia 7.9 Tunisia 5.2 W. Malasia 4.0 Dominican Rep. 4.0 El Salvador 4.0 Mean 7.0	Iran 10.8 Indonesia 6.3 India 2.6 Mean 6.6
Weak		Honduras 6.1 Ecuador 3.5 Mexico 3.2 Guatemala 1.7 Turkey 0.9	Egypt 3.7 The Gambia 2.2 Kenya 2.0 Ghana 2.0 Bangladesh 1.8 Morocco 1.6 Pakistan 1.0 Nigeria 0.3 Nepal 1.5 Mean 1.8
	Mean 12.7	3.1	3.0

Source: Freedman, R. and Berelson, B. The Record of Family Planning. Studies in Family Planning, Vol. 7, No. 1, Jan. 1976, Table 7.

The one year retention rates for the IUD vary over a wide range from a low 55-60 percent to a high of about 85 percent for most countries (Freedman and Berelson, 1976). Reviewing IUD continuation rates for 12 countries with recent data, Ross, et. al. ([illegible]) noted that the continuation rates for 12 months ranged between 62 and 77 per 100 acceptors (Speidel and Ravenholt, 1974).

Discontinuation rates for the pill are generally higher than for the IUD. Ross found the continuation rates for the pill to range between 55 and 62 percent at 12 months for most countries (Speidel and Ravenholt, 1974). Discontinuation rates for the other methods such as condom are comparable to that for the pill.

Rates of discontinuation also vary with age. Women in their thirties and particularly those aged over 35 years have lower discontinuation rates for the IUD. Findings on the discontinuation rates for the pill are not consistent. Westoff-Ryder's study, for instance, shows that younger women (aged less than 30 years) have lower discontinuation rates than older women (Parker and Jones, 1967). Kanitkar's study, on the other hand, shows that women aged over 35 years have the lowest discontinuation rates for 6 months (Parker and Jones, 1967).

1.4 <u>The Influence of Other Factors on Demographic Impact</u>

In addition to the level of contraceptive use several other factors such as the age of users and the effectiveness of the methods affect the program's impact on fertility. One of the factors which affects the age of user is the acceptance age. Although the age of acceptors vary from country to country (Table 1.5), acceptors tend to be generally older and to have more children than the average woman [illegible] [illegible]).

The acceptance age also varies with the contraceptive method accepted. Most acceptors of IUD, for instance, were found to be aged between 25 and 34 years in eleven countries with data (Ross, Germain, Forrest and Ginneken, 1972). In most national programs the median age is about 30 years (Ross, Germain, Forrest, Ginneken, 1972). Mean acceptance age for the pills is somewhat lower than that of the IUD. The median acceptance age for the eleven countries discussed above was found to be about 29. Acceptors of other methods such as sterilization are older than those of the two methods discussed above.

Contraceptive methods are not one hundred percent effective. Thus, some women users are still exposed to the risk of pregnancy inspite of their contraceptive use. There are two types of effectivenesses. One is the effectiveness of the method when it is used as required. This is known as theoretical effectiveness. However, few methods are used as required. Thus, in practice the effectiveness is lower. The effectiveness in this case is referred to as use-effectiveness.

Different methods of contraception have different theoretical and use-effectivenesses. The pill is the most effective reversible method of contraception (Ory, Rosenfield and Landman, 1980). This method has an average failure rate of about 2 percent a year (Ory, Rosenfield and Landman, 1980). The IUD is the next most effective reversible method.

Other contraceptive methods have higher failure rates. Analysis of ten reports published between 1938 and 1965 show rates of between 10 and 38 per hundred woman-years being quoted for coitus interruptus (Oldershaw, 1975). For the rhythm method, failure rates as low as 6 per 100 woman-years have been quoted (Oldershaw, 1975). A survey of seven series reports between 1938 and 1962 reveal wide varying pregnancy rates for the diaphragms and caps. The average of these surveys was 11.8 pregnancies per 100 woman-years (Oldershaw, 1975). The second Hull Family Survey [illegible] reported a failure rate of 3.9 pregnancies per 100 woman years for the condom (Oldershaw, 1975).

Compared with the above methods, sterilization is a more effective method of birth control. The failure rates for vasectory, for instance, is about 0.15 per 100 person years (Population Council, 1973).

Method effectiveness also varies with age. Pregnancy rates are, for instance, higher for the more fertile young women in

TABLE 1.5 ACCEPTORS OF CONTRACEPTIVES BY METHOD AND MEDIAN AGE OF WIFE FOR 23 COUNTRIES WHICH SUPPORT FAMILY PLANNING

Country & Month/Yr.	All Methods	IUD	Orals	Inject-ables	Male Sterl.	Female Sterl.	Abortion
Bangladesh 1976			31.8				
Bolivia 1976	28.8	27.2	27.8				
Brazil 1974	25.9	28.7	25.5				
Colombia 1975	26.0	26.1	24.7		33.6		
Costa Rica 1975	24.4	27.0	23.5				
Dominican Rep. 1976	24.8	26.6	23.8				
Ecuador 1974		26.9	26.5				
El-Salvador 3/1971-8/1972	26.5						
Ghana 1976	27.8	30.1	27.2				
Hong Kong 1976	25.3	32.5	24.6	38.5			
India 4/1975-3/1976		29.2			32.9	31.7	
Indonesia 10-12/'76		27.5	26.5	27.8			
Iran 9-10/1972		29.8	30.7				
Jamaica		29.3	28.0				
Korea, Rep. 1-6/'75		32.9			32.6	34.3	34.4
Malaysia Pen. 1976			24.0	31.6			
Mexico 1976		27.8	27.8	27.7			
Morocco 1969		31.7	30.6				
Nepal 1975-1976		28.7			31.2	32.3	
Philippines 7-12/1975	28.2				33.2	32.4	
Puerto Rico '74-'75	24.5	28.8	23.7				
Singapore 1976	27.3		24.5		30.3	31.3	
Sri Lanka 1973		29.0	27.0		36.4	31.8	
Thailand 1975			28.8				
Turkey 1973	28.3						

Source: Nortman, D.L. and Hoffstatter, E., 1978. Population and Family Planning Programs, Ninth Edition, Table 20.

their thirties in case of some methods. For the 31 mm. loop, pregnancy rates decrease uniformly with age from 3.1 for women under 25 years to 1.2 for women aged 35 years and over (Population Council, 1967).

Many countries with national family planning programs tend to stress not all of the methods offered, but one or two.

As a result some methods are popular in some countries and, thus widely accepted. In Malaysia, for instance, the pill is a popular method. The pill is also popular in countries such as Thailand, Kenya, Egypt and Iran. In countries such as Chile and Colombia the IUD is a popular method. Sterilization, especially vasectomy, is widely accepted in India.

Since different methods were noted to have different characteristics of discontinuation rates and effectivenesses, the adoption of different methods may thus have an independent effect on the program's impact.

1.5 The Role of Family Planning Programs in Fertility Decline

Fertility has declined in a number of countries with national family planning programs. This is illustrated in details in Table 1.6. According to this table, in some countries such as Singapore, Taiwan, South Korea, Trinidad and Tobago, Mauritius and Fiji, fertility decline was substantial.

More recent figures indicate continued fertility decline in several countries. In Hong Kong,the birth rate dropped from 18.3/1000 in 1975 to 17.7/1000 in 1977 (Lam, 1978). Total fertility rate and general fertility rate declined sharply in South Korea during the 1971-1978 period. The crude birth rate in Singapore dropped from 17.8 in 1975 to 16.6 in 1977 (Loh, 1978).

TABLE 1.6 1965 AND 1975 CRUDE BIRTH RATES AND 1965-1975 CRUDE BIRTH RATE DECLINES

Country	1965	1975	% Decline	Country	1965	1975	% Decline
Bangladesh	50	49	2	Kenya	50	50	0
Barbados	27	19	31	Korea, South	35	24	32
Chile	33	23	29	Malaysia	42	31	26
Columbia	44	33	25	Mauritius	36	26	29
Costa Rica	41	29	29	Morocco	49	48	2
Equador	45	45	0	Pakistan	48	47	1
Egypt	46	40	13	Philippines	44	36	19
Fiji	36	28	22	Singapore	29	18	40
Ghana	50	49	2	Sri Lanka	33	27	18
Guatemala	45	43	4	Trinidad & Tobago	33	23	29
Hong-Kong	28	18	36				
India	43	36	16	Tunisia	45	34	24
Indonesia	46	40	13	Turkey	41	43	16
				El Salvador	46	40	13

<u>Source</u>: W. Parker and Bernard Berelson. Conditions of Fertility Decline in Developing Countries, 1965-1975. Studies in Family Planning, Vol. 4, No. 5, May, 1978, Table 3.

In some countries part of the fertility decline is attributed to the national family planning programs. In South Korea, for instance, the IUD program is said to have expedited fertility decline. The double effort of the official program and subsidized sales of contraceptives are presumably involved in fertility decline in Fiji. Adlakha and Kirk argue that fertility decline in India accelerated after the reorganization of the national program.

1.6 Intermediate Determinants of Fertility

Fertility is determined directly by a set of factors which are referred to as the intermediate determinants of fertility. These include program factors such as contraceptive use and non-program factors such as sterility. A classification of these factors was proposed by Davis and Blake in 1956. Later Bongaarts reclassified them into three broad categories. This classification is summarized below:

I Exposure Factors

1) Proportion of married women

II Deliberate Marital Fertility Control Factors

2) Contraception

3) Induced abortion

III Natural Marital Fertility Factors

4) Lactational infecundity

5) Frequency of intercourse

6) Sterility

7) Spontaneous intra-uterine mortality

8) Duration of the fertile period

Variations in fertility result from variations in one or more of the above factors. The degree of influence of these factors on fertility differ in different societies and over time within societies. The influence of these factors on fertility is discussed below.

Marriage has for a long time been recognized by demographers as one of the principal intermediate determinant of fertility (Bongaarts, 1978). Marriage affects fertility through the number who marry, the proportion of those who stay in stable unions and the age at which they marry. Women who marry late have less time to produce and hence their fertility is lower. In Asia, for instance, TFR is low where women marry late and high where they marry early.

The effect of age at marriage on fertility is supported further by the fall in fertility in countries where age at marriage has risen. Among 26 developing countries which have experienced appreciable declines in total fertility rate, 13 of these have also experienced a rise in age at first marriage (Population Council, 1979).

Prolonged lactation is associated with longer periods of post-partum amenorrhea. This is the period of infertility following birth. In developing countries prolonged lactation is common and hence birth intervals are longer. Thus, in developing countries natural marital fertility is lower than in developed countries where prolonged lactation is not common.

The proportion of couples who are sterile is clearly an important determinant of fertility (Bongaarts, 1978). Data on sterility is, however, scarce although sterility is known to have a significant depressing effect on fertility in some developing countries.

Fertility is also influenced directly by coital frequency. Fecundity, the power to produce, has been observed to increase with coital frequency. A survey in the U.S.A. showed that fecundity increases with coital frequency (Louis, 1976).

Within marriage contraceptive use is now responsible for the wide range in the levels of fertility. In developing countries contraceptive practice is virtually absent and marital fertility relatively high. In developed countries, on the other hand, well over half of married women of reproductive ages are users of contraceptives (Bongaarts, 1978).

1.7 Indirect Determinants of Fertility

The intermediate determinants of fertility discussed above are acted upon by a host of social, economic and cultural factors. These factors are referred to as the indirect determinants of fertility because they exert their influence through the intermediate variables. Several of these factors are discussed below.

One of the factors which influences fertility is income. According to the basic version of the economic theory of fertility, income and fertility should be positively related since the higher the income the more children that can be supported. Findings on the relationship between these variables are, however, inconsistent (Thomlinson, 1976). While some fertility surveys show negative relationships, others show positive relationships

Fertility is also influenced by education of the parents. This may affect fertility in a number of ways. Education may, for instance, increase parents preference for consumption items not related to children and reduce preference for more traditional life styles which include a large family size. Education may also increase an individual's willingness to accept new products and to use new procedures more effectively. Thus, for instance, education may reduce fertility by increasing acceptance and effectiveness of contraceptives. Education also increases the woman's earning potential, hence the opportunity cost of withdrawing from the labour force in order to care for children is increased. The above considerations would, therefore, suggest that educational level attainment and fertility should be negatively related (Jonawitz, 1976).

Other considerations would, on the other hand, suggest a positive relationship between fertility and education. Educated women, for instance, have higher income potential, thus, their fertility may be higher since they can afford to support more children. Education may also affect the health of mothers, which may in turn affect fertility. Since educated women are more knowledgeable about hygiene and can afford proper diets, they may be more fecund (Jonawitz, 1976).

Previous studies have shown positive, negative and even no significant relationship between education and fertility (Jonawitz, 1976). At a cross-national level, Adelman ([illegible]), Fred Lander and Silver ([illegible]), Heer ([illegible]) and Jonawitz ([illegible]) have found a negative relationship between education and fertility (Jonawitz, 1976).

Rapid increases in the proportion living in cities have often been suggested as closely linked with fertility decline. (Central Bureau of Statistics, 1980) Rural-urban fertility differentials have been cited in support of this contention. The relationship between urbanization and fertility is, however, believed to be complex. Most authors believe that modern cities have provided a particularly favourable environment for the development of attitudes motivating family limitation. Increased costs of children in cities and their decreased economic usefulness have been mentioned as factors leading to lower fertility in cities.

Mortality affects fertility in a number of ways. Infant and child mortality affect fertility through their effect on the lactation period. A reduction in infant and child mortality, for instance, lengthens the average period of lactation which implies a longer period of post partum amenorrhea. Child and infant mortality also affects fertility through the number of surviving children desired. Thus, in high mortality areas more children would need to be born to achieve the desired number. Adult mortality may also affect fertility especially through marriages. Thus, a reduction in adult mortality may increase the number of marriages and the period of reproduction. Improvement in health conditions, which is usually accompanied by a reduction in mortality, may also affect fertility through the reduction of sub-fecundity and infertility.

Fertility may also be affected by the type of family structure. In joint families fertility is usually high.

Several reasons are advanced to explain this. First, in joint families early marriages are accepted. Secondly, children's care is usually a collective responsibility (Thomlinson, 1976). Thus, mothers may be encouraged to have more children. Children are also economically useful in joint families. This may also tend to raise fertility.

Cultural practices such as polygamy also influence fertility (Mosley, 198[illegible]). In societies where a man's social position is evaluated in terms of the number of children he has, fertility is likely to be higher. Other cultural practices may, on the other hand, constrain reproduction and hence reduce it below the biological maximum. Polygamy is one such behaviour.

The relationship between polygamy and fertility is not well researched. There are, however, several reasons why polygamy and fertility should be negatively related. First, the frequency of sexual relations should be lower on the average for polygamous women as compared to monogamous women. Secondly, polygamous couples can easily follow traditional practices by abstaining from sexual relations, for example, during extended periods of lactation. The demand for children is usually determined by the husband. Thus, on the average women in polygamous unions would be expected to have fewer children.

In other cultures spouses are separated when the woman gets pregnant. She continues staying away from her husband for some time even after delivering. This reduces coital frequency which may eventually lower fertility.

Religions are usually recognized as "populationist". Catholicism has, for instance, retarded contraceptive practice in Spain, Italy and Canada (Alfred, 1966). Both Muslim and Hindu religions are not formally opposed to certain practices restricting fertility although they object to abortion.

1.8 Conclusion

A continued mortality decline after World War II and sustained high fertility has resulted in accelerated population growth rates, particularly in the developing countries. Most of these countries, have, therefore, adopted policies aimed at slowing the population growth rates. Such policies are usually implemented through the family planning programs, hence the increase of such programs in recent years. In 1979, 35 developing countries had such programs.

The level of contraceptive use was noted to be an important factor for programs aimed at fertility control. Two factors which influence it, the discontinuation rate and the acceptance rate, were discussed. Both socio-economic factors and program effort were observed to influence the latter. This was illustrated for 81 developing countries.

Most programs offer modern methods of contraception such as pill and IUD. These methods were observed to have different discontinuation and effectiveness rates.

The pill was noted to have higher discontinuation rates than the IUD. Rates of discontinuation were observed to vary with age. It was noted that older women (aged over 35 years) have lower rates of discontinuation for the IUD. Findings on the pill were seen to be inconsistent.

The acceptance age also varies with method accepted. In most of the eleven countries discussed, it was observed that IUD acceptors are older than those for the pills. The median age for the pill was seen to be about 29 years while that for the IUD was 30 years. Acceptors of sterilization and abortion were noted to be older.

Not all of the contraceptive use averts births because methods are not one hundred percent effective. The effectiveness of various methods was discussed in Section 1.4. It was observed that the pill is the most effective reversible method of contraception while sterilization is the most effective nonreversible method. Other methods such as coitus interruptus, diaphragms and caps were noted to be less effective. Age was seen to influence effectiveness. For the IUD, failure rates were observed to decrease with age. Such different method characteristics coupled with the fact, that methods are used in different proportions, may have an independent effect on the program's overall impact.

Between 1965 and 1975, it was observed that fertility declined in a number of countries with national family planning programs. It was, however, shown later that several program and non-program factors influence fertility directly. Such factors were discussed in Section 1.6 and includes non-program factors such as proportion of married women, lactational infecundity, sterility, etc. Program factors such as contraception were also discussed.

The discussion in that section revealed that age at marriage exerts considerable influence on fertility. In Asian countries, it was noted that, TFR is lower where women marry late than where they marry early. Prolonged lactation, which is common in developing countries, was seen to lower natural marital fertility in these countries. The level of sterility was seen to have a significant depressing effect on fertility in some developing countries. Within marriage contraceptive use was observed to be responsible for the fertility differences particularly between developing and developed countries.

While the intermediate determinants of fertility influence it directly, the indirect determinants do so indirectly, through the former. Several of these factors - social, economic and cultural - were discussed. Income was one of the economic factors discussed. The findings on the relationship between income and fertility were noted to be inconsistent. Some fertility surveys, it was observed, indicate a negative relationship, while others show a positive relationship. The relationship between education and fertility was also discussed. It was noted that the relationship between the two variables is also inconsistent. At the cross-national level, several people were seen to have shown a negative relationship. Fertility was noted to be lower in urban centres.

Mortality was seen to affect fertility in a number of ways. These include: lactational period, number of surviving children, health of mothers and the number of marriages.

Various cultural factors were also seen to influence fertility. Such factors include, polygamy, family structures and separation of spouses. Religion was seen to have retarded the adoption of contraceptives in some countries.

The need to determine the extent to which family planning programs have contributed to fertility decline has increased in recent years. However, an accurate assessment would need first to eliminate the influence of the non-program factors discussed above and secondly take into account several of the program factors such as level of contraceptive use, which were also noted to influence the impact.

CHAPTER II

POPULATION GROWTH, ITS COMPONENTS, FAMILY PLANNING PROGRAM AND DETERMINANTS OF FERTILITY IN KENYA

2.1 Introduction

Kenya is now among world nations with the highest rate of population growth. Such a rapidly growing population was seen in Chapter I to retard both social and economic development. The Government of Kenya is now aware of such problems and has, therefore, taken steps to slow its rate of population growth. One such step was the introduction of the national family planning program.

Rapid population growth in Kenya has been mainly a result of recent trends in the vital rates. Mortality has, for instance, declined impressively since World War II, while fertility has, on the other hand, remained high. Thus, the population growth rate in Kenya has continued to rise. Details of population growth rate trends and those of the vital rates will be given in this chapter.

One of the objectives of the national family planning program is to reduce the rate of population growth by reducing fertility. The program has, however, not been very successful in attaining this objective. The objectives of the national family planning program and its achievements will also be examined in this chapter.

Various non-program factors - economic, social and cultural - exert a significant influence on fertility in Kenya. A discussion of such factors will be given at the end of this chapter.

2.2 Population Growth in Kenya

One method of comparing population growth is to use annual rates of population growth. Such rates are derived by using a suitable mathematical function. One mathematical function which is preferred is the exponential growth law. To derive annual growth rates this function requires populations at two different times. This function is represented below.

$$P_t = Poe^{rt} \qquad - (1)$$

where,

Po = Initial population

P_t = Population at time t

r = Rate of population growth

e = Base of the natural logarithms

Table 2.1 below summarizes annual rates of population growth derived using equation (1) and the four Kenyan censuses. According to this table population growth in Kenya has been high and has continued to be high.

TABLE 2.1 INTERCENSAL ANNUAL POPULATION GROWTH RATES IN KENYA, 1948-1979

Period	Population	Annual Rate of Population Growth (%)
1948-1962	5,406,000	3.3
1962-1969	8,638,000	3.4
1969-1979	10,943,000	3.4
1979	15,327,061	

Source: Derived using the four Kenyan censuses and equation (1).

The population of Kenya increased from about 5.4 million in 1948 to about 8.6 million in 1962. This implies an intercensal growth rate of 3.3 percent per annum during that period. The 1969 population was about 10.9 million (Central Bureau of Statistics, 1977). This indicates an intercensal annual growth rate of 3.4 percent per annum between 1962 and 1969. The 1979 population was about 15.3 million and indicates an intercensal annual growth rate of 3.4 percent per annum between 1969 and 1979.

The above results suggest that population growth rates for the 1948-1962 and 1962-1969 periods were nearly the same. This could, however, be due to the increased accuracy of the 1962 census. For the 1948-1962 period a growth rate of 2.8 percent per annum is estimated as being consistent with later figures (World Bank, 1980).

A high rate of population growth in Kenya is also suggested by data from other sources. A demographic survey in 1963, for instance, revealed that population growth in Kenya was over 3 percent per annum. In mid-1978, the population growth rate could have been as high as 3.8 percent per annum (World Bank, 1980). The population growth rate in Kenya was estimated to be about 4 percent per annum in 1979 and the highest recorded for any country in the world for that year.

2.3 Mortality: Levels and Trends in Kenya

There has been a substantial mortality decline in Kenya since 1948 according to evidence gathered from various sources.

From the censuses various mortality measures show continued mortality decline since the time of the first census in 1948. One such measure is the life expectancy at birth. This is defined as the number of years a new born child is expected to live if mortality levels implied by the age specific mortality rates, in the year under consideration, are maintained. The life expectancies at birth for the period 1948-1969 are summarized in Table 2.2 below.

TABLE 2.2 LIFE EXPECTANCY AT BIRTH IN KENYA, 1948-1969

Year	Life expectancy at birth
1948	35.47
1962	44.38
1969	47.82

Source: Anker, R. and Knowles, J.C. Mortality Differentials in Kenya at Macro and Micro Level, Table 1.

Life expectancy at birth rose from 35.47 in 1948 to 44.38 years in 1962. Between 1962 and 1969 there was a further rise in the expectation of life at birth to 47.82 years in 1969. An estimate of the female expectation of life based on Brass African Standard life table and the model life tables show that the female life expectation at birth increased from 51.2 years in 1969 to 53.8 years in 1979.

The number of children dying per mother is another measure of mortality. A comparison of such number of children from the 1962 census with the 1969 census shows that there was a decline in all the age groups as shown in Table 2.3 below.

TABLE 2.3 PROPORTION OF CHILDREN DYING BY AGE OF MOTHER, 1962 AND 1969

Age	1962	1969
15-19	0.146	0.128
20-24	0.170	0.147
25-29	0.205	0.174
30-34	0.238	0.202
35-39	0.269	0.231
40-44	0.308	0.263
45-49	0.338	0.304

Source: Central Bureau of Statistics, 1969 Population Census, Vol. IV, Table 5.2

Further evidence of mortality decline in Kenya is obtained from the Demographic Baseline Survey of 1973. Comparison of the results of the survey with corresponding figures obtained from the 1969 census for the study area indicates that the proportion of children reported as dead during the baseline survey in both schedules, is appreciably lower than those reported for 1969. This is shown in Table 2.4 below.

TABLE 2.4 PROPORTION OF CHILDREN DYING BY AGE OF MOTHER

Age	1st Jan. 1972 31st Dec. '72	1st June 1972 - 31st May '73	1st Sept. 1968 - 31st Aug. '69
15-19	.0908	.1036	0.1144
20-24	.0706	.1219	0.1332
25-29	.0848	.1430	0.1660
30-34	.0988	.1601	0.1839
35-39	.1149	.1831	0.2146
40-44	.1420	.2316	0.2494
45-49	.1657	.2534	0.2855

Source: Demographic Baseline Survey Report 1973, Central Bureau of Statistics, Ministry of Finance and Planning, July 1975, Table IV.1

2.4 Fertility: Levels and Trends

Fertility estimates based on various fertility measures show that fertility in Kenya is high and has been high in the past. On the basis of the 1948 census Blacker (1962) estimated a TFR of between 6 and 7 (World Bank, 1980). From the 1962 census TFR was estimated as 6.8 (World Bank, 1980). In 1969 TFR was estimated as 7.6 (World Bank, 1980).

Another measure of fertility is the crude birth rate (CBR). This is defined as the number of live births per 1000 persons in the population. From the 1948 census Blacker estimated a crude birth rate of 50 (World Bank, 1980). Estimates from the 1962 and 1969 censuses indicate a crude birth rate of 50 (World Bank, 1980).

More evidence concerning the fertility level in Kenya is obtained from surveys. The National Demographic Survey of 1977 gave an adjusted TFR figure of 8.1 (Central Bureau of Statistics, 1980). The Kenya Fertility Survey gave a figure of 8.1 (Central Bureau of Statistics, 1980).

Between 1962 and 1969 various fertility measures suggest an increase in the fertility level. The estimated TFR of 7.6 from the 1969 census, for instance, indicates an increase of 12 percent over the 1962 figure of 6.8.

Evidence of a fertility rise between 1962 and 1969 is supported further by the mean number of live births. Comparison of such children during 1962 and 1969 suggest an appreciable rise in the fertility level between 1962 and 1969 in all age groups except for those in the age group 15-19 as shown in Table 2.5 below.

TABLE 2.5 MEAN NUMBER OF LIVE BIRTHS PER WOMAN AND BY AGE OF MOTHER

Age	1962	1969
15-19	0.357	0.355
20-24	1.652	1.882
25-29	3.009	3.653
30-34	4.204	5.112
35-39	5.204	6.003
40-44	5.608	6.441
45-49	5.702	6.687
50-59	5.736	6.400
60+	4.780	5.778

Source: Central Bureau of Statistics. 1977. 1969 Population Census, Vol. IV, Table 4.10.

After 1969 fertility may have continued to rise. This contention is supported by comparing the age specific fertility rates of the 1969 census with those of the two schedules of the Demographic Baseline Survey of 1973. The results summarized in Table 2.6 show that fertility increased for the study area although most of the increase may be attributed to improved survey methods.

TABLE 2.6 RECORDED AGE SPECIFIC FERTILITY RATES - BASELINE SURVEY OF 1973 AND 1969 (For Study area)

Age	1st Jan. 1972 -31st Dec. '72	1st June 1972 - 31st May '73	1969
15-19	.1138	.1368	.1205
20-24	.3268	.3195	.2922
25-29	.3200	.3382	.3111
30-34	.2956	.2791	.2712
35-39	.2649	.2738	.2093
40-44	.1737	.1369	.1281
45-49	.0975	.0509	.0614
Total	7.96	7.6745	6.969

Source: Central Bureau of Statistics. 1975. Demographic Baseline Survey Report, 1973., Table III.1

2.5.1 The Kenya National Family Planning Program

Official efforts in family planning in Kenya began in the 1950's with the formation of the Family Planning Association of Kenya (FPAK). This association initiated efforts to inform people about family planning and to provide them with modern methods of birth control.

The national family planning program was launched in 1967 and integrated with Maternal and Child Health (MCH) in the Ministry of Health. The responsibility of implementing this program was given to the Ministry of Health.

2.5.2 Objectives and Achievements of the Program

During the early years the national family planning program made significant progress. Family planning services were, for instance, extended to almost all provinces of the country. By August 1969, 168 clinics had been opened in provincial, district and mission hospitals, health and welfare centres, self-help clinics and a number of private clinics run by the Family Planning Association of Kenya and mobile units (Ejiogu, 1972).

Monthly attendance increased from about 800 clients in 1968 to about 2,000 in 1969 representing an increase of about 150 percent (Ejiogu, 1972). Table 2.7 below shows the attendance during the two years for the months, January to August.

TABLE 2.7 MONTHLY ATTENDANCE TO FAMILY PLANNING CLINICS, 1968 AND 1969

Month	1968	1969	Month	1968	1969
Jan.	3	2,135	May	533	2,677
Feb.	6	1,764	June	664	2,113
March	36	1,847	July	869	2,422
April	224	1,847	Aug.	1,213	1,808

Source: Ejiogu, C.N. The Kenyan Policy and Results. Population & Economic Development in Africa, Table 51.2

Between 1969 and 1974 the number of acceptors of family planning services of birth control continued to increase. Table 2.8 below, shows that the number of acceptors nearly doubled during this period.

TABLE 2.8 ACCEPTORS OF FAMILY PLANNING SERVICES, 1969 - 1974

Year	Acceptors
1969	29,761
1970	35,136
1971	41,100
1972	45,205
1973	50,054
1974	51,446

Source: Evaluation/Research Division, National Family Welfare Centre. 1979. Evaluation of Maternal and Child Health/ Family Planning Annual Report, 1978, Annex G.

In 1969 the census confirmed earlier survey findings of high fertility in Kenya. The Government of Kenya thus appointed a senior Kenyan administrator to head the MCH-FP Unit and to draft a five-year program FY 1975-1979. This program was intended to serve as a basis for the expansion and integration of services and provide operational targets against which to measure progress.

The major constraints were identified as:

a) Lack of trained paramedical man power ;

b) Lack of institutional framework and managerial capabilities to administer the program; and

c) Lack of an adequate coverage and distribution of rural health facilities.

The five year plan proposed to alleviate the situation by:

a) Reducing the shortage of enrolled-level nursing personnel (including community nurses, who dispensed MCH-FP services);

b) Providing the institutional infrastructure and management support needed for an enlarged program of activities; and

c) Improving the availability and standard of MCH-FP where the services had already gained acceptance and at the same time gradually extending part-time mobile services to the rest of the country. Daily services were to be established at some 400 existing service delivery centers rendered by 17 mobile teams at some 190 additional clinics not staffed with full-time trained FP personnel.

This program had two main objectives: health and demographic. The health objective was to enhance the health of the mother and child. For instance, it was projected that the number of preventable disease cases were to be reduced from 16 million to 11 million by 1984. The demographic objective consisted of reducing the population annual growth rate from 3.3 percent per annum in 1975 to 3.0 percent per annum in 1979. This was to be achieved by recruiting 640,000 new acceptors who were estimated to avert some 150,000 births and provide an annual acceptance rate of 4.5 percent among married women.

During the period (1975-1979) the MCH/FP made satisfactory progress in reaching certain operational targets (see Table 2.9). For instance, 90 percent of the service delivery targets were achieved. The targets for enrolled nurses and midwives were also met.

The program also extended and improved information and educational activities. The targets for the family health field educators (FHFE) to motivate and recruit family planning acceptors were also met (see Table 2.9). An infrastructure for family planning delivery system was also established.

TABLE 2.9 TARGET, NUMBER AND PERCENT OF THE TARGET ACHIEVED DURING THE FIVE YEAR PERIOD, 1975-1979

Category	Target	Number achieved	% of target achieved
SDP's	400	364	91
NFWC	1	1	100
Community Nurse School	5	5	100
Training Health Centre	30	30	100
Training EN/M	843	897	106
FHFD	22	38	173
NT/S	162	177	109
FHFE	615	612	96
Clinical Officers	300	0	0
Matrons	70	0	0

Source: Appraisal of Evaluation and Research Activities Within MCH/FP Program during the five year period (1974-1979). Evaluation and Research Division, National Welfare Centre, Ministry of Health, Nairobi, Kenya, May 1980.

The national family planning program was, however, not very successful in attaining its demographic goals. First, the original targets were revised. The number of acceptors and births to be averted were reduced to 455,557 and 83,761, respectively (see Table 2.10). Even these revised targets were not achieved. For instance, only 45 percent of the original targets, 67 percent of the revised, were achieved. The acceptance rate did not exceed 3.4 percent of married women (World Bank, 1980).

TABLE 2.10. REVISION OF FP AND DEMOGRAPHIC TARGETS 1975 - 1979

Year	Original targets		Revised targets	
	No. of acceptors	No. of births	No. of acceptors	No. of births
1975	55,500	3,500	51,643	3,028
1976	91,500	10,948	60,621	7,948
1977	127,500	22,027	90,653	14,722
1978	168,500	40,667	114,400	23,771
1979	192,500	68,635	138,235	34,292
Total	635,500	145,777	455,557	83,261

Source: World Bank, 1980. Population and Development in Kenya. Report No. 2755-KE. A Restricted-Circulation Document, Table 7.1

A comparison of the original acceptor targets with recruited acceptors during the 1975-1979 period further shows the poor performance of the program during this period. Table 2.11 below shows that, except in 1975 when targeted acceptors nearly equalled those recruited, targeted acceptors were substantially lower than those recruited in later years.

During the current development plan (1979-1983) the prospects of expanding and improving the program are considerably brighter. The plan draws attention to the consequences of Kenya's high rate of population growth in a long term perspective. It also provides a strong statement of the

Government's intention to achieve a decline in the rate of population growth. The Government intends to strengthen the on-going MCH/FP and to undertake a new major broad based interagency information and education program to involve and inform families.

TABLE 2.11 A COMPARISON OF TARGETED AND RECRUITED ACCEPTORS, 1975-1979

Year	Original targets	Recruited acceptors
1975	55,500	53,472
1976	91,500	61,227
1977	127,500	72,647
1978	168,500	62,408
1979	192,500	59,255
Total	635,500	309,009

Source: World Bank. 1980. Population and Development in Kenya. Report No. 2755-Ke. A Restricted Document, 7.1 and Table 2.8.

According to this plan child spacing and reduction of infant mortality will continue to be major objectives of the program. The program specifically proposes that during FY 1979-1983 the number of program acceptors recruited annually will more than double present levels and the number of continuing users will increase substantially. The Government hopes that this will lead to a reduction in the rate of population growth.

2.5.3 Contraceptive Use in Kenya

The level of contraceptive use in Kenya is low. According to a contraceptive survey of 1974, for instance, only about 6 percent of the respondents replied having visited a family planning clinic during the two year period, 1973-1974 (World Bank, 1980). In 1975 the Ministry of Health estimates show that only about 2.5 percent of married women of reproductive ages (MWRA) were using contraceptives (World Bank, 1980).

Further indication of contraceptive use in Kenya is given by the number of active clients in the program. An active client is defined as one who is not more than three months late for a scheduled appointment. In 1978 there were 108,570 active clients in the program (Evaluation/Research Division National Family Welfare Centre, 1979).

According to the discussion in Chapter I the level of contraceptive use is influenced by both acceptance level and rate of discontinuation. These factors are examined below.

2.5.4 Discontinuation of Contraceptive Use in Kenya

The rate of discontinuation of contraceptive use in Kenya is high. The Ministry of Health estimated that of the women who visited a family planning clinic for the first time in 1973 approximately 35 percent discontinued their visits in a year and 70 percent within two years (World Bank, 1980).

The rate of discontinuation may also be illustrated using the acceptors of Family Planning Association of Kenya

(FPAK). Table 2.12 summarizes the one year continuation rates for the years between 1971 and 1977. Overall 48 percent of the acceptors discontinued in one year. However, the table shows wide variation in different years.

TABLE 2.12 CONTRACEPTIVE ACCEPTORS OF FPAK CLINICS RETURNING THE FOLLOWING YEAR AFTER ACCEPTANCE

Year	Acceptors	Continuing acceptors	% of continuing acceptors
1971	1,122	675	60
1972	1,376	518	35
1973	2,067	1,185	57
1974	2,625	1,086	41
1975	2,563	1,177	46
1976	3,186	1,813	51
1977	3,755	2,236	60
Total	16,694	8,690	52

Source: Research and Evaluation Unit, Family Planning Association of Kenya. 1979. Family Planning Clients Attending FPAK Clinics, Table 8.

2.5.5 Contraceptive Acceptors in Kenya, 1969-1979

The annual number of acceptors of contraceptives in Kenya are shown in Tables 2.8 and 2.11. These tables show a continued increase of acceptors up to 1977, thereafter there has been a continued decline. In 1969 there were 29,761 acceptors. These increased to 72,647 in 1977. However, in 1979 these had declined to 59,255.

The acceptance of contraceptives in Kenya is low. The annual number of acceptors, for instance, represent only a small percent of married women. In 1969 the 29,761 acceptors represented approximately 1.3 percent of married women. This proportion increased to about 1.8 percent in 1979.

2.5.6 Age of Contraceptive Users in Kenya

One factor which influences the impact of contraceptive use on fertility is the age of users. In Kenya most users of contraceptives are women aged 25 years and over. In 1978, for instance, about 61 percent of active clients were aged 25 years and over (Evaluation/Research Division, National Family Welfare Centre, 1980). Age of users may be illustrated further by considering the age of those who drop out of the program. In 1978 about 48 percent of the drop-outs were aged below 25 years (Evaluation/Research Division, National Family Welfare Centre, 1980).

Age of contraceptive users is influenced by age of acceptors as revealed by discussion in Chapter I. Thus, at constant rates of discontinuation users would tend to be young if acceptors are young. In Kenya acceptors of contraceptives are young women aged below 30 years (Evaluation/Research Division, National Family Welfare Centre, 1980). In 1980, for instance, 68 percent of the acceptors were aged under 30 years (Evaluation/Research Division, National Family Welfare Centre, 1980).

In addition to acceptance age, use is also influenced by discontinuation. In Kenya discontinuation of use is high among young women. Thus although acceptors are young, the age of users is raised.

2.5.7 Contraceptive Methods

As with programs in other countries, the popularity of methods in Kenya also differ. Most acceptors in Kenya choose the pill as shown in Table 2.13 below. Between 1972 and 1978 the table shows that over 70 percent of acceptors, during each year of this period, accepted the pill. In recent years, however, the popularity of the pill is diminishing in favour of the IUD. Between 1978 and 1979, for instance, the percent of acceptors choosing the pill decreased by 3 percent to 67, while that accepting IUD increased by 3 percent to 19 percent.

From 1969 there has been an increased demand for the injectable form of contraceptives, the Depo Provera. This method is, however, restricted to women who have five or more children and who are aged 30 years and over.

Other methods such as condom are also available. These are, however, not popular as shown below.

TABLE 2.13 PERCENT OF ACCEPTORS OF CONTRACEPTIVES CHOOSING VARIOUS METHODS, 1972-1979

Year	Depo Provera	Pill	IUD	Others
1972	6	79	11	4
1973	6	78	10	6
1974	6	80	10	4
1975	6	78	10	6
1976	5	76	12	7
1977	7	71	14	8
1978	6	70	16	8
1979	6	67	19	7

Source: Evaluation/Research Division, National Family Welfare Centre, 1979. Evaluation of Maternal and Child Health/Family Planning Annual Report, 1978. Ministry of Health: Nairobi, Kenya, Table 5.

2.6 Determinants of Fertility in Kenya

As in many other countries fertility in Kenya is influenced by several social, economic and cultural factors. The influence of these factors was investigated by Richard Anker and Jim C. Knowles in their two studies. Their findings are discussed below.

One of these studies was based on data from the 1969 census and used the district as the unit of analysis. According to this study income and fertility are significantly related positively. This study also showed that fertility is lower in urban areas in Kenya. According to this study a negative significant relationship was found between urbanization and fertility.

The other study was based on household data from a household survey conducted in 1974. This study also showed that income and fertility are positively related in Kenya, while urbanization and fertility are negatively related.

Other factors found insignificantly related to fertility at the macro level were found to be significantly related at the micro level. One such factor is female education after standard five. According to this study fertility and women's education after standard five are negatively related. Children's education as measured by the mother's educational expectation for her children is another factor which was found to be significantly related to fertility at the micro study. According to this study the two factors are positively related. Mortality and fertility were also found to be positively related in the micro study.

Some cultural practices in Kenya influence fertility. Polygamy is one such practice which has been found to have a depressing effect on fertility. According to Mosley, birth intervals are longer by about 11 percent for women in polygamous unions (Mosley, 1981).

Breast feeding too influenced fertility in Kenya. Among Mijikenda, for instance, breastfeeding approaches two years leading to almost 18 months of infecundity (Mosley, 1981). Among the Kalenjin, breastfeeding is about 16 months. This results in about 9 months of amenorrhea.

2.7 Conclusion

Kenya's rate of population growth is now one of the highest in the world. In 1979 it was almost 4 percent per annum. Two of the factors responsible for the high rate of growth were seen to be: sustained high fertility and continued mortality decline. TFR was seen to have increased from between 6 and 7 in 1948 to about 8.3 in 1979. Life expectation at birth, on the other hand, increased from 35.5 years, for both sexes, in 1948 to about 53.8 years for females in 1979. The realization of the problems created by such a rapidly growing population, by the Government, and the desire to reduce it, led to the introduction of the national family planning program in 1967.

The program was noted to have made considerable progress in extending its services during the early years. By 1969, for instance, it was seen that the number of family planning clinics had increased to 168. Between 1968 and 1969 the attendance at family planning clinics increased by about 150 percent.

However, the program was noted not to have been very successful in attaining its demographic goal. One of the reasons for this is the low level of contraceptive use in Kenya. Estimates show that only about 2.5 percent of married women were users in 1975. This low level of contraceptive use was seen to be a result of low acceptance levels and high rates of discontinuation.

Several factors which influence the program's impact on fertility were also discussed. It was noted that most contraceptive users in Kenya are women who are aged 25 years and over. Most acceptors were, however, noted to be young women aged below 30 years. The pill was seen to be the most popular method of contraception in Kenya. It was seen that between 1972 and 1978 over 70 percent of the acceptors chose the pill.

Various non-program factors were seen to have a significant influence on fertility in Kenya. Income was found to be positively related to fertility while both education after standard five and urbanization were found to be negatively related. Certain cultural practices such as polygamy and breastfeeding were also seen to influence fertility. Both these factors were seen to reduce fertility.

An accurate assessment of the impact of family planning program on fertility in Kenya would thus require one to take into account the effect of non-program factors.

CHAPTER III

METHODS FOR ASSESSING THE IMPACT OF FAMILY PLANNING PROGRAMS ON FERTILITY

3.1 Introduction

Several methods for assessing the impact of family planning programs on fertility now exist. Such methods differ in their procedures, data requirements and assumptions. Some of these are discussed below.

One of the methods used to assess the impact of the program on fertility is the standardization approach. This method proceeds in two steps. First, changes in the crude birth rate or general fertility rate are determined. The next step then determines the changes in fertility that can be accounted for by changes in marital fertility. Changes in the marital fertility rate can then be attributed to the program if there is additional evidence to do so.

The above approach requires the following data: (a) crude birth rate of the population at two points in time; (b) age sex marital status distribution of population at two points in time; (c) general fertility rates at two points in time; and (d) marital age specific fertility rates of the population at one point in time.

Standardization has several advantages. One of the major advantages is its simplicity of use and calculation.

Another advantage is that it requires data which is readily available. One of the disadvantages of the method is that it cannot be used to determine what change in marital fertility can be attributed to the program and that which can be attributed to socio-economic factors.

The impact of the program on fertility can also be assessed through trend analysis. This method assesses the impact by comparing indicators of observed fertility over a specified time with the same indicator projected over the same period (U.N., Department of Economic and Social Affairs, 1978). Such an indicator may be the crude birth rate or the number of births. The projected fertility data is assumed to represent potential fertility of the population had the program not been undertaken. The difference between the projected fertility trend with the actual fertility is thus assumed to yield an estimate of the impact of the family planning program on fertility.

Several procedures for comparing actual and projected fertility trends exist. One such procedure compares the rate of decline of fertility after the program with the rate before the program. Birth rates are plotted on a graph and the point at which the family planning program was introduced is noted. (Reynolds, 1972). An increased rate of decline in the birth rate is then taken as evidence of the program's impact.

The program's impact on fertility may also be estimated by comparing expected births with actual births. First, the actual births are plotted and the point of entry of the family planning program is noted. The expected births are then estimated. This estimate is then placed on the chart. By comparing the actual births with expected births, births averted are obtained. This is then taken as evidence of program impact. Trend analysis may be applied to the entire population or to acceptors only.

Data requirements for trend analysis consists of one of the following: (a) crude birth rate; (b) general fertility rates; (c) marital age specific fertility rates; (d) gross reproduction rates; (e) distribution of women by the number of children born (parity); and (f) age distribution of the population during the period of the program and before the start of the program (U.N. Department of Economic and Social Affairs, 1978).

A major disadvantage of the trend analysis approach is its failure to consider the influence of non-program factors on fertility. Such factors were discussed in Chapter I.

Regression analysis is also used to assess the impact of family planning programs on fertility. To determine the impact, a fertility measure is taken as the main dependent variable while socio-economic, demographic and possibly biological factors become the main independent variables

(U.N., Department of Economic and Social Affairs, 1978). Program impact is then assessed directly through the regression parameters.

A special type of regression analysis which has been used to assess the impact of family planning programs on fertility is path analysis. This approach is always based on an explicit model where all variables are ordered in a line and the direction of relationship is also explicitly stated. Also specified are the direct and indirect effects on the dependent variable. Path analysis is based on the standard multivariate regression technique and is specifically designed to assess the magnitude of indirect effects in addition to the direct effects.

The estimation of the regression parameters can be carried out through various procedures such as the ordinary least square technique. Other techniques are available if some of the assumptions associated with a particular equation model do not satisfy the least square criteria (U.N., Department of Economic and Social Affairs, 1978). These are, however, more complex.

Regression analysis can be applied to both micro and macro data. The following data is required for micro analysis: (a) one current measure of fertility other than parity (e.g. the crude birth rate); (b) measure of program input (e.g. number of clinics, number of family planning personnel) and/or other program variables that would summarize conditions prior to the date to which the measure of fertility relates; and (c) a measure of non-program variables having direct or indirect effect on fertility (e.g. percent of women in the reproductive ages married, urban-rural residence and socio-economic variables).

The following data are required for a macro analysis: (a) a current measure of fertility; (b) some program variables (e.g. acceptors by method, continuation rates by method, a measure of input); (c) some measure of non-program variables (e.g. age of acceptors or other demographic characteristics, urban-rural residence, educational level); and (d) biological variables such as foetal mortality, amenorrhea and menopause status of women.

Another method used to assess a program's impact on fertility is through the analysis of the reproductive process. This method obtains the births averted by comparing the mean duration of pregnancy interruption due to acceptors use of contraceptives with the mean duration of the expected birth interval (U.N., Department of Economic and Social Affairs, 1978).

Below, is shown a formula used for the estimation of births averted by users of IUD. This method was developed by Potter.

$$I = F(R-A-Pw) \quad - (1)$$

$$B = I/D \quad - (2)$$

where:

F = proportion of non-sterile acceptors at the time of insertion

R = mean time of retention of the device among fertile couples at the time of insertion

A = allowance for post-partum amenorrhea

P = proportion becoming pregnant while believed to retain the device

w = penalty for accidental pregnancy

B = births averted by first segment of IUD use

D = average duration per birth

The computation of R is performed using the usual life table analysis recognizing pregnancy, expulsion and removal as reasons for discontinuing use of the intra-uterine device. This was expanded to include extra competing risks of marital dissolution by death of a spouse and onset of secondary sterility (U.N., Department of Economic and Social Affairs, 1979). The expected birth interval is obtained by taking the reciprocals of the birth rates observed among IUD acceptors three years before acceptance (U.N., Department of Economic and Social Affairs, 1979).

Wolfer's method embodied the same basic logic as Potter's and estimates births averted for acceptor cohorts rather than for calendar year. A major procedural contrast is that in his approach the analysis proceeds month by month, with the various corrections, being imposed on each successive ordinal month of IUD wearing-time with cumulations of childbearing interruptions and births averted carried along (U.N., Department of Economic and Social Affairs, 1979). Another difference between Potter's approach with Wolfer's is that in the latter, duration per potential birth were estimated by means of age specific prospective birth intervals (U.N., Department of Social and Economic Affairs, 1979).

The analysis of the reproductive process requires the following data: (a) average birth interval per birth in the absence of contraceptive use; (b) proportion of couples non-sterile at the time of acceptance; (c) mean time of contraceptive use among non-sterile couples; (d) mean overlap of contraceptive use with post-partum amenorrhea; (e) estimation of IUD-terminations by age-class attributable to accidental pregnancy;and (f) estimate of mean number of fecundable months required per contraception in the absence of IUD by age. Wolfer's method requires the same data except that the estimation of potential fertility is obtained from questions related to birth intervals (United Nations, 1979).

Among the many disadvantages of this method is that it cannot be used for target setting quotas of acceptors needed to achieve a designated reduction of population birth rate or growth rates. Data demands are also heavy.

Experimental designs have also been used to assess the impact of family planning programs on fertility. This method endeavours to compare two populations. One, the "experimental group", is assumed to have undergone a treatment which in the present case is a family planning program. The other group is assumed to have the same characteristics as the experimental group except for the treatment (United Nations, 1979).

Fertility of the two groups is then recorded at one time or at several points in time. Assuming that the two groups are comparable except for the program then fertility differences between them can be considered as resulting from the program.

The following data are required for this method: (a) socio-economic variables (e.g. income, educational level, labour force participation, religion, ethnic characteristics, residence); (b) demographic variables (e.g. sex, age, marital status, parity); (c) biological variables (e.g. foetal mortality, amenorrhea); and (d) general fertility rates for both groups at the beginning and end of the observation period.

Simulation models have been developed for assessing the impact of family planning programs on fertility. In assessing the impact the usual process is to simulate the natality process of two or more populations in which one operate in the absence of a program. By comparing the resultant fertility of say two cohorts of women similar in all respects except for the practice of family planning an indication of births averted by the program may be obtained (United Nations, 1979).

Various types of simulation models for the assessment of program impact on fertility exist. One of these simulates period populations. Such models can, thus, be used to relate birth control to crude birth rates. POPREP, a general-purpose Monte Carlo micro simulator of periodic populations known as POPSIM to which a family planning module was added, is one such example. This model was developed by Lachenbruch, Sheps and Sorant in 1973 as an extension of POPSIM (United Nations, 1979).

POPREP generates the reproductive histories of a hypothetical female population of all ages. The model provides for the demographic factors of marriage, marital dissolution, remarriage and death. The biological factors included are: fecundability, various outcomes of pregnancy including induced abortion, the post-partum non-susceptible period and sterility. In addition, it provides for the use of contraceptives, surgical sterilization and induced abortion.

A stochastic model of C.J. Mode [illegible] is another model which simulates period populations. This model treats the reproductive process as a terminating non-homogeneous semi-markov renewal process, which is then embedded into a branching process to obtain the equivalent population projection (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

COMPSIM is yet another model which simulates period populations. This model uses Monte Carlo micro simulation to generate potential birth rates of users that are specific for the age of woman, her status (amovulatory or fecundable) at time of acceptance and duration for acceptance (Nortman, Potter, Kirmeyer and Bongaarts, 1978). These results are then incorporated into a component projection.

The other class of simulation models simulates cohort populations. REPSIM-B is one such example. This model simulates the detailed reproductive history of a hypothetical cohort of women aged between 15 and 50 years (U.N., Department of Economic and Social Affairs, 1979). REPSIM-B cannot, thus, be used for studying the effect of a family planning program on fertility within a particular period of time. This model provides for a woman marrying, dying, becoming sterile, becoming pregnant and varying outcomes of pregnancy including abortion. Provision is also made for the adoption of contraception or surgical sterilization. In the case of contraceptive use two different modules are provided for in the computer program - a developing country module and a developed country module. In a particular simulation only one family planning module can be used.

Two of the models required in this study obtain the impact as a product of the potential fertility of users and their effective use. The two methods on which the two models are based are discussed below in Sections 3.2 and 3.3

3.2 Couple-Years of Protection (CYP)

Couple-years of protection determines the program's impact on fertility from the data on birth control methods and acceptors (United Nations, 1979). The impact is then determined in two steps. First, the number of couples who are protected from the risk of pregnancy is determined. This then yields the couple-years of protection index. This index is calculated by estimating the length of time each couple is likely to be protected by each application of a family planning method (United Nations, 1979).

CYP index can be obtained through various methods. Wishik's prevalent index is one such method. The procedure for deriving CYP index using this method is described below.

Let "r" be the annual rate of discontinuation of contraceptive use and "a" be the proportion of acceptors who remain after the immediate drop out.

Then the couple-years of protection in the year i after acceptance per acceptor is obtained using equation (3):

$$\text{CYP per acceptor} = \int_i^{i+1} ae^{-rt}dt \qquad - (3)$$

$$= \frac{a}{r}\left[e^{-ri} - e^{-r(i+1)}\right]$$

Now the couple-years of protection in year T by acceptor in years before is given by equation (4).

Couple years of protection in year T by acceptors i years before

$$= \frac{a}{r} \left[N_{T-i} \{ e^{-ri} - e^{-r(i+1)} \} \right] \qquad - (4)$$

where N_{T-i} are the acceptors in year T-i.

The total couple-years of protection in year T is finally obtained. This is the sum of the couple-years of protection by acceptors between years T-i and T. This is summarized in equation (5) below.

Total couple-years of protection

$$= \frac{a}{r} \sum_{i=0}^{J} \left[N_{T-i} \{ e^{-ri} - e^{-r(i+1)} \} \right] \qquad - (5)$$

where J is the maximum value of i.

Couple-years of protection index in year n may also be calculated using the formula below.

$$CYP_n = b_oC_n + (b_o' I_n + b' I_{n-1} + b_2' I_{n-2}) + b_o''S_n + b_1''S_n + b_2''S_{n-2}) \quad -(6)$$

where b_o, b',S and b'',S are constants showing the number of contraceptives to be distributed to give one couple-year of protection and the rate of discontinuation.

A particular example of the formula above is shown below.

$$CYP_n = 0.01C_n + (0.75I_n + 0.50I_{n-1} + 0.35I_{n-2})$$
$$+ (S_n + 0.95S_{n-1} + 0.90S_{n-2}) \qquad - (7)$$

where:

C = Number of conventional contraceptives

I_n = Number of Intra-Uterine devices inserted

S = Sterilizations (vasectomies and tubectomies).

The coefficients are estimated on the basis of how many of each unit are required to give one couple-year of protection. Thus, for instance, 100 units of conventionals are required to give one couple-year of protection.

To obtain the births averted a simple translational equation of the form 1CYP = n births averted is used - n varies with the level of fertility.

3.3 Component Projection approach

Like the couple-years of protection approach, the component approach estimates the births averted by using acceptors as the basis of computation. To find the estimates of prevented births, estimates of users in each age group and their potential fertility are obtained. Births averted are then estimated using equation (8) below (United Nations, 1979).

Births averted by users in age group i at time t =

$$Q_{i,t} \times g_i \qquad - (8)$$

where,

$Q_{i,t}$ = Number of acceptors belonging to age group i who are practicing totally effective contraception during the period April 1 of year t-1 and April 1 of year t.

g_i = The potential fertility of women in age group i.

$Q_{i,t}$ is estimated in two steps. First, the continuation rates by age groups are applied to the number of acceptors classified by age groups at the time of acceptance. Assuming the acceptance rates are constant throughout the year, the above calculation then yields the number of users on October 1st of year t-1 as classified by age groups at the time of acceptance. Users by age group on October 1st are then calculated. This is done as below. As acceptance during the year and continuation rates in age groups are constant, the number of acceptors proceeding to the next age group is also constant. Thus, on October 1st of year t-1 the acceptors who accepted from April of year t-2 only 75 percent remain in that age group while 25 percent proceed to the next. Similarly, of those acceptors who accepted from April of year t-3, 45 percent pass to the next age group. Also, acceptors who accepted during the first 9 months of year t-1, 92.5 percent remain in the same age group while 7.5 proceed to the next (United Nations, 1979).

The total number of effective users as of October 1st of year t-1 who will be in the ith age group in year t is therefore obtained from equation (9) below.

$$Qi,t = 0.925q_{i,t-1}+0.075q_{i-1,t-1}+0.75q_{i,t-2} + 0.25q_{i-1,t-2}+0.55q_{i,t-3}+0.45q_{i-1,t-3} + 0.35q_{i,t-4}+0.65q_{i-i,t-4}+0.15q_{i,t-5} + 0.85q_{i-i,t-5}+0.95q_{i-1,t-6}+0.05q_{i-2,t-6} + \ldots\ldots \quad - (9)$$

where:

$q_{i,t-n}(n = 1,2,\ldots\ldots P)$ = Number of effective users in the ith age group who accepted in year t-n as classified at the year of acceptance.

In addition to the assumptions mentioned in the calculation of $Q_{i,t}$ the following assumptions are also made: (a) It is assumed that for the purpose of estimating users by age, the annual number of acceptors shown in service statistics relate to 1st July of that year; (b) Mortality of users between 1st of April of year t-1 and 1st of April of year t is considered negligible; (c) Acceptors are distributed evenly within the age groups.

The coefficients and the number of terms taken in formula (9) vary both with the data for which the estimated $Q_{i,t}$ is compiled and the number of years taken into account.

The data required for the estimation of $Q_{i,t}$ include: acceptors of family planning methods, age group and year of acceptance, continuation rates for each method and in each age group.

Several methods for estimating potential fertility are available. Isbister and Lee, for instance, estimated it from age specific marital fertility of acceptors. The latter were increased by 20 percent to obtain the potential fertility rates (W.H. Mosley, 1973).

3.4.1 Computerized Models

Sophisticated computerized models are now available for assessing the impact of family planning programs on fertility. These models may be classified into two classes. One class consists of target setting models. Such models translate a given demographic target into acceptor recruitment requirements. PROJTARG and TABRAP are examples of such models. The other class consists of models which translate a given contraceptive use to demographic impact. CONVERSE is one such example.

PROJTARG was developed by Bogue, et. al., in 1973. This model calculates the contraceptive protection required to achieve a specified fertility reduction. The role of some non-program factors such as women of child bearing ages who are protected from pregnancy by natural sterility or sexual inactivity, age specific marital status, mortality and migration, are considered (Teachman, Hogan and Bogue, 1978)

PROJTARG is based on a linear fertility-contraceptive function that links the proportion of fecund women who are protected to the level of the current birth rate (Teachman, Hogan and Bogue, 1978). This may be represented symbolically as below.

Observed birth rate = M - Y(P - K) - (10)

where M is the maximum birth rate which the human species is actually capable of attaining under realistic conditions.

P is the percent age of all fecund women - years of experience that are protected by all possible sources (adjusted for use-effectiveness of contraception). It ranges from 1 to 100.

k is the estimated percent age of fecund women who are protected from pregnancy and non-exposure under conditions of maximum fertility(Teachman, Hogan and Bogue, 1978).

Y is the slope of the straight line linking M and P as follows:

$$Y = \frac{M}{100-K} \qquad - (11)$$

From equations (10) and (11):

$$\text{observed birth rate} = M - \frac{M}{100-K}(P-K) \qquad - (12)$$

As was seen in Chapter I, Bogue estimates that about 34 percent of fecund women are protected in a situation where the total fertility rate reaches the maximum value of 8.384. 100 percent protection is required to reduce fertility to zero. Assuming linearity between the two values, the linear equation linking protected women and fertility becomes:

$$TRF = 12{,}700 - 127P$$

PROJTARG computes the value of P which results from the value of TFR assumed for a particular year. This value is then applied by the model to the number of fecund women it has calculated for that year, subtracts the number of women who are not exposed (unmarried or not in sexual unions) and leaves the residual number of married (i.e. sexually exposed) women who are being prevented from getting pregnant by contraception and abortion in order for the birth rates to be at the desired level (Teachman, Hogan and Bogue, 1978). For any value of P it is possible to calculate the number of woman-years of protection from pregnancy. Calculations for P are done on an age-specific basis with the value of P for women of a given age calculated on the basis of fertility rate. The above calculations can be performed for a period as long as 30 years. Parameters are specified for the initial and terminal year with linear interpolations performed for each year(Teachman, Hogan and Bogue, 1978).

PROJTARG is based on a number of assumptions. Age specific fertility rates associated with a demographic goal are assumed as uniform reductions of the initial age specific fertility rates. The relationship between fertility and fecund women is taken as the average experience of many populations. Protected women are converted into acceptors by using the mean duration of practice for each contraceptive with all years of use (less adjustment for contraceptive failure). TABRAP overcomes some of these limitations (Teachman, Hogan and Bogue, 1978).

3.4.2 TABRAP Model

Like PROJTARG, TABRAP is also computerized and provides a direct solution to the number of annual acceptors required to achieve a desired crude birth rate through a prescribed path. The original version of TABRAP was developed by Nortman in 1972 (Nortman, Potter, Kirmeyer and Bongaarts, 1978). In this model crude birth rates were specified annually and thus the acceptor quota was reduced to one equation with one unknown. In this model acceptance rates were assigned to all age groups except the age group (20-24) because of the few acceptors who were required to meet even modest declines in fertility. This group was allowed to recruit the remaining acceptors to meet the required numbe (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

In a subsequent refinement of the model the residual recruitment age group (i.e. 20-24) was replaced with a fixed pattern of relative disposition to accept among eligible women. Acceptors were recruited under the pattern set at a level adequate to meet the target. This new version was computerized as TABRAP, Target, Birth, Rate Acceptor Program.

TABRAP has three distinct phases. Phase 1 projects the female population, one year at a time in five year age groups over the target interval in accordance with the given crude birth rate path and postulated mortality trend. Two projections are made. The first projection does not take the crude birth rate target into account. The other projection takes the crude birth rate target into account (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

To obtain the first projection one proceeds as below. First the female population aged five years and over is obtained.

Let DPOPB(a,t) be the female population which at any time t consists of survivors of the female population of the standard age group a in year 1, POPD(a,1).

$t = 2, \ldots\ldots., 6$

$a = 1, \ldots\ldots\ldots\ldots..17$

Thus, for instance, DPOPB(3,2) consists of females aged 11-15 in year 2. These are the survivors of women age 10-14 in year 1.

In general DPOPD(a,t) is obtained using equation (14) below:

$$DPOPB(a,t) = DPOPB(a,1)\exp\left[\frac{t-1}{5}\ \ln s(a)\right] \qquad - (14)$$

where, s(a) is the probability of surviving from age group a to age group a+1.

The female population in the standard age group during each year t, POPD(a,t) is next obtained. POPD(a,t) is obtained by interpolating linearly between DPOPB(a,t) and DPOPB(a-1,t). This is shown in equation (15) below.

$$POPD(a,t) = \frac{6-t}{5}\ DPOPB(a,t) + \frac{t-1}{5}\ DPOPB(a-1,t) \qquad - (15)$$

$a = 2, \ldots\ldots., 16$ and $t = 2, \ldots\ldots, 6.$

The females aged 80 years and over are obtained using equation (16) below:

$$POPD(17,t) = DPOPB(17,t) + \frac{t-1}{5}\ DPOPB(16,t) \qquad - (16)$$

To complete the female population projection, POPD(1,t) (i.e. female population in the age group 0-4 at any time t) is calculated.

POPD(1,t) consists of three subgroups:

a) The survivors of DPOPB(1,1) who remain under five years in time t. This is obtained from equation (17) below

$$DPOPB(1,t) = \frac{6-t}{5} DPOPB(1,1) \qquad - (17)$$

b) The survivors of the female births after the start of the five year cycle but before t-1 (i.e. female age 2-4 years at time t). These are calculated using equation (18) below (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

$$\text{Females aged 2-4 years at time t} = \frac{BC(t-k)+BC(t-k-1)}{2} \exp\left(\frac{t-1}{5}\right) \ln\left(\frac{{}_4L_1}{4}\right) \qquad - (18)$$

c) Survivors of the births in the past year between mid year t-1 and t (i.e. infants less than one year old at time t). This calculation is summarized in equation (19) below (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

$$\text{Infant girls less than 1 year} = \frac{BC(t) + BC(t-1)}{2} \; {}_1L_0 \qquad - (19)$$

Since BC(t), the number of female girls, is unknown it is obtained first from equation (20) below.

$$BC(t) = \frac{BE(t)}{1+SR} \qquad - (20)$$

where BE(t) is the total births and SR, sex ratio.

BE(t) is obtained from equation (21) below.

$$B^{-}(t) = \sum_a FERM(a) \; PERM(a) \quad POPD(a,t)$$

$$= \sum_a FER(a) \; POPD(a,t) \qquad - (21)$$

where:

FERM(a) is the age specific marital fertility rates of women in age group a

PERM(a) is the proportion of married females in age group a

POPD(a,t) is the female population in age group a at time t

FER(a) is the age-specific fertility rates in age group a

From equations (17,), (18) and (20) we get:

$$POPD(1,t) = \frac{6-t}{5} DPOPB(1,1) + \sum_{k=1}^{t-2} BC(t-k)+BC(t-k-1) \exp\left[\frac{t-1}{5} \ln\left(\frac{4^{L}1}{4}\right)\right]$$

$$+ \frac{BC(t) \quad +BC(t-1) \quad 1^{L}0}{2} \qquad - (22)$$

$t = 2, \ldots\ldots, 6$

The female population is next projected by taking the crude birth target into account. This projection applies the targeted crude birth rate, CBR(t), to find the allowed births, BTAR(t), during each year of the projection (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

By definition,

$$CBR(t) = \frac{BC_{L}(t)}{\sum_{a=2}^{17} POPD(a,t) + POPD(1,t)} \qquad - (23)$$

where

$BC_{L}(t)$ are the female births allowed.

From equations (22) and (23) $BC_{L}(t)$ is obtained:

$$BC_L(t) = CBR(t)\frac{\sum_{a=2}^{17} POPD(a,t) + \frac{6-t}{5}DPOPB(1,1)}{1-0.5CBR(t)\,{}_1L_0}$$

$$+ \frac{\sum_{k=1}^{t-2} \frac{BC(t-k) + BC(t-k-1)}{2} \exp\left(\frac{t-1}{5}\ln \frac{{}_4L_1}{5}\right) + \frac{BC(t-1)\;{}_1L_0}{2}}{1-0.5CBR(t)\,{}_1L_0} \qquad - (24)$$

$t=2, \ldots\ldots, 6$

Given a sex ratio SR at birth, allowed births at year t are calculated as below:

$$BTAR(t) = (1+SR)BC_L(t) \qquad - (25)$$

A ten year projection is obtained by extending the five year projection. This is done by using the five year projected population as the base and subjecting it to a further five year projection.

The number of births to be averted in year t, BTABA(t) is the difference between allowed births in that year and total births. Thus, using equations (20) and (25) we get:

$$BTBA(t) = BE(t) - BTAR(t) \qquad - (26)$$

To find the number of acceptors required to avert the births in equation (26), births averted per acceptor are obtained first. This is phase II of TABRAP.

Births averted per acceptor requires the use per acceptor and the potential fertility nine months later. First, use per acceptor, U(a,i), in age group a in year i is derived using equation (27) below (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

$$U(a,i) = \int_{i-1.25}^{i-0.25} RETA(a)\, e^{-RETR(a)t}\, dt$$

$$= \frac{RETA(a)}{RETR(a)} \left[e^{-RETR(a)(i-1.25)} - e^{-RETR(a)(i-0.25)} \right] \qquad - (27)$$

for i = 1, 2, 3, ...

When i = 1 the lower limit of integration is ⁻20, the overlap of use with post partum amenorrhea.

RETA(a) = popportion of users who do not discontinue use immediately in age group a.

RETR(a) is the annual rate of discontinuation in age group a.

U(a,i) is obtained 9 months before the calendar year so as to properly time averted births.

Potential fertility of users is obtained from the age specific natural marital fertility rates, C(a), under the assumption that all acceptors are non-sterile (ie-fecund) at the time of acceptance. Appropriate allowance for acceptor ageing while using is also made. Potential fertility is obtained from equations(28-a) and 28-b) below (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

$$F(a,i) = \frac{iC(a+i)}{5FECU(a)} + \frac{(5-i)C(a)}{5FECU(a)} \qquad - (28\text{-}a)$$

$1 \leq i \leq 5$

and

$$F(a,i) = \frac{(i-5)\ c(a+2)}{5FECU(a)} + \frac{(10-i)\ C(a+1)}{5FECU(a)} \text{ for } 6 \leq i \leq 10 \quad - (28\text{-b})$$

where:

F(a,i) = Potential fertility of acceptors in age group a at time i

C(a,i) = Age specific fertility rates

FECU(a) = Proportion of non-sterile women in age group a.

From equations (27), (28-a) and (28-b), births averted by each acceptor in age group a at year i, BAV(a,i) is obtained by using equation (29) (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

$$BAV(a,i) = U(a,i)\ F(a,i) \quad - (29)$$

The number of acceptors in each age group each year t required to meet the target is finally obtained.

To find the number of acceptors in each age group required to meet the target in year t we first obtain the births to be averted by each acceptor, BAVAV(t+1) and the births to be averted by all acceptors ETBAV(t+1), in year t+1.

The first step in finding BAVAV(t+1) is to calculate the relative disposition to accept ACP(a) for each age group a. This is defined as the proportion of acceptors in each age group if all the age groups have the same number of eligible women. ACP(a) is obtained from equation (30) below. (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

$$ACP(a) = \frac{\frac{ACPDS(a)}{EL(a,1)}}{\sum_a \frac{ACPDS(a)}{EL(a,1)}} \quad - (30)$$

where ACPDS(a) is the expected distribution of acceptors in year 1 and EL(a,1) is the number of eligibles in year 1 in age group a.

Using ACP(a) above the proportion of acceptors in each age group is then obtained.

$$PROPØ(a,t) = \frac{ACP(a)\ EL(a,t)}{\sum_a ACP(a)\ EL(a,t)} \qquad - (31)$$

where:

PROP(a,t) is the proportion of acceptors in age group a at time t

EL(a,t) is the number of eligible women in age group a at time t.

The births averted per acceptor BAVAV(t+1) is obtained using equation (32) below:

$$BAVAV(t+1) = \sum_a PROP(a,t)\ BAV(a,i) \qquad - (32)$$

We next find the number of births to be averted by acceptors in year t+1. The births to be averted in year t+1 consist of those averted by acceptors in year t and by acceptors before year t. Let ABA(t+1) be births averted by acceptors who accepted before year t. Then,

$$ABA(t+1) = \sum_a \sum_{i=2}^{t-1} AAC(a,t-i+1)\ BAV(a,i) \qquad - (33)$$

where AAC(a,t-i+1) is the acceptors in year t-i+1 in age group a.

Then, births to be averted in year (t+1) by acceptors in year t is the difference of all births to be averted in year t+1, BTBA(t+1), and those to be averted by acceptor before year t, ABA(t+1).

$$ETBAV(t+1) = BTBA(t+1) - ABA(t+1) \qquad - (34)$$

BTBA(t) is obtained from equation (26) while ABA(t+1) is obtained from equation (33).

From equations (32) and (34) we get the total number of acceptors, AACT(t) as shown in equation (35) below.

$$AACT(t) = \frac{ETBAV(t+1)}{BAVAV(t+1)} \qquad - (35)$$

Equation (36) then gives acceptors in each age group AAC(a,t).

$$AAC(a,t) = PROP(a,t)\ AACT(t) \qquad - (36)$$

3.4.3 CONVERSE Model

CONVERSE like TABRAP has three phases. Phase 1 projects the female population without considering the influence of contraceptive use. The other projection considers the influence of contraceptive use. The first projection is the same as in TABRAP(Nortman, Potter, Kirmeyer and Bongaarts, 1978).

Projection in the presence of contraceptive use requires the estimation of births averted by the acceptors during the period of projection. First, the births averted by each acceptor is obtained. This is then multiplied by the number of acceptors in each age group to find the number of births averted in that age group. Summing over all the age groups then gives the births averted.

The number of births to be averted by each acceptor in each age group, BAV(a,i) in year i is calculated as in

TABRAP. The number of acceptors in each age group is estimated using the proportion of acceptors in each age group and one of the six input options of the acceptors as described below.

The proportion of acceptors in each age group in year t PROP(a,t), is obtained using equation (31). If the total number of acceptors in each year is given then, AAC(a,t), acceptors in each age group is obtained using equation (37) below.

$$AAC(a,t) = PROP(a,t)\ AACT(t) \qquad - (37)$$

If the proportion of married acceptors ACM(t) is given, then AAC(a,t) is obtained as below:

$$AAC(a,t) = PROP(a,t)\ ACM(t) \sum PM(a,t) \qquad - (38)$$

where PM(a,t) is the number of married women in each age group in year t.

If acceptors are given as proportion of eligible women, then AAC(a,t) is obtained from equation (39).

$$AAC(a,t) = PROP(a,t)\ AC(a,t)\ EL(a,t) \qquad - (39)$$

where:

AC(a,t) is the proportion of eligible women in age group a in year t.

If the proportion of women in each age group accepting ASAR(a,t) is given, then, AAC(a,t) is obtained as below.

$$AAC(a,t) = ASAR(a,t)\ POPD(a,t) \qquad - (40).$$

Finally if the proportion of married women accepting is given then equation (41) below is used to find the acceptors in each age group in year t.

$$AAC(a,t) = APOC(a,t)\ PM(a,t) \qquad - (41)$$

where APOC(a,t) is the proportion of married women accepting at time t.

In this study the number of acceptors in each age group will be obtained using the first option.

The total number of averted births in year t by acceptors in age group a at time t, BTA(a,t) is then obtained using equation (42) below:

$$= \sum_{i=1}^{5}\left[\frac{5-C}{5} AAC(a,t-i)BAV(a,i) + \frac{i}{5}AAC(a-1,t-i)BAV(a-1,i)\right]$$
$$+\sum_{i=6}^{10} AAC(a-1,t-i)BAV(a-1,i)+\frac{i-5}{6} AAC(a-2,t-i)BAV(a-2,i) \qquad - (42)$$

In the absence of contraception, the number of births to women in age group a at time t equals FER(a,t) POPD(a,t). In the presence of contraceptive use women have BTA(a,t) fewer births. So the age specific fertility rates become:

$$PFER(a,t) = \frac{FER(a,t)\ POPB(a,t)\ -\ BTA(a,t)}{POPD(a,t)} \qquad - (43)$$

for $1 \leq t \leq 11$.

By using the reduced age specific fertility rate a new population projection is made in the presence of contraception.

A simplifying assumption in both TABRAP and CONVERSE that facilitates algebra is that family planning program acceptors enter the program simultaneously at mid-year. (Nortman, Potter, Kirmeyer and Bongaarts, 1978).

3.4.4 Auxiliary Programs

A number of auxiliary programs have been added both to TABRAP and CONVERSE. These have two uses. Three of these have been designed to facilitate the data adjustment process. The other five are used to facilitate further analysis. In this study only one of the auxiliary programs, CONTINUE, was utilized. This was used to calculate RETA(a) and RETR(a) required as input by both CONVERSE and TABRAP.

3.4.5 Conclusion

Various methods for assessing the impact of family planning programs on fertility were discussed in this chapter. These methods were seen to differ both in their procedures and assumptions. Standardization assesses the impact by determining the changes in fertility which can be attributed to changes in marital fertility which can in turn be attributed to the program. Trend analysis assesses the impact by comparing actual fertility trends with projected trends. This can be done by comparing crude birth rates or births. The regression analysis assesses the impact directly from the regression parameters. One way of estimating these is to use the least square technique. This method can be applied to both micro and macro data. Another method of assessing the impact is through the analysis of the reproductive processes. The impact is obtained by comparing the expected birth intervals in the absence of contraceptive use with actual birth intervals.

Two methods, one due to Potter and the other due to Wolfers, were discussed. The impact of family planning programs on fertility can also be assessed through experimental designs. This method compares the fertility of a "control" group and an experimental group. Simulation models, for assessing the impact of programs on fertility, have also been developed. Two classes of these models were discussed. One class was seen to generate periodic populations. This class includes models such as POPREP and a stochastic model due to C.J. Mode. The other class of simulation models discussed, is that which generated cohort populations. REPSIM-B is one example of these models. Couple-years of protection determines the impact by first obtaining use per acceptor. This is then multiplied with acceptors to determine couple-years of protection from all acceptors. This is then eventually converted to estimates of prevented births as described in Section 3.2. The component projection approach determines impact by converting use in each age group to prevented births. This is done by estimating users in each age group and then multiplying it with their estimated potential fertility.

The two models required in this study, TABRAP and CONVERSE, were discussed in the section on computerized models. Two classes of these models were distinguished. The first class consists of models used for target setting. PROJTARG and TABRAP were seen to be examples of such models. The other class includes models such as CONVERSE which translates given contraceptive use to demographic impact.

Advantages and disadvantages of the different assessment methods were also discussed. The standardization approach has the advantage of being simple to use and also requiring readily available data. Trend analysis like the standardization approach does not require a lot of data. The experimental designs, simulation models and computerized models have the advantage of giving more accurate results of the impact.

Among the disadvantages of some methods, is their failure to take into account the influence of non-program factors. Trend analysis is one such example. This method assumes that changes in fertility are only due to the program. The standardization approach cannot be used to determine what changes in marital fertility can be attributed to the program. The experimental design has the disadvantage of being difficult to set. Simulation and computerized models have the disadvantage of needing a lot of data which is usually not available.

The choice of both TAPRAB and CONVERSE in this study was influenced by factors such as the objectives of the study, the accuracy of the models and the availability of data.

CHAPTER IV

DATA REQUIREMENTS AND METHODS OF COLLECTION

4.1 Introduction

In this study both demographic and family planning program data were required. The former were mainly obtained from 1969 and 1979 censuses or estimated from these censuses. Most of the family planning program data were obtained from the National Family Welfare Centre annual reports and the Chogoria Family Planning Program. Some demographic and family planning program data were, however, not available. Estimates of such data were made using demographic techniques and the available data. Sources of the data or estimating procedures are also given.

4.2 Summary of the Required Data

The following demographic data will be required:

a) Length of projection or assessment period;

b) The female population size and its age structure;

c) Age specific marital fertility rates at the start of the projection or assessment period and estimated period;

e) Female crude birth rate in the initial year of assessment (specification of the desired female crude birth rate is required during each year in case of projection);

f) Female life expectancy at birth and its changes over the assessment or projection period;

g) Specification of one of Coale-Demeny model life tables;

h) Sex ratio at birth in the initial year of assessment or projection period; and

i) Female crude death rate at the initial year of the projection period.

The following family planning program data will also be required:

a) Number of family planning program contraceptive methods and a specification of whether abortion is one of the methods;

b) The overlap of use for each method with the period of post-partum amenorrhea;

c) The age distribution of acceptors for each method at the initial year of assessment or projection period;

d) The annual rate of discontinuation of contraceptive use for each method and in each age group;

e) The proportion of each method accepted during each year of the assessment or projection period;

f) The annual number of acceptors during each year of the assessment period;

g) The number of users of each method during the initial year of the assessment or projection period; and the

h) Proportion of users among married women in each age group of MWRA.

4.3.1 Period of Assessment of Family Planning Program on Fertility

The impact of the national family planning program on fertility will be assessed for the period 1969-1979. Several reasons have led to the choice of this period. One of the reasons is to solve the demographic data problem. By choosing this period the demographic data required will be obtained from the 1969 and 1979 censuses.

The other reason is due to the limitations of the models. "CONVERSE" and "TABRAP", the assessing models, have a projection limitation of 10 years.

4.3.2 Projection Period

As was stated in Chapter I, one other objective of this study will be the estimation of users and acceptors required to achieve the demographic goal in 2000. This will be done for the period 1979-1989. The choice of this period was partly to solve the demographic data problem and is also due to the limitations of the models. Most of the required demographic data will be obtained from the 1979 census. TABRAP, the model required for this estimation, has a maximum projection period of 10 years as mentioned in the last section.

4.3.3 Female Population Size and the Age Structure in 1969

The initial year for assessing the impact of the program on fertility is 1969. Thus, the female population size and its age structure is required for this year. This was obtained directly from the 1969 census. However, the models require that the population distribution be specified up to 80 years and over. Since from the census this is specified only up to 70 years and over, estimates for the three remaining age groups were made. These were estimated by assuming that the population sizes in these age groups decrease at the constant ratio of the populations in age groups (60-64) and (65-69). Table 4.1 below summarizes the estimated age distribution.

TABLE 4.1 FEMALE POPULATION SIZE AND AGE STRUCTURE IN 1969

Age	Fem. Pop.	Percent	Age	Fem. Pop.	Percent
0-4	1,046,380	19.16	40-44	201,936	3.70
5-9	893,559	16.36	45-49	163,852	3.00
10-14	663,808	12.16	50-54	139,072	2.55
15-19	544,847	9.98	55-59	102,235	1.87
20-24	450,096	8.24	60-64	94,508	1.73
25-29	411,245	7.53	65-69	63,307	1.16
30-34	229,241	5.48	70-74	43,683	0.80
35-39	264,819	4.85	75-79	27,302	0.50
			80+	5,460,324	-

Source: Central Bureau of Statistics. 1977. 1969. Population Census, Vol. IV, Analytical Report.

4.3.4 Female Population Size in 1979

The female population in 1979 was obtained from the 1979 census. Newton's formula was then used to adjust its age structure. To adjust the population in a particular age group, population in six age groups is required. Newton's formula then adjusts the population sizes in the two middle age groups. This formula is given below:

$$f_{na} = \frac{1}{2}\left[f_n + \frac{1}{8}(f_{n-1} - f_{n+1})\right] \qquad - (1)$$

where f_{na} is the size of the first of the two middle age groups.

f_n is the sum of the two middle age groups

f_{n-1} is the sum of the first two age groups

f_{n+1} is the sum of the two last age groups.

The last few age groups are not possible to adjust using Newton"s formula. These were, thus, left unadjusted. Table 4.2 below summarizes the adjusted population.

TABLE 4.2 FEMALE POPULATION SIZE AND AGE STRUCTURE IN 1979

Age	Fem. Pop.	Percent	Age	Fem. Pop	Percent
0-4	1,421,385	18.44	45-49	221,965	2.88
5-9	1,244,749	16.15	50-54	191,022	2.47
10-14	1,023,839	13.29	55-59	134,554	1.74
15-19	887,722	11.52	60-64	109,518	1.42
20-24	868,003	8.90	65-69	83,221	1.11
25-29	541,261	7.02	70-74	62,539	0.81
30-34	412,691	5.35	75-79	45,466	0.59
35-39	325,369	4.22	80+	40,842	0.53
Total				7,706,075	99.99

Source: Adjusted from 1979 Census as described in this section.

4.3.5 Age Specific Marital Fertility Rates During 1969-1979 Period

Age specific marital fertility rates in 1969 were obtained from the age specific fertility rates. The former were then obtained by dividing the age specific fertility rates with the proportion of married women. These are summarized in Table 4.4.

The 1979 age specific marital fertility rates (ASMFRs) were obtained from the 1979 age specific fertility rates in a calculation similar to that used to obtain ASMFRs in 1969.

The age specific fertility rates (ASFRs) in 1979 were, however, not available and had first to be estimatd using the Brass technique.

The Brass technique estimates ASFRs from reported births in the censuses, born during the last 12 months before the census, and children ever born. In this estimation the first step was to obtain the multiplying factors in column (5) of Table 4.3. These were obtained by interpolating linearly for the ratio of births born by women in age group (15-19) to those born by women in age group (20-24) (f_1/f_2) during the 12 months before the 1979 census.

The multiplying factors were then applied to births born per woman in each age group reported in the census and cumulated fertility (column 5, Table 4.3) to give the adjusted cumulated fertility in column (6). This calculation is shown below.

cumulated fertility (c.f) = column (2) X column (5) + column (4) - (2)

From the adjusted cumulated fertility (f_1) and the average number of children ever born (P_i), the ratio P_i/F_i was obtained. This ratio was then used to adjust (f_i) in column (2). This was done as shown in equation (3) below.

Adjusted age specific fertility rates (AASFRs) = column (2) X column (7) - (3)

Table 4.3 summarizes the adjusted age specific fertility rates.

TABLE 4.3 ESTIMATED AGE SPECIFIC FERTILITY RATES USING BRASS TECHNIQUE

Age	f_i	Av. child. ever born (P_i)	Cumm. fert. from age i	Multi-plying factor	Estd. cumm fert. (f_i)	P_i/F_i	Adjusted f_i
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
15-19	0.1077	0.3206	0.0000	2.0595	0.2218	1.4454	0.1559
20-24	0.2934	1.8529	0.5385	2.8554	1.3763	1.3643	0.3950
25-29	0.3086	3.6521	2.0055	3.0177	2.9368	1.2436	0.3838
30-34	0.2570	5.3881	3.5485	3.1262	4.3520	1.2381	0.3182
35-39	0.1950	6.4703	4.8335	3.2573	5.4690	1.1831	0.2308
40-44	0.1039	7.0215	5.8090	3.5408	6.1769	1.1367	0.1182
45-49	0.04765	7.1735	6.3285	4.4675	6.5414	1.0966	0.0523
	TFR						8.27

$f_i/f_2 = 0.367$

Source: Derived from 1979 Census using Brass technique.

The Brass technique is based on a number of assumptions. These are summarized below:

a) Fertility is assumed to have remained constant in the past;

b) For the age groups below 30 years the reported children ever born are assumed to be accurate; and

c) The pattern of fertility is assumed to be accurately depicted by the data on the number of children in the past year, i.e.the proportion of underreporting and overreporting is assumed to be the same in all age groups.

The adjusted age specific fertility rates were utilized to find the age specific marital fertility rates. The latter were obtained by dividing the ASFRs with the proportion of married women in each age group. The proportion of married women were obtained directly from the 1979 Census. The ASMFRs are summarized in Table 4.4

During the intervening years ASFRs were obtained by interpolating linearly between the 1969 and 1979 ASMFRs. This is done internally by the model.

TABLE 4.4 AGE SPECIFIC MARITAL FERTILITY RATES FOR 1969 AND 1979

Age	1969			1979		
	Percentage married	ASFR	ASMFR	Percentage married	ASFR	ASMFR
15-19	33.4	0.132	0.3953	27.09	0.1557	0.5748
20-24	76.6	0.331	0.4378	71.14	0.3950	0.5552
25-29	86.6	0.337	0.3891	84.57	0.3838	0.4541
30-34	87.6	0.294	0.3356	86.42	0.3182	0.3682
35-39	86.2	0.223	0.2587	86.03	0.2308	0.2683
40-44	80.1	0.135	0.1685	82.79	0.1182	0.1428
45-49		0.068		79.06	0.0523	0.0662

Source: Obtained from 1969 and 1979 Censuses.

4.3.6 Women's marital Status Between 1969 and 1979

The proportion of married women in 1969 and 1979 are summarized in Table 4.4 above. During the intervening years, these were estimated internally by the models. These estimates are obtained by linear interpolation.

4.3.7 Female Crude Birth Rates, 1969 and 1979

The Female crude birth rate is 1969 was estimated from the age specific fertility rates. These were first divided by the sex ratio to obtain the number of female births per woman in each age group. The female age specific fertility rates obtained above were then multiplied by the number of women in that age group to estimate the number of female births in each age group. The total female births were obtained by summing over all age groups. Table 4.5 summarizes the above procedure.

TABLE 4.5 CALCULATION OF FEMALE BIRTHS IN 1969

Age	ASFR	FASFR	Fem. Pop.	Fem. births
15-19	0.132	0.06586	544,847	35,888
20-24	0.331	0.16517	450,096	74,342
25-29	0.337	0.1682	411,245	69,156
30-34	0.294	0.1467	299,241	43,899
35-39	0.223	0.1113	264,819	29,468
40-44	0.135	0.0674	201,936	13,603
45-49	0.068	0.03394	163,852	5,560
Total				271,916

Female crude birth rate was, then, calculated using equation (4) below:

$$CBR_f^{1969} = \frac{B_f^{1969}}{P_f^{1969}} \times 1000 \qquad - (4)$$

$$= \frac{271,916}{5,460,324} \times 1000 = 49.8$$

where: CBR_f^{1969} = female crude birth rate in 1969

B_f^{1969} = Number of female births in 1969

P_f^{1969} = Female population in 1969

An estimation of the female crude birth rate in 1979

(CBR_f^{1979}) was also made. The 1979 age specific fertility rates were utilized for this estimation. First, total births were estimated using the age specific fertility rates. These were then divided with the sex ratio to obtain the female births. The rest of the calculation is the same as that for 1969. Table 4.6 summarizes the procedure of obtaining the births.

TABLE 4.6 FEMALE BIRTHS FROM 1979 CENSUS

Age	Fem. Pop.	ASFR	Fem. births
15-19	887,722	0.1557	138,218
20-24	686,003	0.3990	270,971
25-29	541,261	0.3838	207,736
30-34	412,691	0.3182	131,318
35-39	325,367	0.2308	75,095
40-44	273,702	0.1182	32,352
45-49	221,965	0.0523	11,609
Total			867,299

$$CBR_f^{1979} = \frac{867,299}{2} \times \frac{1,000}{7,706,075} = 56.3$$

4.3.8 <u>Sex Ratio at Birth in 1979 and 1979</u>

Sex ratio at birth is defined as the ratio of male births to the female births. In 1969 the sex ratio was estimated from the 1969 census. This was found to be 1.004. In 1979 the sex ratio at birth was approximated as 1.00. The 1979 census data, prior to adjustment, however, show a sex ratio slightly less than 1.

4.3.9 Female Crude Death Rates, 1969 and 1979

The Female crude death rate in 1969 was obtained from the female model life table constructed from the 1969 census data. The model life table was constructed on the basis of estimates of mortality in the first two years of life and the expectation of life for adults at various ages. The two were then linked using the Brass two parameter model life table (Central Bureau of Statistics, 1977).

To estimate the female crude death rate the female age-specific mortality rates were utilized. These were multiplied with the female population in that age group to obtain an estimate of the number of deaths in that age group. From these, the total number of deaths were obtained. Table 4.7 summarizes the above procedure.

TABLE 4.7 ESTIMATION OF THE FEMALE CRUDE DEATH RATE FROM THE MODEL LIFE TABLE

Age	e_x	$_nM_x$	Fem. pop.	Fem. deaths	Age	e_x	$_nM_x$	Fem. pop.	Fem. deaths
0	51.2	0.1215	180,506	21,932	35	34.2	0.0067	264,819	1,774
1	56.6	0.0199	865,874	17,231	40	30.3	0.0081	201,936	1,636
5	57.1	0.0069	893,359	6,164	45	26.5	0.0101	163,852	1,654
10	54.1	0.0025	663,808	1,660	50	22.7	0.0137	139,072	1,905
15	49.7	0.0042	544,847	2,288	55	19.1	0.0184	102,235	1,881
20	45.5	0.0056	450,096	2,521	60	15.7	0.0267	94,508	2,523
25	41.9	0.0060	411,245	2,468	65	12.6	0.0390	63,307	2,469
30	38.1	0.0062	299,241	1,855	70+	9.8	0.1020	121,619	12,162
Total								5460324	81,931

Source: Calculated using the model life table generated from 1969 Census data.

Female crude death rate was then obtained from equation (5) below:

$$CDR_f^{1969} = \frac{\text{female deaths}}{\text{female population}} \times 1000 \quad - (5)$$

$$= \frac{81,931}{5,460,324} \times 1000 = 15.00$$

To estimate the female crude death rate in 1979 a life table had to be constructed first. In this construction both child and adult mortalities were utilized. Child mortality was estimated using the Brass technique. Adult mortality was estimated from the 1969 and 1979 censuses and model life tables. The two mortalities were then linked using the Brass two parameter model life table.

The estimation of child mortality required data on children ever born by each women (P_i) and the proportion dead (d_i). These are summarised in Table 4.8 below. The ratio of children ever born by women in age group 15-19 to those aged 20-24, (P_1/P_2) was, then, used to derive multiplying factors in column (5) of Table 4.8.

TABLE 4.8 ESTIMATION OF CHILD MORTALITY USING BRASS TECHNIQUE

Age	p_i	d_i	$\frac{d_i}{p_i} = (1 - \frac{s_i}{p_i})$	Multiplying factors	$_xq_o$	x
(1)	(2)	(3)	(4)	(5)	(6)	(7)
15-19	0.3206	0.0372	0.1160	1.010	0.1172	1
20-24	1.8529	0.2213	0.1248	1.0270	0.1282	2
25-29	3.6521	0.5152	0.1411	1.0033	0.1416	3
30-34	5.3881	0.8936	0.16558	1.0092	0.1672	5
35-39	6.4703	1.1941	0.1846	1.0180	0.1879	10
40-44	7.0215	1.5267	0.2174	0.9963	0.2166	15
45-49	7.1735	1.8160	0.25315	0.9948	0.2519	20

Source: Calculated using 1979 Census data.

The Brass technique, however, gives mortality for both sexes. To obtain an estimate of the female mortality 10 points were arbitrarily added to the female survivorship life table column, while 10 points were arbitrarily subtracted from the male column. This adjustment has been found to give good estimates of mortality for the separate sexes in African countries (Central Bureau of Statistics, 1977). The adjusted mortalities are summarized in Table 4.9 below.

TABLE 4.9 FEMALE CHILDREN LIFE TABLE SURVIVORSHIP

x	$_xq_0$	l_x	$l_x^f = l_x + 10$
1	0.1172	.883	.893
2	0.1282	.872	.882
3	0.1416	.858	.868
5	0.1671	.833	.843
10	0.1879	.812	.822
15	0.2166	.783	.793
20	0.2519	.748	.758

Adult mortality was obtained by comparing the 1979 female population aged 10 years and over with the 1969 female population projected under different mortality levels using the West model life table.

The 1969 female population was first projected under different mortality levels of the west model life table. The projected population was, then, compared with the 1979 female population aged 10 years and over. The two mortality levels whose projected populations bracketed the 1979 population were thus obtained. For instance, the female population aged 10 years and over was bracketed by the 1969 population projected under mortality level 15 and 17 (see Table 4.10). This process was repeated for the population aged 15 years and over and so on up to 50 years and over. This procedure is summarized in Table 4.10.

TABLE 4.10. 1969 FEMALE POPULATION PROJECTED UNDER DIFFERENT MORTALITY LEVELS

Age	Fem. Pop. 1979	Level 11	Level 13	Level 15	Level 17
10 and over	5,039,979	4,822,029	4,932,590	5,004,088	5,081,158
15 and over	3,994,269	3,881,695	3,953,282	4,012,329	4,071,506
20 and over	3,128,418	3,031,579	3,094,049	3,144,431	3,196,193
25 and over	2,411,444	2,405,007	2,459,980	2,503,525	2,548,847
30 and over	1,901,156	1,894,809	1,945,429	1,982,542	2,021,435
35 and over	1,486,402	1,483,586	1,524,361	1,555,491	1,558,398
40 and over	1,163,098	1,109,106	1,143,013	1,168,139	1,195,124
45 and over	889,483	839,580	868,130	888,648	911,084
50 and over	667,431	603,918	627,595	643,982	662,392

Source: Obtained from 1979 Census and 1969 Census projected under the shown mortality levels.

The bracketing mortality levels are summarized in Table 4.11 below.

TABLE 4.11 THE BRACKETING MORTALITY LEVELS

Age	Lower level	Upper level
10 & over	15	17
15 & over	13	15
20 & over	13	15
25 & over	11	13
30 & over	11	13
35 & over	11	13
40 & over	15	17
45 & over	17	19

Source: Table 4.10.

From the above levels the median level was chosen as the best estimate of mortality between 1969 and 1979. This was found to be 14.39.

Using the estimated mortality level above the adult life table survivorship column for the ages 25 to 45 was derived. This was obtained by linear interpolation of the columns for levels 13 and 15. This procedure is summarized in Table 4.12 below.

TABLE 4.12 FEMALE ADULT LIFE TABLE SURVIVORSHIP

Age	Level 13	Level 14.39	Level 15
25	.74769	.78694	.80416
30	.72326	.76501	.78333
35	.69647	.74082	.76029
40	.66756	.71438	.73492
45	.63656	.68542	.70686

The child and adult mortalities estimated in Tables 4.9 and 4.12 were then linked using the Brass two parameter African model life table. The linking equation is linear in parameters α and β as shown below:

$$Y(x) = \alpha + \beta Y_s(x) \qquad - (6)$$

where Y(x) is the logit of l(x) and $Y_s(x)$ is the logit of the l(x) of Brass Standard African Life Table. The logit of l(x) is defined below.

$$\text{logit } l(x) = \frac{1}{2}\log_e\left(\frac{1-l(x)}{l(x)} \right) \qquad - (7)$$

To find the linking equation estimates of α and β were made. First, several β value estimates were made. These were estimated using the adult survivorship column in Table 4.12, the logit of Brass Standard African Life Table and l(2) value in Table 4.9. The median was then taken as the best estimate. The estimated β and, l(2) and $l_s(2)$ (i.e. l(2) of the standard life table) were then used to derive α in equation (6). Thus, the linking equation (8) was obtained.

$$Y(x) = -0.3141 + 0.8714\ Y_s(x) \qquad - (8)$$

Equation (8) was used together with the Brass Standard Life Table to generate a female life table for Kenya. The $_nq_x$ column of this life table was utilized to derive the $_nM_x$ column using equation (9) below:

$$_nM_x = \frac{2\ _nq_x}{n(2-{}_nq_x)} \qquad - (9)$$

The crude death rate estimating procedure is the same as that for the crude death rate in 1969. Table 4.13 below summarizes this procedure.

TABLE 4.13 FEMALE CRUDE DEATH RATE IN 1979

Age	${}_nM_x$	Fem. pop.	Fem. deaths
0-1	.09096	282,758	25,719
1-4	.01757	763,622	13,420
5-9	.00548	1,244,749	6,821
10-14	.00243	1,023,839	2,489
15-19	.00370	887,722	3,285
20-24	.00530	686,003	3,635
25-29	.00518	541,261	2,805
30-34	.00586	412,691	2,418
35-39	.00941	325,367	3,060
40-44	.00769	273,702	2,104
45-49	.00981	221,965	2,178
50-54	.01323	191,022	2,537
55-59	.01840	134,534	2,475
60-64	.02708	109,518	2,965
65-69	.04004	83,221	3,333
70-74	.06444	62,539	4,030
75+	.13298	86,539	11,508
Total			94,772

$$CDR_f^{1979} = \frac{94,772}{7,719,948} \times 1000 = 12.276 \quad 12.3$$

As can be seen from Table 4.2.3 the female births were underreported. This would, thus, imply that the crude death rate could be slightly higher.

4.3.10 The Female Life Expectation at Birth Between 1969 and 1979

The female life expectation at birth was estimated using the female model life table. Life expectation at birth in 1979 was obtained from the female life table generated using the Brass Standard Life Table as discussed in the last section. During the intervening years life expectation was obtained by interpolating linearly between the 1969 and 1979 values. These are summarized in Table 4.14 below.

TABLE 4.14 THE FEMALE LIFE EXPECTATION AT BIRTH BETWEEN 1969 AND 1979

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Ex. of life	51.2	51.5	51.7	52.0	52.2	52.5	52.8	53.0	53.3	53.5	53.8

4.3.11 Female Expectation of Life at Birth Between 1979 And 1989

The projection of program acceptor recruitment requirements between 1979 and 1989 requires the expectation of life during each year of this period. This was estimated by assuming a linear increase in the expectation of life during this period. Thus, an increase in expectation of life between 1969 and 1979 were extrapolated to 1989 to obtain these estimates. These estimates are summarized in Table 4.15.

TABLE 4.15 ESTIMATES OF FEMALE EXPECTATION OF LIFE AT BIRTH, 1979-1989

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Ex. of life	53.8	54.1	54.3	54.6	54.8	55.1	55.3	55.6	55.8	56.1	56.3

4.3.12 Female Crude Birth Rate Estimation in 1979

Family planning program targets are usually set in terms of a reduction in the population growth rate desired within a specified period. Since, however, it is the birth rate which is affected by the program, it is necessary to translate a desired growth rate to a corresponding reduction in the birth rate. In 1979 a population growth rate of 3.0 percent per annum was targeted. To estimate the female crude birth rate corresponding to this growth rate the stable population model was utilized.

As Table 4.16 below shows, the female population was growing at a faster rate than the male population. From the combined growth rate, the female population growth rate was first estimated as described below.

TABLE 4.16 POPULATION RATES OF NATURAL INCREASE BY SEXES IN 1969

Sex	CBR	CDR	CRNI
Male	49.79	18.11	31.68
Female	49.79	15.00	34.78

Let k be the ratio of the female population rate of natural increase to that of the males.

From Table 4.16 above,

$$k = \frac{34.79}{31.69} = 1.098 \qquad - (9)$$

If r_1 and r_2 are the female and male population growth rates respectively and, assuming an exponential growth rate then,

$$P_1 e^{tr_1} + P_2 e^{tr_2} = (P_1 + P_2) e^{tr} \qquad - (10)$$

where:

P_1 = Female population
P_2 = Male population
r = combined population growth rate

Ignoring powers of r_1, r_2 and r greater than 1, equation (10) becomes:

$$P_1(1+r_1 t) + P_2(1+r_2 t) = (P_1+P_2)(1+rt) \qquad - (11)$$

i.e.

$$P_1 r_1 + P_2 r_2 = (P_1+P_2) r$$

but $\frac{r_1}{r_2} = k$

From (11)

$$P_1 r_2 k + P_2 r_2 = (P_1 + P_2) r \qquad - (12)$$

i.e.

$$r_2 = \frac{\left(1 + \frac{P_2}{P_1}\right) r}{\left(k + \frac{P_2}{P_1}\right)} \qquad - (13)$$

r_1 and r_2 were then calculated from equation (13) above.

These are summarized below.

$$r_1 = 0.3135$$

$$r_2 = 0.286$$

Female life expectation at birth was estimated by extrapolating the expectation of life at birth between 1962 and 1969 to 1979. In this extrapolation linear increases in the expectation of life at birth were assumed. Using this approach the expectation of life at birth was estimated to be 56.2 in 1979. This estimate is higher than the expectation of life at birth obtained from the 1979 census. This implies that the rise in expectation of life at birth between 1969 and 1979 was lower than during 1962-1969 period.

The estimated female population growth rate and the expectation of life at birth were then utilized to select a stable life table. From this, a female crude birth rate was estimated.

First, a mortality level corresponding to the above expectation of life was obtained. This was obtained by interpolating linearly between level 15 (e^o_o = 55.0 years) and level 17 (e^o_o = 60.0 years). This was found to be 15.49. The female crude birth rates corresponding to the growth rates (r = .030) and (r= .035) were estimated for this mortality level. These are summarized in Table 4.17 below.

TABLE 4.17 BIRTH RATES FOR LEVEL 15.49

r	.030	.035
CBR	.04050	.04519

Using the birth rates above and interpolating linearly between the population growth rates (r = .030) and (r=.035), the birth rate corresponding to the female population growth rate (r=.0314), estimated earlier was obtained. This is shown in Table 4.18 below.

TABLE 4.18 FEMALE CRUDE BIRTH RATE ESTIMATES

r	.030	.031	.035
CBR	.04054	.04147	.04519

A female crude birth rate of 41.5/1000 would, thus, have been required to achieve a combined population growth rate of 3.0 percent per annum.

4.3.13 Female Crude Birth Rate in 1989 Required to Achieve A Population Growth Rate of 2.8% per Annum in 2000

The combined population growth rate in 1989 was first estimated. This estimate was obtained by assuming a linear decline in the population growth rate from the 1979 level to the desired level in 2000. From the estimated combined population growth rate a female population growth rate in 1989 was obtained. This estimate together with the assumed mortality trend was used to select a stable population life table from which an estimate of the female crude birth rate was made.

In 1979 the population growth rate was estimated as 3.9 percent per annum. Thus, if a growth rate of 2.8 percent per annum is required by the end of the century a combined population growth rate of 3.35 percent per annum in 1989 would be required if the reduction in the growth rate is linear.

To estimate the female population growth rate in 1989 from the above growth rate, a ratio of the female population growth rate to that for the male(K) is needed. "K" was estimated from the intercensal population growth rates for the males and females between 1969 and 1979. From (K) and the combined population growth rate (r) the female population growth rate (r_f) was estimated using equation (13). This was estimated as 3.44 percent per annum.

Female life expectation at birth in 1989 was estimated to be 56.3 years. Both the above mortality level and the population growth rate for the females estimated earlier were then utilized to estimate the female crude birth rate in 1989. The procedure used for this estimation is the same as that used to estimate the female crude birth rate in 1979.

First, the mortality level corresponding to an expectation of life of 56.3 years was found by interpolating linearly between levels 15(e^o_o = 55.0 years) and 17 (e^o_o= 60 years). This was found to be 15.5. The crude birth rates for this level corresponding to the growth rates (r = .030) and (r = .035) were then obtained. These are summarized in Table 4.19 below.

TABLE 4.19 CRUDE BIRTH RATES FROM STABLE POPULATION LIFE TABLES

r = .030

Level	15	15.5	17
CBR	.0425	.0422	.0399

r = 0.35

Level	15	15.5	17
CBR	.0473	.0453	.0445

The female crude birth rate corresponding to a female population growth rate of (r = .0344) estimated earlier was finally obtained. Table 4.20 below summarizes the estimated crude birth rate.

TABLE 4.20 ESTIMATED FEMALE CRUDE BIRTH RATE IN 1989 NEEDED TO ACHIEVE A POPULATION GROWTH RATE OF 2.8 PERCENT AT THE END OF THE CENTURY

r	.030	.0344	.035
CBR	.0442	.0433	.0435

Table 4. 20 thus shows that the female crude birth rate

would have to be reduced to 43.3 in 1989 if a growth rate of 2.8 percent per annum is to be achieved at the end of the century.

4.3.14 Proportion of Sterile Women

Data on the proportion of sterile women in Kenya are not available. Henry Louis data on natural sterility were, thus, assumed. These are summarized in Table 4.21 below:

TABLE 4.21 ESTIMATES OF PROPORTION OF STERILE WOMEN IN KENYA

Age	Proportion sterile	Age	Proportion sterile
15-19	.020	30-34	.130
20-24	.045	35-39	.235
25-29	.080	40-44	.455

4.4.1 Family Planning Program Data

A summary of the family planning data needed for this study was given in Section 4.1. In this section the sources of such data and/or estimating procedures are given.

4.4.2 Contraceptive Methods Offered by the Kenyan National Family Planning Program

In Chapter II it was seen that several methods of contraception are available in family planning clinics in Kenya. For the purpose of this study these were classified into pills, IUD, injection and "other". The "other" method includes methods such as the condom, which are also available in some clinics.

4.4.3 Annual Overlap of Contraceptive Use with Post-Partum Amenorrhea

The overlap of contraceptive use with post partum amenorrhea is that period in which contraceptives are used when the acceptor is in the period of post-partum amenorrhea. This period was estimated for each of the four methods from random samples of 1978 acceptors taken at the Kenya National Family Welfare Centre. The information obtained from these samples together with the average period of post-partum amenorrhea was then utilized for the estimation of this period.

For each acceptor in the sample the time of last birth and the time of acceptance were recorded. Assuming that use commences at acceptance, then the delay in acceptance was estimated to the nearest month. Using the information above and the average period of post-partum amenorrhea the overlap of use was then estimated. In this estimation it was assumed that the overlap is zero for all those acceptors who delayed acceptance for a period greater than the mean period of post-partum amenorrhea. Estimates of overlap of use for each method were obtained as explained below.

Let n be the sample size. Then if x is the average period of post-partum amenorrhea and P_i is the proportion of acceptors in the sample who accept i months after the last birth, then the average period of overlap may be defined by equation (14) below:

$$\text{Average period of overlap (A.O)} = \sum_{i=0}^{x}(x-i)P_i \qquad - (14)$$

Note for $i \geq x$, overlap is assumed to be zero.

To finally estimate the annual overlap of use (A.O.U), the average birth interval is required. This interval was estimated as 33.7 months (Mosley, 1981). Using equation (14) the annual overlap was obtained from equation (15) below:

$$\text{A.O.U.} = \frac{\text{A.O.}}{\text{Average birth interval}} \qquad - (15)$$

The estimated annual overlap for each method is summarized below:

TABLE 4.22 ESTIMATES OF ANNUAL OVERLAP OF CONTRACEPTIVE USE WITH POST-PARTUM AMENORRHEA FOR ACCEPTORS OF VARIOUS CONTRACEPTIVE METHODS IN KENYA

Method	Sample size	Overlap per women (years)	Annual Overlap (years)
Pills	218	0.3538	0.126
IUD	177	0.3717	0.132
Injection	216	0.2451	0.087
"Other"	312	0.3481	0.124

4.4.4 Age Distribution of Acceptors in 1969

The age distribution of acceptors in 1969 was estimated from the age distribution in 1968. In 1968 the age distribution of acceptors is available for the pills, IUD and all methods combined. With this information an estimated age distribution for each of the four methods was derived for 1968. To obtain the age distribution of injection and the "other" methods it was assumed that no women are allowed to accept the injection if they are below 30 years. The estimated age distribution in 1968 was assumed to give a reasonable age distribution of acceptors in 1969. Table 4.23 below shows the age distribution.

TABLE 4.23 ESTIMATED AGE DISTRIBUTION OF ACCEPTORS IN 1969

Age	Pill	IUD	Injection	"Other"
15-19	5.7	3.4	0.0	16.2
20-24	28.6	22.9	0.0	15.5
25-29	29.6	30.4	0.0	16.2
30-34	17.8	21.8	41.4	27.0
35-39	12.8	14.0	45.0	27.0
40-44	5.8	7.4	13.1	0.0
All	100.00	99.9	10.00	101.9

4.4.5 Annual Rates of Discontinuation of Contraceptive Use

Estimates of rates of discontinuation of contraceptive use were obtained from Chogoria data and the national estimates of monthly rates of discontinuation. Chogoria data were utilized to estimate the discontinuation rates for the pills and IUD in each age group of women in the reproductive ages. The national estimates of monthly rates of discontinuation were used to estimate the discontinuation for injection and the "other" method. Procedures for obtaining these estimates are given below.

The Chogoria data used for the estimation of annual rates of discontinuation for the pill and IUD consisted of small samples of women acceptors of these methods between January and July 1973. These are summarized in Table 4.24. For each of the two methods and in each age group information on those who discontinued use in 6 months was available. Such information was available for up to 72 months. From this information the proportion of those who continued using was obtained. These are also shown in Table 4.24.

Proportions from Table 4.24 were then fitted into a continuous exponential curve. This curve was chosen because in previous other studies it has been found to give reasonable estimates of discontinuation rates. This curve is shown below.

$$C(t) = ae^{-rt} \qquad - (16)$$

TABLE 4.24 ACCEPTORS OF CONTRACEPTIVES AND PROPORTION OF THESE ACCEPTORS STILL CONTINUING USE

Age Group	15-19		20-24		25-29		30-34		35-39		40-44	
Year	Pill	IUD	Pill	IUD	Pill	IUD	Pill	IUD	Pill	IUD	Pill	IUD
0.0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.5	.7143	.8235	.8075	.9663	.7895	-	.6667	-	.7857	-	-	-
1.0	.4286	.6470	.5238	.6562	.5789	.8571	.6250	.4545	.6427	.5833	.8333	-
1.5	.1429	.5294	.3571	.5000	.5263	.619	.5417	-	.4286	.5000	.6667	.6000
2.0	.0714	.4705	.2619	.4688	.3684	.4760	.5000	-	.2857	.2500	.5000	.4000
2.5	-	.3529	.2143	.4063	.3157	.4286	.3333	.3636	.2143	-	.3333	-
3.0	-	.2353	.1667	.3125	.2632	.3809	.1667	.1818	-	-	.1617	-
3.5	-	.1176	.1190	.2500	.1429	.2857	.1250	-	.1429	.1667	-	-
4.0	-	-	.0714	.1875	.1579	.2380	.083	.0909	-	-	-	-
4.5	-	-	.0476	.1563	.1053	.1905	.0416	-	-	-	-	-
5.0	-	-	-	.1250	-	.1428	-	-	-	-	-	-
5.5	-	-	-	-	-	.0472	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-	-	-	-	-
original acceptors	14	17	47	32	19	21	23	11	14	12	6	5

where: C(t) is the proportion of original acceptors remaining at time t

r is the annual rate of discontinuation

a is the proportion remaining after immediate drop out

To define fully the curve, estimates of "a" and "r" are required. These were estimated using the program CONTINUE. To make these estimates CONTINUE required the proportion of original acceptors still in the program at any two different times after acceptance. Using the data summarized in Table 4.24 above, several exponential curves were, thus, generated. Table 4.25 below shows such curves generated for the pill and IUD in age group (15-19).

TABLE 4.25 EXPONENTIAL CURVES GENERATED FOR ACCEPTORS OF PILLS AND IUD FOR THE AGE GROUP 15-19

Pill		IUD	
"a"	"r"	"a"	"r"
1.000	0.8463	1.000	.4354
1.000	1.3225	1.000	.4245
1.000	1.0279	1.000	.3729
		1.000	.4163
		1.000	.4827

In each age group and for each of the two contraceptive methods such curves were generated. From these, a representative curve was, then, chosen for each method and in each age group. This was done by comparing the actual proportions in Table 4.25 with those produced by the generated curves. The curve which then gave the closest estimates of the actual proportions was, then, chosen as the representative curve. Table 4.26 below summarizes this procedure.

TABLE 4.26 SELECTION OF DISCONTINUATION CURVE FOR THE PILL IN AGE GROUP 15-19

t(years)	Actual proportions	e^{-r_1} r_1=0.8463	$e^{-r_2 t}$ r_2=1.3225	$e^{-r_3 t}$ r_3=1.0279
0.0	1.000	1.000	1.000	1.000
0.5	0.7143	.6510	.5162	.5981
1.0	0.4286	.4290	.2665	.35175
1.5	0.2143	.2810	.1375	.2140
2.0	0.1429	.1840	.0710	.1280
2.5	0.0714	.1205	.03665	.0765

The curve with a = 1.000 and r = 0.8463 was in this case chosen as the representative discontinuation curve in the age group 15-19 for the pill. The two other curves are seen to represent a higher discontinuation rate.

The discontinuation curve for the IUD in age group 15-19 was similarly selected. This is shown in Table 4.27 below.

TABLE 4.27 SELECTION OF THE DISCONTINUATION CURVE FOR IUD IN AGE GROUP 15-19

t (years)	Actual proportion	$e^{-r_1 t}$ $r_1=.4354$	$e^{-r_2 t}$ $r_2=.4245$	$e^{-r_3 t}$ $r_3=.5729$	$e^{-r_4 t}$ $r_4=.4123$
0.0	1.000	1.000	1.000	1.000	1.000
0.5	0.8235	0.8044	0.8088	0.8299	0.8120
1.0	0.6470	0.647)	0.6541	0.6887	0.6594
1.5	0.5294	0.5204	0.5290	0.57158	0.5354
2.0	0.4705	0.4186	0.4278	0.4744	0.4347
2.5	0.3529	0.3367	0.3460	0.3937	0.3530
3.0	0.3354	0.2708	0.2799	0.3267	0.2866
3.5	0.1176	0.2179	0.2263	0.2711	0.2328

In this case "r" = .4123 and a=1.000 was chosen as the representative discontinuation curve in age group 15-19.

The above selection procedure was repeated in all age groups and for the two methods. The representative curves obtained by this procedure are summarized in Table 4.28 below.

TABLE 4.28 ESTIMATED ANNUAL RATES OF DISCONTINUATION

Age	Pill		IUD	
	"a"	"r"	"a"	"r"
15-19	1.000	0.8463	1.000	0.4123
20-24	1.000	0.5966	1.000	0.3786
25-29	1.000	0.4581	1.000	0.3117
30-34	.831	0.2850	1.000	0.4031
35-39	1.000	0.5557	1.000	0.5396
40-44	1.000	0.270	1.000	0.4581

The annual rates of discontinuation for injections and "other" methods were estimated from the national monthly rates of discontinuation for these methods. From the monthly rates of discontinuation the proportion of acceptors still using for 6 months and one year were obtained. These two proportions were then applied to CONTINUE to derive an exponential discontinuation curve. For injection the parameters for the discontinuation curves were estimated as a=1.000 and r=0.4360. "r" was assumed to be constant in all age groups. The estimates for the "other" method were a=1.000 and r=0.1955. Again "r" was assumed to be constant throughout the age groups.

4.4.6 Annual Number of Acceptors, 1969-1979

The annual number of acceptors during each year of this period were obtained from the annual reports of the Kenya National Family Welfare Centre. These are summarized in Table 4.29

TABLE 4.29 ANNUAL ACCEPTORS OF CONTRACEPTIVES, 1969-1978

Year	Acceptor	Year	Acceptor
1969	29,761	1974	51,446
1970	35,136	1975	53,471
1971	41,100	1976	61,227
1972	45,265	1977	72,647
1973	50,054	1978	62,407

4.4.7 Contraceptive Users, 1979

Contraceptive users in 1979 are required for the projection of users and acceptors during 1979-1989 period. These were estimated by assuming that users in 1978 were the same as in 1979. The estimates for each method are summarized in Table 4.30 below.

TABLE 4.30 ESTIMATED CONTRACEPTIVE USERS IN 1979 BY METHOD

Method	Pill	IUD	Injection	"Other"
Users	59,606	21,497	18,023	7,383

4.4.8 Users as a Proportion of Married Women by Age

Users as a proportion of married women were estimated from the 1979 census and the 1978 users in each age group. The latter were divided by estimated married women in each age group. Table 4.31 summarizes these proportions.

TABLE 4.31 CONTRACEPTIVE USERS AS PROPORTION OF MARRIED WOMEN BY AGE

Age	15-19	20-24	25-29	30-34	35-39	40-44
Proportion	0.0398	0.0728	0.0717	0.0545	0.0317	0.0165

4.4.9 Proportion of Each Method Accepted, 1969-1978

The proportions of each of the four methods accepted during the 1969-1979 period were obtained from the annual reports of the National Family Welfare Centre. Between 1969 and 1971 these were not available. To obtain estimates it was assumed that the proportions of each method remained constant between 1969 and 1972. Table 4.32 summarizes these estimates.

TABLE 4.32 PERCENT OF EACH METHOD ACCEPTED, 1969-1978

Year	Pill	IUD	Injection	"Other"	Year	Pill	IUD	Injection	"Other"
1969	79	11	6	4	1974	80	10	6	4
1970	79	11	6	4	1975	78	10	6	6
1971	79	11	6	4	1976	72	12	5	7
1972	79	11	6	4	1977	71	14	7	8
1973	78	10	6	6	1978	70	16	6	8

4.5 Conclusion

A summary of the required demographic and family planning program data was given in this chapter. Since not all such data were available, procedures for estimating non-available data were also given. Section 4.3 discussed the demographic data required. Such data include female population size and its structure in 1969 and 1979, fertility levels in 1969 and 1979, womens marital status in 1969 and 1979, the mortality trend between 1969 and 1979 and the proportion of sterile women.

Procedures for estimating non-available demographic data were also given. In obtaining these estimates, several assumptions were made. Such assumptions were also stated.

Both models require a crude birth rate target as the input requirement. Thus, crude birth rates corresponding to the desired population growth rates in 1979 and 1989 were estimated. Details for this estimation were given in Section 4.3. For this estimation both a mortality trend and a stable population were required. Several assumptions were made in deriving these estimates. Thus, estimated figures give slightly different population growth rates.

In Section 4.4 the sources of family planning data and procedures for estimating non-available family planning data were discussed. The family planning program data required include: methods offered; continuation rates of these methods; overlap of use with post-partum amenorrhea and the proportion of each method accepted. As with demographic data, several assumptions were made in the estimation of non-available family planning program data. Annual rates of discontinuation were, for instance, derived from small samples of acceptors. The overlap of use with post-partum amenorrhea estimates were also based on small samples. Thus, these estimates only show the trend and may be quite different from the actual figures based on the entire population.

Given the enormous data problems in most of developing countries, the data used in this study may be considered quite reasonable indeed.

CHAPTER V

THE IMPACT OF THE KENYAN NATIONAL FAMILY PLANNING PROGRAM ON FERTILITY DURING 1969-1979 PERIOD

5.1 Introduction

During the 1969-1978 period most visitors to family planning clinics accepted contraceptive methods. The pill, IUD and injection were the three most popular methods in that order. Few acceptors, however, chose other methods such as the condom which were also offered in some clinics. The annual number of acceptors of all the methods are shown in Table 4.29 in Chapter IV.

Some of the acceptors discontinued use for various reasons which will not be detailed here. The estimated annual rates of discontinuation are summarized in Table 4.28 in Chapter IV. Table 5.1 below shows the estimated mid-year users remaining after discontinuation according to these rates. According to this table the number of users was slightly underestimated. In 1978, for instance, there were 103,731 mid-year users estimated. The National Family Welfare Centre, on the other hand, estimated mid-year users as 108,570. The discrepancy probably indicates that the actual discontinuation rates were lower than the estimates summarized in Table 4.28.

TABLE 5.1 ESTIMATED MID-YEAR CONTRACEPTIVE USERS, 1969-1978

Year	Users	Year	Users
1969	0	1974	65,658
1970	18,061	1975	73,470
1971	32,738	1976	80,020
1972	45,746	1977	89,453
1973	54,804	1978	103,731

Source: Computer output based on the model

5.2 The Impact of the Family Planning Program on Fertility

The mid-year users of contraceptives during each year of the period 1969-1978 are shown in Table 5.1. Such use had some impact on fertility. This impact was estimated using the CONVERSE model. The data utilized for this estimation are summarized in Appendix I. Appendix I shows that both demographic and family planning program data were required for this estimation. The demographic data required included: female population size and its structure; marital fertility rates and estimated changes during this period; proportion of married women and expected changes; mortality trend and the proportion of married women in each age group. The sex ratio was also required. Family planning program data required included: methods offered; discontinuation rates for each method by age group; proportion of acceptors choosing each method during each year and the age distribution of users in 1969. The total number of acceptors during each year was also required. Given the above data

CONVERSE then estimated the prevented births and resulting changes in birth rates and population size.

The estimated prevented births are summarized in Table 5.2. In this estimation, methods were assumed to be one hundred percent effective. Since, as was shown in Chapter I, no method is one hundred percent effective, this assumption may result in an over-estimation of prevented births. However, most users in Kenya adopt effective methods and thus this over-estimation may not be high. Another assumption, in the estimation of prevented births, was that there were no initial users at the start of this period. Since there were some on-going users, this may underestimate the prevented births. Prior to 1969, however, users were few and the underestimation is, thus, small. It can be, therefore, concluded that the estimation of prevented births is quite reasonable.

TABLE 5.2 ESTIMATES OF PREVENTED BIRTHS, 1969-1979

Year	Prevented Births	Year	Prevented Births
1969	0	1975	30,957
1970	5,704	1976	33,721
1971	12,792	1977	37,192
1972	18,706	1978	42,548
1973	23,052	1979	44,926
1974	27,338	Total	276,936

Source: Computer output based on the model

According to Table 5.2 a total of 276,936 births were estimated as having been prevented during the 1969-1979 period. The table also shows the number of births prevented during each year of this period. These are seen to have increased about 8 times during this period. There were 5,704 births estimated as prevented in 1970, which increased to 44,926 in 1979. There were no initial births prevented in 1969 because it was assumed that there were no initial users, and acceptors have to use for about 9 months to prevent births.

5.3 The Impact of the Family Planning Program by Age Groups

In Chapter I, it was seen that the level of contraceptive use is determined by the acceptance level and the rate at which these acceptors drop out. In Kenya these factors vary among the age groups.

Table 5.3 summarizes the distribution of acceptors by age. This shows that women in age group 20-24 and 25-29 contributed most of the acceptors. These two age groups are seen to have contributed over half of the acceptors during this period.

Discontinuation rates by methods and in each age group reveal a pattern similar to that of the acceptors (Refer to Table 4.28 in Chapter IV). According to these estimates, rates of discontinuation are lowest among women in age groups 20-24 and 25-29 for the IUD and in age groups 25-29 and 30-34 for the pill.

TABLE 5.3 PERCENT DISTRIBUTION OF ACCEPTORS BY AGE, 1969-1978

Age Group	YEAR									
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
15-19	5.55	5.54	5.52	5.49	5.69	5.43	5.47	5.89	5.87	5.91
20-24	25.46	25.54	25.65	25.76	25.48	26.00	25.63	25.50	24.76	25.01
25-29	27.51	26.90	26.35	25.19	25.19	25.00	24.89	25.10	24.61	24.99
30-34	20.12	20.71	21.24	22.39	22.39	22.60	22.29	21.87	22.01	21.41
35-39	15.27	15.04	14.82	14.64	14.64	14.12	14.83	15.20	16.29	16.33
40-44	5.09	6.27	6.43	6.60	6.60	6.87	6.65	6.44	6.47	6.33
All	99.00	100.00	100.00	100.14	99.99	100.02	99.76	100.00	100.01	99.98

Source: Computer output based on the model.

From the discussion above it is observed that both acceptance and continuation rates are high among women in the age groups 20-24 and 25-29. Contraceptive use would thus, be expected to be high among these women. Table 5.4 below shows this to be the case. This shows that, in 1970 for instance, the two age groups contributed over 50 percent of the users. This contribution decreases in later years as users from these age groups advance to older age groups.

TABLE 5.4 PERCENT DISTRIBUTION OF MID-YEAR USERS BY AGE 1969-1979

Age Group	YEAR									
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
15-19	0.00	4.41	3.91	3.55	3.42	3.72	3.16	3.24	3.38	3.32
20-24	0.00	22.49	20.71	19.31	18.42	17.80	17.24	16.96	16.87	16.31
25-29	0.00	28.04	27.34	26.55	25.67	24.89	24.33	23.98	23.71	23.46
30-34	0.00	21.28	22.89	24.11	25.90	25.38	25.50	25.22	24.83	24.68
35-39	0.00	15.90	16.44	17.15	17.90	18.75	19.60	20.32	20.85	21.44
40-44	0.00	7.88	8.71	9.33	9.63	9.90	10.16	10.29	10.36	10.78
All	0.00	100.00	100.00	100.00	100.00	100.44	99.99	100.01	100.00	99.99

Source: computer output based on the model

The program's impact on fertility is also influenced by the potential fertility of the users. The potential fertilities are summarized in Table 5.5. This shows that during this period fertility was highest among women in the age group 20-24. Fertility declines as one moves to older age groups. In the age group 15-19 fertility is slightly lower than in age group 20-24.

TABLE 5.5 POTENTIAL FERTILITY OF ACCEPTORS

Age Group	YEAR									
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
15-19	.4118	.4206	.4294	.4382	.4469	.4369	.4269	.4169	.4069	.3969
20-24	.4484	.4381	.4279	.4176	.4073	.3851	.3851	.3740	.3629	.3518
25-29	.4113	.3998	.3883	.3737	.3652	.3317	.3317	.3150	.2983	.2815
30-34	.3685	.3508	.3331	.3154	.3977	.2563	.2563	.2356	.2149	.1943
35-39	.3150	.2915	.2680	.2444	.2209	.1325	.1325	.0884	.0442	.0000
40-44	.2841	.1861	.1240	.0620	.0000	.0000	.0000	.0000	.0000	.0000

Source: Computer output based on the model

The impact on fertility is mainly a function of both use and potential fertility. Since these factors vary among age groups, the impact also varies. This is shown in Table 5.6. As expected the two age groups 20-24 and 25-29 contributed most of the program's impact. According to Table 5.6, these two age groups contributed over half of the program's impact on fertility during this period.

TABLE 5.6 PERCENT OF BIRTHS AVERTED BY AGE

Age Group	YEAR									
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
15-19	0.00	5.41	5.14	4.98	4.88	4.94	4.94	5.00	5.42	5.59
20-24	0.00	28.76	28.09	27.56	27.12	26.73	26.54	26.27	25.70	25.31
25-29	0.00	30.26	30.59	30.57	30.46	30.08	29.75	29.53	29.09	29.14
30-34	0.00	18.61	19.89	21.10	22.24	23.37	24.12	24.72	24.82	24.93
35-39	0.00	12.67	12.16	11.78	11.44	11.27	10.99	10.93	11.57	11.79
40-44	0.00	4.30	4.12	4.01	3.86	3.71	3.66	3.56	3.40	3.42
All	0.00	100.01	99.99	100.00	100.00	100.00	100.00	100.01	100.00	100.18

Source: Computer output based on the model

5.4 The Effect of the Program on the Female Crude Birth Rate During 1969-1979 Period

In section 5.2 it was shown that a total of about 276,936 births were prevented by the program. These had a measurable effect on the female crude birth rate as shown in Table 5.7. According to this table, the female crude birth rate was reduced by about 2.13/1000 points in 1979. The program had its greatest effect on the female crude birth rate in 1975. During that year the female crude birth rate was reduced by 2.55 points. In 1969 the program did not have any effect on the crude birth rate because it was assumed that there were no initial users and acceptors have to use for at least 9 months before they prevent births.

During this period (1969-1979) fertility continued to rise. The total fertility rate rose from 7.6 births in 1969 to an estimated 8.3 births in 1979. This rise in fertility is also indicated by the female crude birth rate shown in

Table 5.7. This shows that the female crude birth rate potential rise was about 4.2/1000 points from 48.9/1000 in 1969 to 53.7/1000 in 1979. The program's effect on the crude birth rate as shown above was smaller. Thus, the program only showed the rise in fertility during this period.

TABLE 5.7 THE EFFECT OF THE FAMILY PLANNING PROGRAM ON THE FEMALE CRUDE BIRTH RATE, 1969-1979

Year	Potential female CBR	Actual female CBR	Reduction in CBR
1969	48.87	48.87	0.00
1970	49.36	48.87	0.49
1971	49.77	48.73	1.01
1972	50.18	48.35	1.43
1973	50.59	48.94	1.65
1974	51.00	49.16	1.84
1975	51.59	49.04	2.55
1976	51.99	50.03	1.96
1977	52.37	50.37	2.00
1978	52.75	50.58	2.17
1979	53.12	51.00	2.12

Source: Computer output based on the model

According to Table 5.7 the female crude birth rate rose by about 2.1 points between 1969 and 1979, from 49.8/1000 in 1969 to 51.0/1000 in 1979. Table 5.7 summarizes the potential and resulting female crude birth rates during each year of the period.

5.5 The Family Planning Program Effect on the Age Specific Fertility Rates (ASFRs)

The resulting age specific fertility rates were lower in all age groups than they would have been without the program. This is shown in Table 5.8. The table, however, shows that the reduction in these rates was not the same in all age groups. According to this table the reduction in ASFRs was highest in age group 35-39. Without the program the ASFRs in this age group would have been 0.23. The estimated actual ASFR was 0.207 and represents a reduction of 10.0 percent. The smallest effect in ASFR was in age group 15-19 where the reduction was only 1.28 percent.

TABLE 5.8 EFFECT OF THE FAMILY PLANNING PROGRAM ON THE AGE SPECIFIC FERTILITY RATES IN 1979

Age Group	ASFR without program	Actual ASFR	% reduction in ASFR
15-19	0.156	0.154	1.28
20-24	0.395	0.385	3.84
25-29	0.384	0.362	5.73
30-34	0.318	0.291	8.49
35-39	0.230	0.207	10.00
40-44	0.117	0.103	8.55

Source: Computer output based on the model

5.6 The Effect of the Family Planning Program on The Female Population Size

The actual female population in 1979 was smaller than would have been without the program as shown in Table 5.9. This shows that without the program the female population would have been 7,926,012. The projected actual female population was 7,815,263 and represents a reduction of 1.4 percent in the female population.

Compared with the census female population in 1979, the above projection is higher. From the census the female population was estimated as 7,706,075. The discrepancy in the two figures could be due to several reasons. One of these would be due to underreporting of births in the census. The projected female population, by the model, is based on the 1969 census. The accuracy of the 1969 census would thus, influence the accuracy of the projected population. The accuracy of the assumed mortality trend between 1969 and 1979 would also affect the projected female population. The discrepancy is, however, seen to be small.

According to Table 5.9 the projected actual female population during each year of the 1969-1979 period is higher than the births prevented. The table shows that in 1979 the projected female population was only smaller by 110,749 whereas 276,936 births were prevented during this period. This difference is due to the fact that the prevented births include both sexes. The female population size would thus be smaller by about half the prevented births because the sex ratio is about 1.

TABLE 5.9 FAMILY PLANNING PROGRAM EFFECT ON THE FEMALE POPULATION SIZE, 1969-1979

Year	Potential fem. pop.	Actual fem. pop.	Difference in pop.
1969	5,460,324	5,460,324	0
1970	5,670,198	5,668,874	1324
1971	5,887,837	5,882,205	5632
1972	6,105,122	6,092,298	12824
1973	6,321,224	6,299,232	21992
1974	6,536,362	6,503,787	32575
1975	6,794,580	6,748,716	45864
1976	7,076,374	7,015,570	60804
1977	7,359,365	7,282,968	76397
1978	7,642,540	7,549,374	93166
1979	7,926,012	7,815,263	110749

5.7 The effect of the Family Planning Program on the Female Population Growth Rate

Between 1969 and 1979 fertility rose as indicated by the 1969 and 1979 censuses. During the same period mortality continued to decline. The female life expectancy at birth, for example, rose from 51.2 years in 1969 to an estimated 53.8 years in 1979. These trends in the vital rates, thus, resulted in a rise in the population growth rate. The female population growth rate, for instance, rose from 3.5 percent per annum in 1969 to 3.9 percent per annum in 1979.

The population growth rate would, however, have been even higher without the program. Table 5.10 shows that the crude rate of natural increase (CRNI) of the female population was slowed by the program. In 1969 the crude rate of natural increase of the female population was 33.88/1000. This would have risen to 38.88/1000 in 1979. The estimated actual CRNI of the female population was 36.92 which is lower than the potential CRNI by nearly 2/1000 points. However, it is noted that this is still about 3 points above its 1969 level. Table 5.10 below illustrates the crude rate of natural increase during each year.

TABLE 5.10 FAMILY PLANNING PROGRAM EFFECT ON THE CRUDE RATE OF NATURAL INCREASE OF THE FEMALE POPULATION

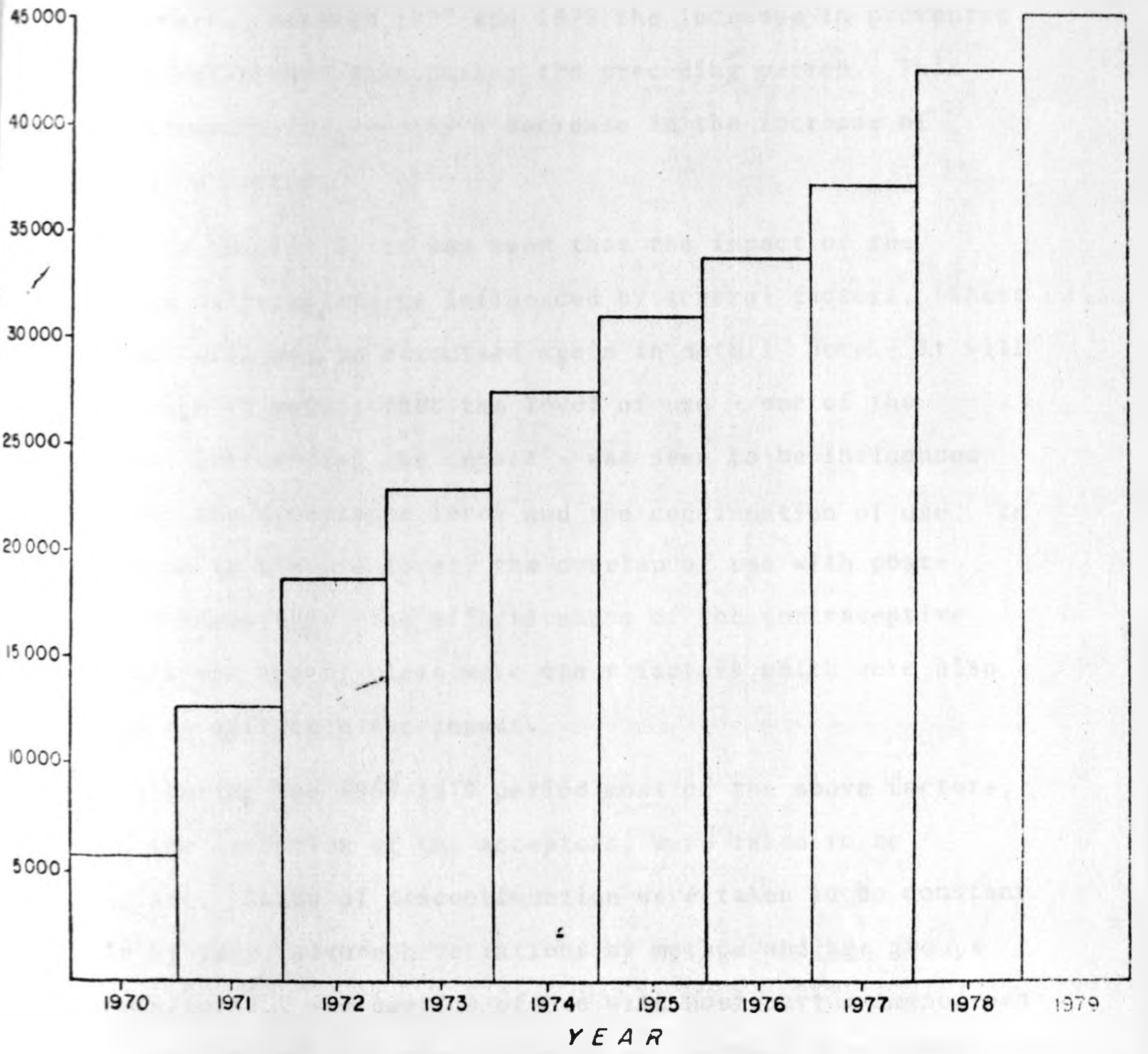
Year	CRNI without prog.	Actual CRNI	Reduction in CRNI
1969	33.87	33.87	0.00
1970	33.90	33.43	0.47
1971	34.43	33.45	0.98
1972	35.00	33.67	1.33
1973	35.50	33.97	1.53
1974	36.04	34.35	1.69
1975	36.85	35.06	1.79
1976	37.36	35.57	1.79
1977	37.91	36.06	1.85
1978	38.37	36.36	2.01
1979	38.88	36.92	1.96

Source: Computer output based on the model

5.8 Effect of Acceptors Changes on the Impact of Family Planning Program on Fertility During 1969-1979 Period

Between 1969 and 1979 prevented births continued to increase. Prevented births rose from 5,704 in 1969 to 44,926 in 1979. This increase was, however, not constant as shown in Figure 5.1. Increase was higher during the early and later years of this period. For instance, between

FIG. 5.1: CHANGES IN THE PROGRAM IMPACT.



1970 and 1972 the increase in prevented births was higher than during the next 3 years up to 1975. The increase between 1975 and 1977 was still lower than during the preceding years. Between 1977 and 1978 the increase in prevented births was higher than during the preceding period. This was, however, followed by a decrease in the increase of prevented births.

In Chapter I, it was seen that the impact of the program on fertility is influenced by several factors. These factors will not be discussed again in detail here. It will be enough to recall that the level of use - one of the factors influencing the impact - was seen to be influenced by both the acceptance level and the continuation of use. In addition to the use level, the overlap of use with post-partum amenorrhea, the effectiveness of the contraceptive methods and age of users were other factors which were also noted to influence the impact.

During the 1969-1979 period most of the above factors, with the exception of the acceptors, were taken to be constant. Rates of discontinuation were taken to be constant year by year, although variations by method and age groups were allowed. The overlap of use with post-partum amenorrhea for each method was also taken to be constant throughout this period. The age of users did not change greatly during this period. Thus, changes in prevented births during this period were mainly a function of acceptors. This is illustrated by comparing the actual program impact with the impact that would have resulted from constant number of acceptors.

The results of the above analysis are summarized in Table 5.11. This shows that with a constant number of acceptors only 174,314 births would have been prevented, whereas about 276,936 actual births were estimated to have been prevented. The number of prevented births during each year are also illustrated. The table shows that during each year (after 1970) the prevented births with a constant number of acceptors are lower than at the actual acceptor level. In 1971, for instance, there were 11,763 prevented births whereas 12,792 births were actually estimated as prevented.

The effect of a rising number of acceptors on program impact is illustrated in Figure 5.2. With a constant number of acceptors and a constant rate of discontinuation, the number of users also becomes constant because those who drop out balance those who enter the program. Under such conditions the program's impact would also be expected to plateau. Figure 5.2 shows that the impact of the program plateaus at slightly over 21,000 births prevented. The difference between the two curves, thus, shows the effect of a growing number of acceptors on the impact of the program during this period.

FIG. 5.2: THE ROLE OF ACCEPTOR INCREASES ON THE PROGRAM IMPACT.

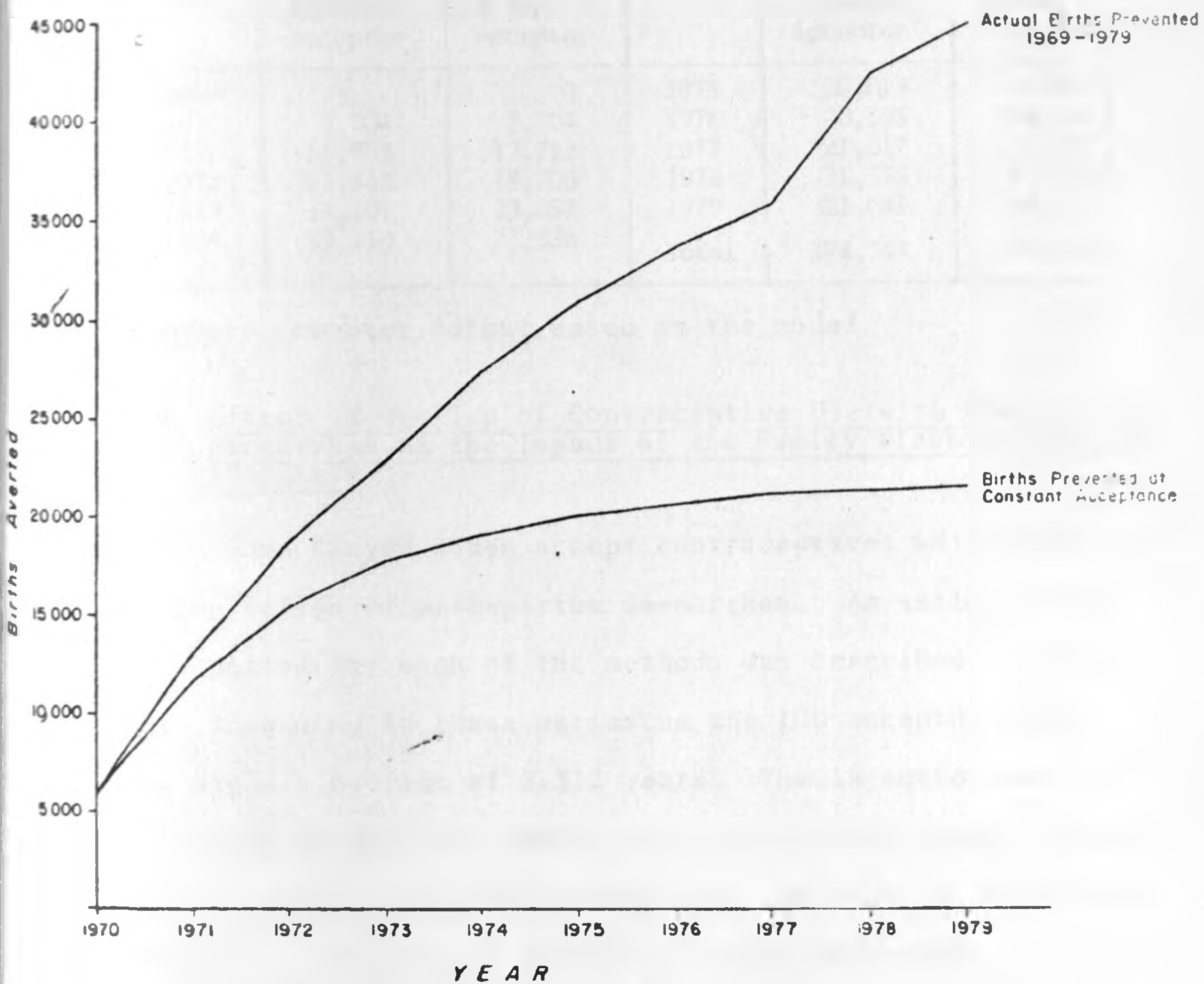


TABLE 5.11 EFFECT OF GROWING NUMBER OF ACCEPTORS ON THE PROGRAM IMPACT, 1969-1979

Year	Births prevented		Year	Births Prevented	
	Constant Acceptor	Actual Acceptor		Constant Acceptor	Actual Acceptor
1969		0	1975	20,013	30,957
1970	5,704	5,704	1976	20,595	33,721
1971	11,763	12,792	1977	21,017	37,192
1972	15,442	18,706	1978	21,359	42,548
1973	17,701	23,052	1979	21,641	44,926
1974	19,110	27,338	Total	174,344	276,936

Source: Computer output based on the model

5.9 Effect of Overlap of Contraceptive Use with Post-Partum Amenorrhea on the Impact of the Family Planning Program, 1969-1979

Some Kenyan women accept contraceptives while they are in the period of post-partum amenorrhea. An estimation of this period for each of the methods was described in Chapter IV. According to these estimates, the IUD acceptors have the highest overlap of 0.312 years. The injection was estimated to have the lowest overlap of 0.087 years. Contraceptive used during this period play no role in preventing births because the woman is already protected.

The effect of post-partum amenorrhea on the program's impact on fertility is shown in Table 5.12. According to this table, the effect of the program on fertility would have been higher if all acceptors were non-amenorrheic. A total of 300,417 births or 7.8 percent more would have been prevented in this case. The effect of overlap during each year is also shown. In 1970, 7,109 births would have been prevented if all acceptors were non-amenorrheic. It is estimated that about 5,704 births were actually prevented during this year.

TABLE 5.12 THE EFFECT OF OVERLAP OF CONTRACEPTIVE USE WITH POST-PARTUM AMENORRHEA

Year	Births prevented		Year	Births prevented	
	Without overlap	Actual		Without overlap	Actual
1970	7,109	5,704	1975	33,374	30,957
1971	14,449	12,792	1976	36,228	33,721
1972	20,640	18,706	1977	40,071	37,192
1973	25,037	23,052	1978	45,982	42,548
1974	29,680	27,338	1979	47,847	44,926
Total				300,417	276,936

Source: Computer output based on the model.

5.10 Effect of Continuation Rates on the Impact of Family Planning Program on Fertility

The estimation of annual rates of discontinuation for each of the four contraceptive methods was described in detail in Section 4.4,5 of Chapter IV. These rates were found to be different for different methods and for each age group. Generally, the "other" method was found to have the lowest discontinuation rate of r = 0.196. This was assumed to be constant in all age groups. The estimate for injection was higher (r = 0.436). This was also taken to be constant in all age groups. Both the pill and IUD were found to have higher discontinuation rates. The estimates by age group for these methods show that rates of discontinuation were lowest among women in age group 40-44 for the pill (r = 0.270) and highest (r = 0.846) among women in age group 15-19. The rates of discontinuation for the IUD are lower than that for the pill.

The estimated rates of discontinuation indicate that the rate of discontinuation of contraceptive use in Kenya is high. In the age group 40-44 the estimated annual rate of discontinuation for the pill (r = 0.27) implies that about 23.7 percent of the original acceptors discontinue use within one year. The estimate for the "other" methods means that about 17.8 percent discontinue use within one year. At the discontinuation rate of r=0.847 for the pill in the age group 15-19 about 57.1 percent discontinue within one year.

The rate of discontinuation affects the number of users. At the actual discontinuation rates during the 1969-1979 period it was estimated that there were 103,731 mid-year users in 1979. At the lowest discontinuation rate (r=0.196) the number of mid-year users would have been nearly double. These were estimated as 194,264 in 1978. On the other hand, if acceptors had high rates of discontinuation (r=0.846) the number of mid-year users would have been 47,115, less than half the actual users during this period.

The number of mid-year users during each year of the

1969-1979 period is illustrated in Table 5.13. This shows that at the low discontinuation rate users accumulate much faster. In 1970, for instance, there were 23,561 mid-year users at the low discontinuation rates. During the same year, these were estimated as 12,195 and 18,061 at the actual and high discontinuation schedules, respectively.

TABLE 5.13 ACCUMULATION OF MID-YEAR USERS AT DIFFERENT RATES OF DISCONTINUATION

Year	Discontinuation Rate			Year	Discontinuation Rate		
	Low	Actual	High		Low	Actual	High
1969	0	0	0				
1970	23,561	18,061	12,195	1974	112,887	65,658	32,084
1971	40,907	32,738	19,504	1975	131,871	73,470	34,433
1972	70,526	47,746	24,996	1976	148,740	80,020	36,277
1973	90,513	54,804	27,735	1977	168,467	89,453	40,227
				1978	194,464	103,731	47,115

Source: Computer output based on the model

The impact on fertility of these discontinuation schedules is summarized in Table 5.14. As expected, at the low discontinuation rate the impact is greater than at the two other discontinuation rates. A total of 443,300 births are prevented at these discontinuation rates. At the high discontinuation schedule only 165,565 births are prevented. This, thus, shows that the rate of discontinuation has a considerable influence on the impact.

TABLE 5.14 EFFECT OF DISCONTINUATION OF CONTRACEPTIVE USE ON THE PROGRAM'S IMPACT, 1969-1979

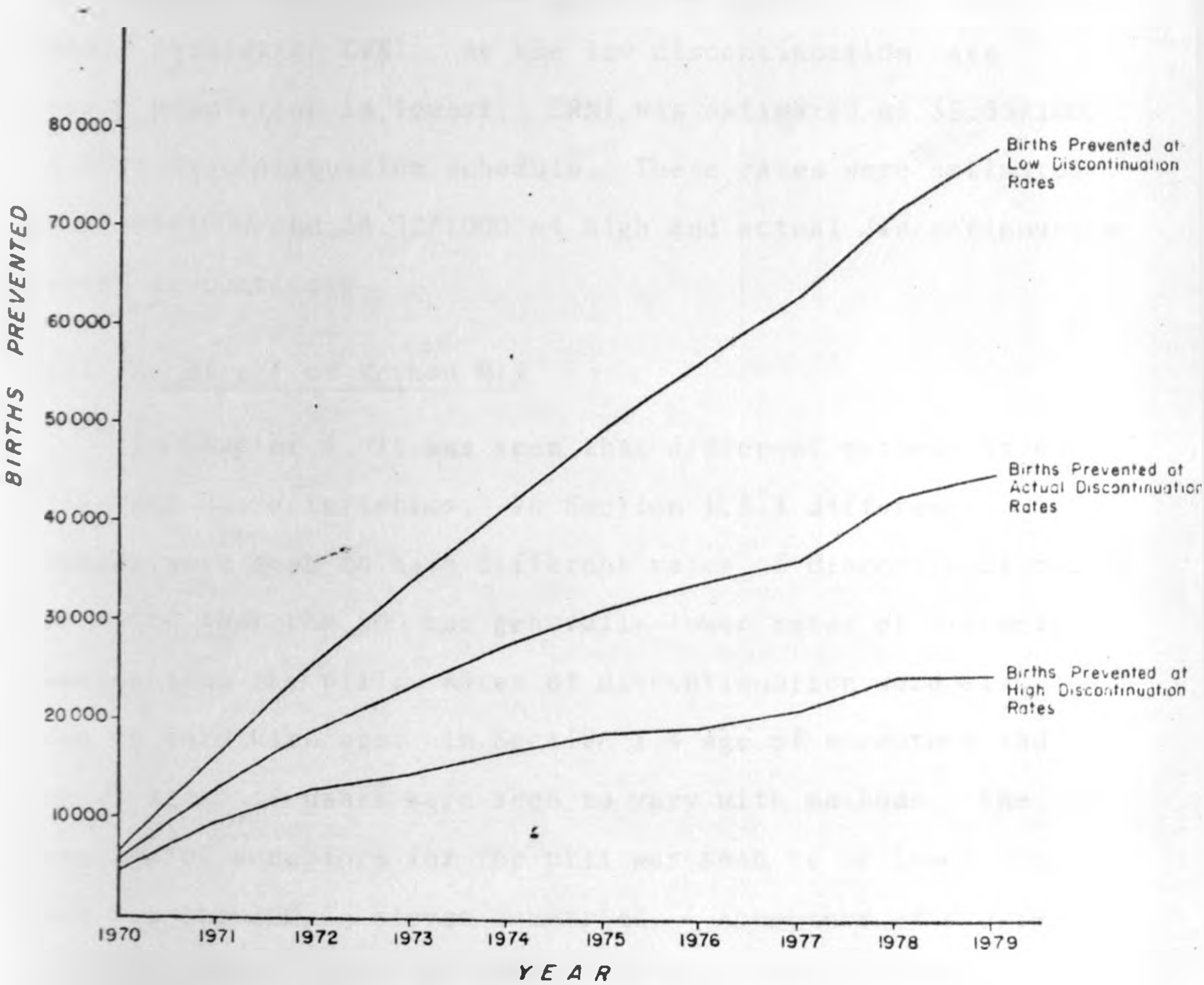
Year	Prevented births		
	Low discontinuation	Actual discontinuation	High discontinuation
1970	6,423	5,704	4,862
1971	16,031	12,792	9,549
1972	25,465	18,706	12,746
1973	33,768	23,052	14,577
1974	42,063	27,338	16,646
1975	49,695	30,957	18,176
1976	56,226	33,721	19,208
1977	63,214	37,192	21,024
1978	72,213	42,547	24,265
1979	78,202	44,926	24,512
Total	443,300	276,936	165,565

Source: Computer output based on the model.

The rate of increase in prevented births at the three discontinuation schedules is shown in Figure 5.3. This figure shows that at low discontinuation rates prevented births increase much faster than at the other two discontinuation schedules. Based on the discontinuation schedule prevented births rose from 72,213 in 1978 to 78,202 in 1979. During the same year the prevented births increased from 24,265 to 24,512 at the high discontinuation schedule. Thus, with high discontinuation rates prevented births plateau much faster.

Population sizes in 1979 are also different in each of the three discontinuation schedules. At the low discontinuation rate more births are prevented and hence the population size

FIG. 5.3: PROGRAM IMPACT AT DIFFERENT DISCONTINUATION RATES



is smaller than at the two other discontinuation rates. The female population was projected as 7,749,627 in 1979 at this discontinuation rate. At the high rate of discontinuation the female population was projected as 7,859,476. The female population was actually projected as 7,815,263 in 1979.

In 1979 the three discontinuation schedules give different rates of population growth as indicated by the female population CRNI. At the low discontinuation rate female population is lowest. CRNI was estimated as 35.33/1000 at this discontinuation schedule. These rates were estimated as 37.85/1000 and 36.92/1000 at high and actual discontinuation rates, respectively.

5.11 The Effect of Method Mix

In Chapter I, it was seen that different methods have different characteristics. In Section 1.3.4 different methods were seen to have different rates of discontinuation. It was noted that the IUD has generally lower rates of discontinuation than the pill. Rates of discontinuation were also seen to vary with age. In Section 1.4 age of acceptors and hence age of users were seen to vary with methods. The mean age of acceptors for the pill was seen to be lower than that for the IUD in eleven countries. Acceptors of sterilization and abortion are older. Methods also differ in their effectiveness. The pill was noted to be the most effective reversible contraceptive method while sterilization is the most effective nonreversible method. The methods accepted may, thus, independently affect the program's impact on fertility because of these characteristics.

In Kenya methods were seen to differ in popularity. The pill was seen to be the most popular method. IUD and injection were seen to be less popular, while "other" method is even less popular.

The estimated rates of discontinuation are different for the four methods. According to these estimates the "other" method had the lowest rate of discontinuation. The pill had the highest rate of discontinuation. The injection had higher rates than the "other" method but lower than the IUD. Rates of discontinuation were also seen to vary with age. Discontinuation rates were seen to be higher among young women, with those for the pill being the highest. In the age group 15-19, for instance, these were estimated as $r = 0.8463$ and $r = 0.4354$ for the pill and IUD, respectively. Due to lack of data, however, no attempt was made to determine the discontinuation rates by age group for the injection and "other" methods.

The age of acceptors showed that the pill acceptors are younger than those for the injection or the IUD, while the "other" method acceptors were the youngest. The discussion above thus suggests that different method mixes in Kenya may give different program impact. This is examined below.

First different method mixes were derived from different combinations of the various contraceptive methods. 15 such method mixes were, thus, derived. These are summarized in Table 5.15. The first four of these consist of the single method mixes, while the next six consist of method mixes having two methods. The next four consist of method mixes of three methods. The last method mix includes all the four methods.

Table 5.15 also summarizes the number of acceptors required under the above mixes to achieve the observed program impact during the 1969-1979 period. According to this table the "other" method mix would have required the least acceptors to achieve the actual impact during this period. 300,908 acceptors would have been required in this case. In estimating these acceptors, however, methods were assumed to be one hundred percent effective. Since the "other" method includes less effective methods such as the condom and traditional methods the number of acceptors required may be substantially higher than those estimated above. Also to be noted is that during this period there were 27,354 estimated acceptors of the "other" methods. Thus, the acceptor recruitment efforts would have been quite great. Among the single method mixes, the injection would have required the largest number of acceptors. 578,629 acceptors would have been required in this case.

TABLE 5.15 ACCEPTORS REQUIRED TO ACHIEVE THE ACTUAL DEMOGRAPHIC IMPACT DURING 1969-1979 PERIOD AT DIFFERENT METHOD MIXES

Mix	Required Acceptors	Actual Acceptors	Extra Acceptors
Pill	525,262	382,572	142,690
IUD	436,309	59 441	372,868
Injection	578,629	31,685	546,944
"Other"	300,908	27,354	273,554
Pill and IUD	511,807	442,013	69,794
Pill and injection	528,876	413,657	115,219
Pill and "Other"	503,213	409,926	93,287
IUD and injection	476,707	90,526	386,177
IUD and "other"	384,742	86,795	297,947
Injection and "other"	413,868	58,439	355,429
Pill, IUD and injection	512,287	473,098	39,189
Pill, IUD and "other"	496,863	469,367	27,496
Pill, injection and "other"	505,460	444,011	61,449
IUD, injection and "other"	425,532	117,880	307,652
Pill, IUD, injection & "other"	500,435	500,435	0

Source: Computer output based on the model

The method mix consisting of the IUD and "other" methods would have required the least number of acceptors among the method mixes consisting of two methods, while that of the pill and injection would have required the highest. These were estimated as 384,742 and 528,876 for the two mixes, respectively.

For the three method mixes, the IUD, injection and "other" mix would have required the least number of acceptors (425,532), while the pill, IUD and injection mix would have required the highest (512,287).

Overall, the "other" method mix would have required the least number of acceptors, while the injection mix would have required the highest. This indicates that both acceptance age and discontinuation rates have a considerable influence on the impact. Few "other" method acceptors are required because the discontinuation rate is low and acceptors are young. Although injection has lower discontinuation rates than either the pill or IUD, more acceptors are required because this method is restricted to older women.

The extra acceptors required during the 1969-1979 period are also shown in Table 5.15. Method mixes including the pill as one of the methods would have required the least number of extra acceptors. For the pill mix 525,262 acceptors were required while 382,572 were recruited. Greater program effort would have been required for method mixes without the pill. The injection method mix would have required 578,629 acceptors while only 31,685 were recruited during this period.

5.12 Conclusion

During the 1969-1979 period the national family planning program in Kenya was shown to have had a measurable effect on fertility. During this period an estimated 276,936 births were prevented. However, the prevention of births was not constant year by year. It was observed that prevented births increased from 5,704 in 1970 to about 44,926 in 1979. This increase was mainly attributed to increasing numbers of acceptors. It was shown that with a constant number of acceptors prevented births would have increased to only 21,641. Overall it was observed that only 174,344 births would have been prevented with a constant number of acceptors as against 276,936 actual births estimated to have been prevented during this period.

The analysis of the contribution to the impact by age groups showed that the age groups 20-24 and 25-29 had the highest contribution. These two age groups were shown to have contributed over half of the program's impact during this period. The factors responsible for this were also discussed. It was noted that the two age groups had the highest proportion of users and the highest potential fertility.

The program slowed the rate of population growth. It was shown that the female crude birth rate rose by about 2.1/1000 points during this period, while the potential rise was about 4.2/1000 points.

Age specific fertility rates were also shown to have been lowered by the program. The reduction in ASFRs was different in different age groups. In age group 35-39 ASFR was reduced most (10 percent).

Female population size was smaller thanit would have been without the program. In 1979 the female population was smaller by 110,749 persons or 1.4 percent.

Like the female crude birth rate, the crude rate of natural increase of the female population was slowed by the program. The female population CRNI rose from 33.87 to 36.92

during this period. Without the program, however, CRNI would have risen to 38.88.

Several factors which influenced the impact of the program on fertility were also discussed. It was shown that the overlap of contraceptive use with post-partum amenorrhea had a negative effect on the impact. Without the overlap 300,417 births or 7.8 percent more would have been prevented.

A comparison of the actual rates of discontinuation with the high and low discontinuation rates showed the influence of discontinuation rates on the impact. At the low discontinuation rates there would have been more users during each year of this period and, thus, the program's impact would have been greater. Under the assumption of low discontinuation, 1978 mid-year users were estimated as 194,464 and 443,330 births would have been prevented. At high discontinuation rates mid-year users would have been 45,115 in 1978 and only 165,565 births would have been prevented during this period (1969-1979). There were 103,731 actual mid-year users in 1978 and a total of 276,736 births were estimated as actually prevented.

The effect of method mixes on acceptor recruitment requirements was also investigated. It was shown that different method mixes required different numbers of acceptors to achieve the actual program impact during the 1969-1979 period. The least number of acceptors would have been required if the "other" method mix was adopted. In this case, a total of 300,908 acceptors would have been required. This was attributed to the young age at acceptance for the "other" method and the low discontinuation rates. The injection mix, on the other hand, would have required 528,876 acceptors. This was mainly attributed to the high age of acceptors.

CHAPTER VI

ESTIMATES OF CONTRACEPTIVE USE AND ACCEPTANCE REQUIRED TO ACHIEVE THE DEMOGRAPHIC GOAL IN 1979

6.1 Introduction

During the 1969-1979 period the Kenyan national family planning program had little effect on fertility as revealed by the analysis in Chapter V. In fact, fertility continued to rise and thus the program only slowed this rise. This is indicated by the female crude birth rate which was lowered by 2.1/1000 points by the program.

The other component of population growth in Kenya is mortality. During the 1969-1979 period mortality continued to decline. The female life expectancy at birth rose from 51.2 years to an estimated 53.8 years in 1979.

The above trends in the vital rates, thus, resulted in a rise of the population growth rate. The female population growth rate, for instance, rose from 3.5 percent per annum in 1969 to 3.9 percent per annum in 1979. However, the program slowed the rate of increase of the population growth rate. Thus, the crude rate of natural increase (CBR-CDR) of the female population was lower by 2/1000 points in 1979.

One of the objectives of the national family planning program discussed in Chapter II was to reduce the population growth rate during the 1969-1979 period. The program targeted a population growth rate of 3.0 percent per annum in 1979. However, as shown above, this target was not achieved. The objective of the analysis in this chapter is to estimate the level of contraceptive use and acceptance that would have been required to achieve this target.

TABRAP model was utilized for this estimation. The required data are summarized in Appendix II. Most of these are the same as that required by CONVERSE in Appendix I. The only additional data are the female crude birth rate in 1969 and the path linking it to the desired level in 1979. The annual number of contraceptive acceptors are generated as one of the outputs and thus, not needed as input.

Since the crude birth rate and not the population growth rate is required by TABRAP, the desired growth rate was first converted to a corresponding female crude birth rate as described in Chapter IV. This conversion estimated the birth rate, corresponding to a growth rate of 3.0, to be 41.5

6.2 Contraceptive Use Required to Achieve the Population Growth Rate Target in 1979

In 1978 only about 5.2 percent of MWRA were estimated to be contraceptive users. This level of use was low, and, thus, not sufficient to reduce the population growth rate to the desired level. Table 6.1 summarizes the required level of contraceptive use during this period. This shows that 22.36 percent of married women of reproductive ages users were required in 1978 at the estimated actual rates of discontinuation.

TABLE 6.1 CONTRACEPTIVE USERS AS PERCENT OF MWRA REQUIRED TO ATTAIN THE DEMOGRAPHIC GOAL IN 1979: ASSUMING DIFFERENT RATES OF DISCONTINUATION

Year	Discontinuation rates			Actual Users
	Actual	Low	Low & no overlap	
1969	0.00	0.00	0.00	0.00
1970	0.93	1.08	0.89	1.14
1971	3.49	3.97	3.47	2.01
1972	5.60	6.23	5.81	2.73
1973	8.09	9.03	8.40	3.19
1974	10.58	11.78	11.10	3.72
1975	13.71	15.30	14.37	4.03
1976	16.37	18.20	17.30	4.25
1977	19.39	21.57	20.46	4.61
1978	22.36	24.82	23.66	5.20

Source: Computer output based on the model.

The level of use required at low rates of discontinuation (r = 0.196) is also shown. According to this table slightly more users (24.82 percent) were required in 1978.

As was seen in the discussion in Chapter V, some Kenyan women acceptors are amenorrheic at the time of acceptance. Further discussion in that chapter showed that such contraceptive use does not contribute to the reduction of fertility. It was also shown that the program's impact would have been higher by about 23,481 births prevented if all acceptors were non-amenorrheic. Table 6.1 shows that fewer women users were required if all acceptors were non-amenorrheic. In 1978, about 23.16 percent of MWRA were required at the low discontinuation schedule.

In absolute numbers the above rates are summarized in Table 6.2. This shows that there were 103,731 projected actual users in 1978. At the same discontinuation rates, 446,327 users were required to attain the demographic goal by 1979. At the low discontinuation rates, more users (495,435) were required. About 472,344 users were required at low discontinuation rates and without overlap of use with post-partum amenorrhea.

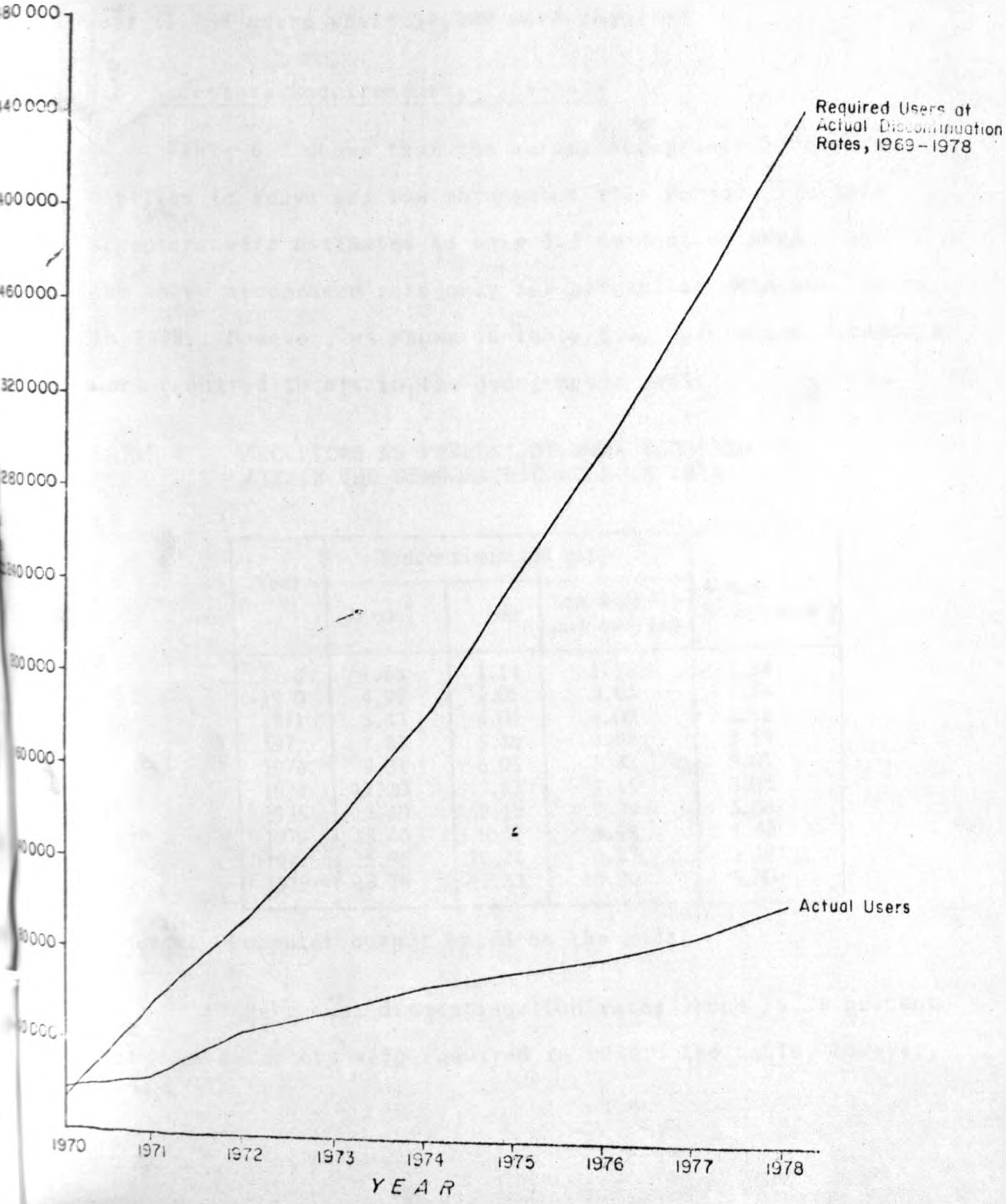
TABLE 6.2 NUMBER OF MID-YEAR USERS OF CONTRACEPTIVES REQUIRED TO ATTAIN THE DEMOGRAPHIC GOAL IN 1979

Year	Discontinuation Rates			Actual Users
	Actual	Low	Low & no overlap	
1969	0	0	0	0
1970	14,738	17,065	14,054	18,061
1971	56,809	64,514	56,378	23,738
1972	93,622	104,236	97,164	45,746
1973	139,009	155,250	144,374	54,804
1974	186,719	207,831	195,855	65,658
1975	249,951	279,079	262,116	74,470
1976	308,084	342,487	325,643	80,020
1977	376,148	418,462	396,868	89,453
1978	446,327	495,435	472,344	103,731

Source: Computer output based on the model.

A comparison of the actual build-up of users with that required to attain the demographic goal is shown in Figure 6.1. According to this figure the gap between required users

FIG. 6.1: A COMPARISON OF ACTUAL AND REQUIRED USERS



and actual users continued to widen during each year of this period. In 1970, there were 18,061 estimated users which were more than the 14,738 who were required. In 1971, however, there were 23,738 users while 59,809 were required.

6.3 Acceptors Requirements, 1969-1978

Table 6.3 shows that the actual acceptance of contraceptives in Kenya was low throughout this period. In 1978 acceptors were estimated as only 3.3 percent of MWRA. At the above acceptance rate only 5.2 percent of MWRA were users in 1978. However, as shown in Table 6.3, more women acceptors were required to attain the demographic goal.

TABLE 6.3 ACCEPTORS AS PERCENT OF MWRA REQUIRED TO ATTAIN THE DEMOGRAPHIC GOAL IN 1979

Year	Discontinuation rates			Actual acceptance
	Actual	Low	Low without overlap	
1969	1.58	1.14	1.16	1.94
1970	4.95	4.06	3.60	2.25
1971	5.83	4.04	4.00	2.58
1972	7.81	5.36	4.97	2.59
1973	9.31	6.05	5.82	3.01
1974	12.20	7.97	7.45	3.03
1975	13.30	8.12	7.90	3.06
1976	15.40	9.52	8.98	3.40
1977	16.96	10.24	9.87	3.98
1978	18.78	11.33	10.80	3.30

Source: Computer output based on the model.

At the actual discontinuation rates about 18.78 percent of MWRA acceptors were required in 1978. The table, however, shows that the acceptance rate is greatly influenced by discontinuation rates. At the low discontinuation schedule (r=0.196) only 11.3 percent of married women were required in 1978. Still fewer acceptors of MWRA (10.8 percent) were required in 1978 if all acceptors were non-amenorrheic.

The number of acceptors required under the three discontinuation schedules are summarized in Table 6.4. At the actual rates of discontinuation a total of 1,940,529 acceptors were required. At the low discontinuation schedule 1,237,887 acceptors or 36.2 percent less were required. The required number of acceptors would still have been fewer (1,174,428) if all were non-amenorrheic. During this period there were 500,455 estimated acceptors.

TABLE 6.4 ACCEPTORS NEEDED TO ACHIEVE THE DEMOGRAPHIC GOAL IN 1979 AT DIFFERENT RATES OF DISCONTINUATION

Year	Discontinuation rates			Actual acceptors
	Actual	Low	Low & no overlap	
1969	24,243	21,560	17,756	29,761
1970	78,109	64,084	56,883	35,136
1971	94,721	65,714	65,116	41,110
1972	130,595	89,624	83,110	42,205
1973	161,327	103,991	99,986	50,054
1974	215,183	140,991	131,415	51,446
1975	242,604	148,052	144,057	53,471
1976	289,851	179,159	169,055	61,227
1977	329,045	198,586	171,450	73,647
1978	374,849	226,126	215,600	62,408
Total	1,940,527	1,237,887	1,174,428	500,455

Source: Computer output based on the model.

The actual increase in the number of acceptors during this period was much lower than would have been required as shown in Figure 6.2. In 1969 there were 29,761 actual acceptors which was more than the 21,560 acceptors needed to attain the demographic goal. In 1970, however, there were 35,136 actual acceptors while 64,054 were required. The actual and required acceptors in 1978 further illustrate the low rate of increase in acceptors during this period. During this year there were only 62,408 acceptors recruited while 374,849 were required to achieve the demographic goal.

6.4 Acceptors by Methods

Several contraceptive methods are offered in family planning clinics in Kenya. In this analysis, however, these were classified into: pill, IUD, injection and "other". The "other" method includes methods, such as the condom, which are also available in some clinics. During the 1969 to 1979 period, all of the acceptors used one of these four methods. The number of acceptors of each method required were, however, different.

Table 6.5 shows that the required pill acceptors were considerably higher than those of the three other methods. A total of 1,471,117 acceptors of this method were required. During this time, only about 382,572 pill acceptors were recruited. Thus, the program would have had to increase pill acceptance by about four times.

FIG. 6.2: A COMPARISON OF ACTUAL AND REQUIRED ACCEPTORS

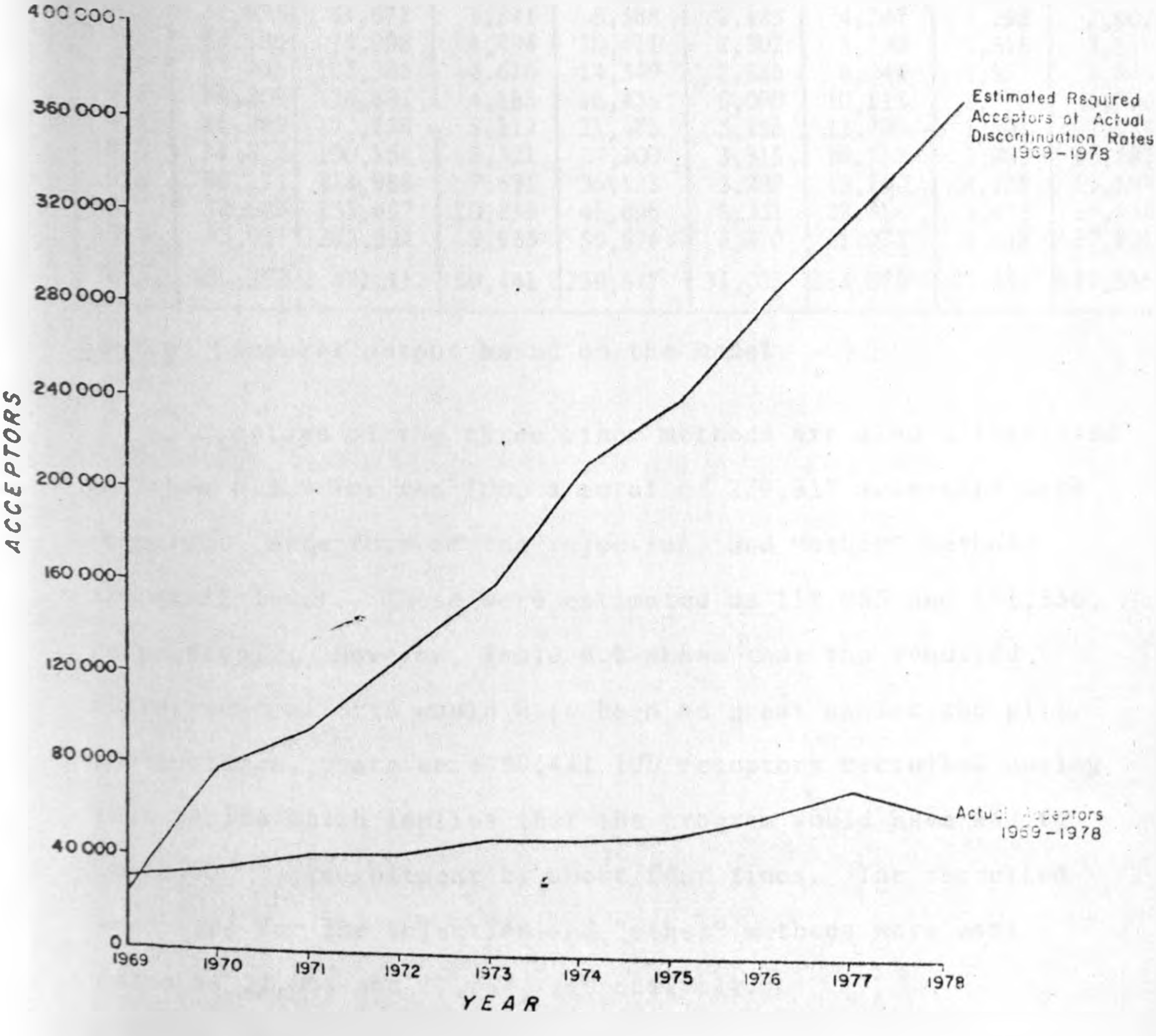


TABLE 6.5 ACCEPTORS BY METHODS REQUIRED TO ATTAIN THE DEMOGRAPHIC GOAL IN 1979

Year	Pill		IUD		Injection		"Other"	
	Actual	Reqd.	Actual	Reqd.	Actual	Reqd.	Actual	Reqd.
1969	23,626	19,218	3,254	2,665	1,782	1,450	1,099	901
1970	27,873	61,872	3,841	8,588	2,123	4,747	1,298	2,902
1971	32,586	74,998	4,494	10,411	2,502	5,793	1,518	3,519
1972	33,446	103,386	4,616	14,349	2,586	8,044	1,557	4,846
1973	39,209	128,681	4,185	16,436	3,090	10,113	2,770	6,096
1974	41,249	172,558	5,117	21,475	3,188	13,205	1,891	7,945
1975	41,872	190,164	5,321	24,200	3,315	14,757	2,962	13,482
1976	46,171	218,989	7,621	36,123	3,298	15,140	4,138	19,599
1977	52,583	235,857	10,259	45,896	5,331	22,854	5,473	24,438
1978	43,957	265,394	9,933	59,674	3,870	21,972	4,648	27,808
Total	382,572	1,471,117	59,441	239,817	31,085	118,075	27,354	111,536

Source: Computer output based on the model.

Acceptors of the three other methods are also illustrated in Table 6.5. For the IUD, a total of 239,817 acceptors were required. Acceptors of the injection and "other" methods are still lower. These were estimated as 118,085 and 111,536, respectively. However, Table 6.5 shows that the required recruitment efforts would have been as great as for the pill. For instance, there were 59,441 IUD acceptors recruited during this period which implies that the program would have had to increase recruitment by about four times. The recruited acceptors for the injection and "other" methods were estimated as 31,085 and 27,354, respectively.

6.5.1 Reduction in Population Size and Changes in Other Demographic Measures

During the 1969-1978 period a total of about 500,455 women accepted contraceptives. At the estimated rates of discontinuation there were 103,731 users in 1978. A total of 276,936 births were prevented by users during this period (1969-1979). These births were, however, inadequate to achieve the demographic goal in 1979. In fact, the program only slowed the rate of increase in fertility. The female crude birth rate, for instance, rose to an estimated 51.00/1000 in 1979.

To achieve the demographic target in 1979 the female crude birth rate would have had to be reduced to 41.5/1000, which was estimated to correspond to a population growth rate of 3.0 percent per annum in 1979. To attain the above crude birth rate a total of about 981,433 births should have been prevented during this period as shown in Table 6.6.

TABLE 6.6 PREVENTED BIRTHS REQUIRED TO ACHIEVE THE TARGET, 1969-1979

Year	Actual	Required	Year	Actual	Required
1969	0	0	1975	30,957	102,129
1970	5,704	4,684	1976	33,721	129,847
1971	12,792	20,024	1977	37,192	155,610
1972	18,706	37,212	1978	42,548	185,116
1973	23,052	56,035	1979	44,926	216,433
1974	27,338	76,035	Total	276,936	981,651

Source: Computer output based on the model

Both the births to be prevented during each year and those which were actually prevented are shown in Table 6.6. This shows that the increase in prevented births was obviously lower than that of births which should have been prevented. In 1970 there were 5,704 births prevented which increased to 12,792 in 1971. Over the same period, there should have been a rise from 4,684 births in 1970 to 20,024 in 1971. Figure 6.3 further illustrates the low increase in prevented births. This figure shows that the gap between the actual births prevented and those which should have been prevented continued to widen.

6.5.2 Changes in Population Size

If the demographic target was reached in 1979 the corresponding population size would have been smaller. This is shown in Table 6.7. According to this table, without the program the female population size was projected as 7,926,012 in 1979. Under the existing program the female population was projected as 7,815,263 which is 1.4 percent lower. The female population would still have been smaller (7,542,531) if the target was achieved. This represents a 4.84 percent reduction in female population size. As explained earlier, the female population is reduced by only about half of the prevented births.

G. 6.3: A COMPARISON OF ACTUAL PROGRAM IMPACT AND REQUIRED PROGRAM IMPACT

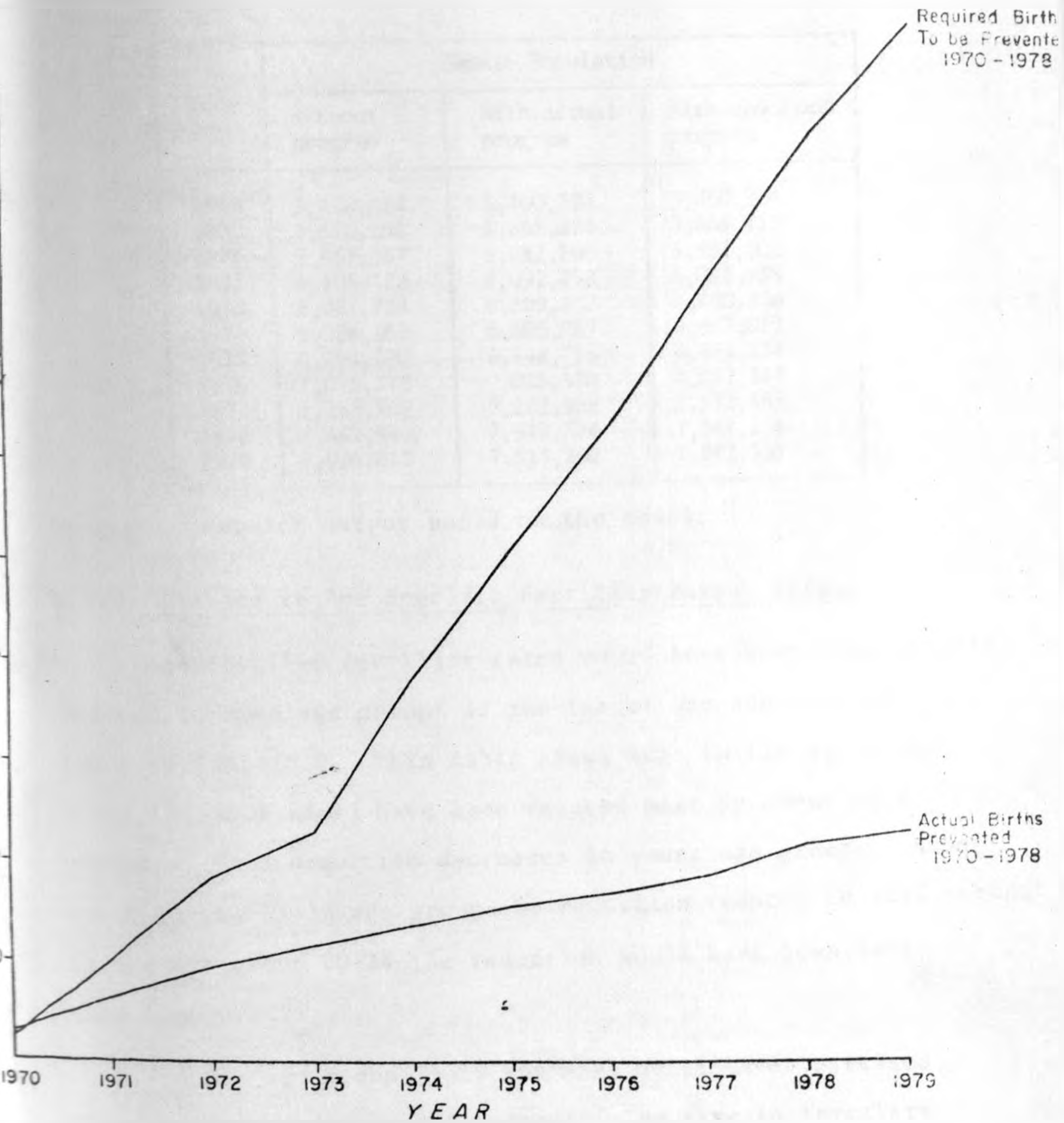


TABLE 6.7 CHANGES IN THE FEMALE POPULATION SIZE

Year	Female Population		
	Without program	With actual program	With required program
1969	5,460,324	5,460,324	5,460,324
1970	5,670,198	5,668,874	5,669,111
1971	5,887,837	5,882,205	5,881,002
1972	6,105,122	6,092,298	6,085,135
1973	6,321,224	6,299,232	6,280,436
1974	6,536,362	6,503,787	6,467,019
1975	6,794,580	6,748,716	6,684,224
1976	7,076,372	7,015,570	6,912,544
1977	7,359,365	7,282,968	7,132,185
1978	7,642,540	7,549,374	7,342,138
1979	7,926,012	7,815,262	7,542,531

Source: Computer output based on the model.

6.5.3 Changes in Age Specific Fertility Rates (ASFRs)

Age specific fertility rates would have been considerably reduced in some age groups if the target was achieved as shown in Table 6.8. This table shows that in the age group 40-44 the ASFR would have been reduced most by about 63.4 percent. This reduction decreases in young age groups. Among women in the 35-39 age group the reduction reduces to 42.8 percent In the age group 20-24 the reduction would have been less than 1 percent.

In the age group 15-19 the ASFR would have increased from 0.135 to 0.149 or 8.9 percent. The rise in fertility in this age group could be due to several factors. Between 1969 and 1979 fertility increased in all age groups. It was also noted that the level of contraceptive use in this age group is low. Among all women users, the women in the age group 15-19 are in the program for the shortest time. Thus, it can be concluded that the effect of the program on fertility in this age group is smaller than the effect of factors affecting fertility positively. Since women in the age group 40-44 are in the program for the longest time, this could explain why fertility is reduced most in this age group and this reduction declines in younger age groups.

TABLE 6.8 PROJECTED CHANGES IN AGE SPECIFIC FERTILITY RATES IF THE DEMOGRAPHIC TARGET WAS ACHIEVED

Age Group	ASFR 1969	ASFR 1979	Percent Reduction
15-19	0.135	0.147	-8.9
20-24	0.336	0.333	0.89
25-29	0.338	0.274	19.50
30-34	0.294	0.193	34.35
35-39	0.224	0.128	42.86
40-44	0.134	0.049	63.42

Source: Computer output based on the model

6.5.4 The Effect on Total Fertility Rate (TFR)

TFR was estimated as 7.3 in 1969 by the model. This is lower than the estimate of 7.6 by the Central Bureau of Statistics because the model only considers fertility of women in age groups 15-44. However, the difference between the two estimates is small. As shown in the discussion in Section 6.5.3, ASFR would have been reduced considerably in some age groups. This reduction would have resulted in a considerable reduction in TFR. In 1979 TFR would have been reduced to 5.6 or by 23.3 percent.

6.5.5 The Effect on The Female Population Growth Rate

Between 1969 and 1979 it was noted that the population growth rate rose. The female population growth rate was shown to have increased from 3.5 percent per annum in 1969 to 3.9 percent per annum in 1979. The target, however, required the population growth rate to be reduced to 3.0 percent per annum in 1979. This was estimated to correspond to a female CBR of 41.5 and female population growth rate of 3.1 percent per annum. However, the CBR was estimated from the female population growth rate on the assumption that the population is stable. Thus, there is some small discrepancy between the desired population growth rate and that achieved. For an example, the female population growth rate of 3.0 percent per annum is estimated to correspond with the above crude birth rate. The difference between the targeted and achieved growth rate is, however, small and would not be expected to affect acceptor recruitment greatly.

6.6 Conclusion

The main objective of the analysis in this chapter was to estimate the number of users and acceptors of contraceptives required to achieve a targeted population growth rate of 3.0 percent in 1979. The analysis revealed that the level of contraceptive use in Kenya, during the 1969-1979 period, was insufficient to achieve the demographic goal in 1979. In 1978 5.2 percent of MWRA were estimated as users of contraceptives, while 22.36 percent were required. It was observed that this level of use was not significantly affected by rates of discontinuation. In 1978, 24.82 percent of MWRA users were required at the low discontinuation rate. The level of use required at low discontinuation and without overlap was noted to be lower (23.66 percent).

The actual level of contraceptive acceptance in Kenya was much lower during the 1969-1979 period than would have been required to achieve the target. In 1978 only 3.3 percent of MWRA were acceptors while 18.78 percent were required.

The required acceptance level was shown to be greatly influenced by rates of discontinuation. At low discontinuation rates the percent of MWRA acceptors is reduced to 11.4 in 1978. Still fewer acceptors (10.8 percent) would have been required if all acceptors were non-amenorrheic.

Analysis of recruitment requirements by methods revealed that the pill would have required more acceptors than the three other methods. In 1978, 265,394 pill acceptors out of 324,849 were required. To achieve this number of acceptors recruitment efforts would have had to increase about four times. Although the other methods would have required fewer acceptors, recruitment efforts would have been about the same as for the pill.

If the demographic target had been reached in 1979 the female population would have been 7,542,531, or 4.84 percent less than the actual population. Age specific fertility rates would also have been reduced substantially in some age groups. This would in turn have reduced the TFR substantially. TFR would have been reduced by 23.3 percent to 5.6.

CHAPTER VII

ESTIMATES OF CONTRACEPTIVE USERS AND ACCEPTORS, 1979-1989

7.1 Introduction

The discussion in Chapters V and VI showed that the level of contraceptive use and acceptance during the 1969-1978 period was too low to achieve the targeted population growth rate of 3.0 percent in 1979. In Chapter V it was noted that the population growth rate rose to nearly 4 percent per annum under the present program. In Chapter VI it was observed that to reduce the population growth rate to 3 percent per annum in 1979 more contraceptive users and acceptors were needed during this period.

The long range goal of the family planning program is to achieve a population growth rate of 2.8 percent per annum in 2000. However, the analysis in Chapters V and VI indicates that the goal will not be achieved at the present level of performance by the program. In this chapter we intend to estimate the number of users and acceptors of contraceptives needed during the 1979-1989 period to achieve the population growth rate targeted in 2000.

The analysis in this chapter was carried out using the TABRAP model. The information summarized in Appendix III was required and includes both demographic and family planning program data. Future trends in some demographic and family planning program data were also required. Since such data cannot be accurately derived estimates were obtained using some assumptions.

One of the input data required by TABRAP is fertility levels during 1979-1989. This was estimated by assuming no further rise in fertility during this period. A female mortality trend is also required. This was estimated by assuming a linear increase in the life expectation at birth during this period. This was derived by extrapolating the increase between 1969 and 1979 to 1989. The estimate was 56.3 years. The path linking the female crude birth rate in 1979 to its desired level in 1989 is also required. First, the two crude birth rates, in 1979 and 1989 were obtained. The latter was estimated from the 1979 census and was found to be 56.3/1000. In 1989 the female crude birth rate was estimated as 43.3/1000 as described in Section 4.2.7. The two were linked by a linear path. Proportion of married women was estimated by assuming no change in the proportion getting married during this period. Thus, in 1989, these proportions were taken to be the same as in 1979.

Several assumptions were also made to estimate some of the family planning program data. The overlap of use with post-partum amenorrhea for each method during 1979-1989 were assumed to be the same as during 1969-1979 period. Other assumptions were made, for example, on the proportion of acceptors accepting the various methods. These will be described in the relevant sections.

7.2 Acceptor Requirements, 1979-1988

The annual number of acceptors required to achieve the demographic goal in 1989 are shown in Table 7.1. According to this table, 3,070,202 acceptors will be required in this decade. The table also shows that these increase by about 5 times between 1979 and 1988. In 1979, 105,531 acceptors were required. These increase to 522,174 in 1988.

TABLE 7.1 ACCEPTOR REQUIREMENTS, 1979-1988

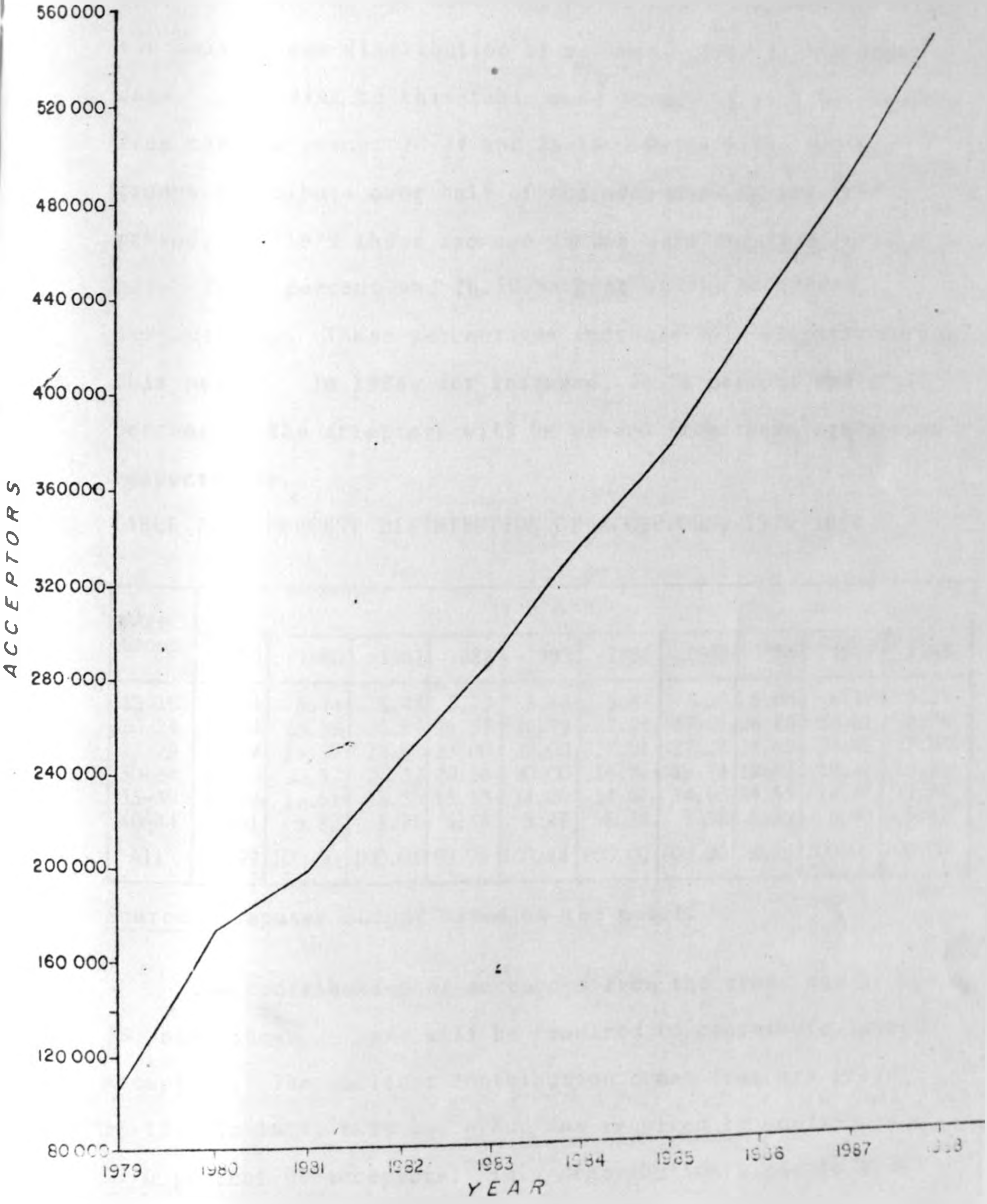
Year	Acceptors	Year	Acceptors
1979	105,531	1984	323,298
1980	172,123	1985	360,504
1981	192,315	1986	414,210
1982	238,114	1987	465,189
1983	276,744	1988	522,174
Total			3,070,202

Source: Computer output based on the model.

The increase in the number of acceptors is illustrated in Figure 7.1. This is seen to be more or less linear. However, between 1979 and 1980 the increase is higher than in later years. 105,531 acceptors rise to 172,123 in 1980. In 1981 the increase is lower. Thereafter acceptors increase linearly.

The age distribution of acceptors is summarized in Table

FIG. 7.1: ACCEPTOR REQUIREMENTS, 1979-1988.



7.2. This is the age distribution of acceptors derived using the initial age distribution by methods, given as the input data. According to this table more acceptors will be required from the age groups 20-24 and 25-29. Overall the two age groups contribute over half of the acceptors during this period. In 1979 these two age groups were required to contribute 24.72 percent and 26.89 percent of all acceptors, respectively. These percentages increase only slightly during this period. In 1988, for instance, 26.78 percent and 27.85 percent of the acceptors will be needed from these age groups, respectively.

TABLE 7.2 PERCENT DISTRIBUTION OF ACCEPTORS, 1979-1988

Age Group	YEAR									
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
15-19	5.76	5.74	5.78	5.79	5.83	5.87	5.97	6.06	6.17	6.29
20-24	24.74	25.33	25.87	26.33	26.79	27.21	27.01	26.88	26.81	26.78
25-29	26.89	26.97	26.97	27.00	27.00	27.01	27.27	27.49	27.68	27.85
30-34	20.70	20.52	20.32	20.16	20.00	19.86	19.74	19.62	19.47	19.29
35-39	15.89	15.61	15.36	15.13	14.90	14.69	14.63	14.55	14.47	14.38
40-44	6.01	5.83	5.71	5.58	5.47	5.36	5.38	5.39	5.40	5.41
All	99.99	100.00	100.01	99.99	100.24	100.00	100.00	99.99	100.00	100.00

Source: Computer output based on the model.

The contribution of acceptors from the other age groups is also shown. These will be required to contribute fewer acceptors. The smallest contribution comes from age group 15-19. In 1979, this age group was required to contribute 5.76 percent of acceptors. This contribution rises to 6.29 percent in 1988. The age group 40-44 contributes 6.01 of acceptors in 1979, which decreases to 5.41 in 1988.

The required number of acceptors for each method is shown in Table 7.3. These are the estimates based on the assumed proportion of each method accepted. During the 1979-1988 period these proportions were assumed to be constant. Thus, these were taken to be the same as those of 1979 during each year of this period. According to this table more pill acceptors will be needed. Out of the 3,070,202 acceptors, 2,074,923 will be for pill. The number of acceptors during each year are also shown. In 1979, 70,822 pill acceptors out of 105,530 were required.

TABLE 7.3. ACCEPTORS BY METHODS, 1979-1988

Method	YEAR				
	1979	1980	1981	1982	1983
Pill	70,822	115,727	129,515	160,590	186,908
IUD	19,823	32,327	36,104	44,690	51,920
Inj.	6,285	10,091	11,117	13,590	15,596
"Other"	8,600	13,978	15,579	19,244	22,320
All	105,530	172,123	192,315	238,114	276,744

Method	1984	1985	1986	1987	1988	Total
Pill	218,634	243,855	280,276	314,913	353,683	2,074,923
IUD	60,632	67,617	77,693	87,244	97,910	575,960
Inj.	18,000	19,990	22,863	25,531	28,473	171,536
"Other"	26,033	29,041	33,379	37,500	42,109	247,783
All	323,299	360,503	414,211	465,188	522,175	3,070,202

Source: Computer output based on the model

The number of acceptors of the three other methods are also shown. A total of 575,960 IUD acceptors will be required. Acceptors of the two other methods will still be lower. These were estimated as 171,536 and 247,783, for the injection and the "Other" methods, respectively.

7.3. The Effect of Discontinuation Rates and Post-Partum Amenorrhea on Acceptor Recruitment Requirements

Acceptor recruitment requirements are considerably influenced by the rates of discontinuation as revealed by the analysis in Chapter VI. It was observed that at the low discontinuation rate (r = 0.196), 1,137,551 acceptors were required to attain the demographic goal in 1979. At the actual discontinuation rates during this period 1,940,527 acceptors were required. The effect of rates of discontinuation on acceptor recruitment requirement was further illustrated by the acceptance level required at different rates of discontinuation. At the low rate of discontinuation only 11.33 percent of married women acceptors were required in 1978 to attain the demographic goal. 18.78 percent of married women acceptors were required at the estimated actual discontinuation rates.

During 1979-1988 period the required acceptors will be reduced substantially if the discontinuation rates are low. This is illustrated in Table 7.4. At the low discontinuation rate a total of 1,909,718 acceptors are required. This represents a reduction of 37.8 percent of the 3,070,202 acceptors required if the actual discontinuation rates during this period apply.

TABLE 7.4 ACCEPTOR REQUIREMENTS AT DIFFERENT RATES OF DISCONTINUATION, 1979-1989

Year	Discontinuation		
	Actual	Low	Low and no overlap
1979	105,531	82,444	67,824
1980	172,123	108,821	105,040
1981	192,315	126,537	120,140
1982	238,114	151,244	143,648
1983	276,744	174,781	166,762
1984	323,298	201,187	191,870
1985	360,504	219,073	210,694
1986	414,210	252,378	240,311
1987	465,189	280,127	268,826
1988	522,174	313,126	299,626
Total	3,070,202	1,909,718	1,814,741

Source: Computer output based on the model.

The overlap of use with post-partum amenorrhea increases the number of required acceptors because contraceptive use during this period has no effect on fertility. During the 1978-1988 period the number of acceptors is reduced further if all of them are non-amenorrheic as shown in Table 7.4. At the low discontinuation rate and no overlap a total of 1,814,741 acceptors or 40.9 percent less will be needed.

7.4 Contraceptive Users, 1979-1988

The analysis in Chapters V and VI showed that the level of contraceptive use in Kenya was low during the 1969-1979 period. In 1978 contraceptive use was estimated as only 5.2 percent among married women whereas about 22.36 percent of married women users were required to achieve the demographic goal.

The proportion of married women users required during each year of the period 1979-1988 are summarized in Table 7.5. This table shows that in 1979 there were about 5.19 percent of married women estimated as users. This percentage increases to 23.26 in 1988.

TABLE 7.5 USERS AS PERCENT OF MARRIED WOMEN AT DIFFERENT RATES OF DISCONTINUATION

Year	Discontinuation		
	Actual	Low	Low and without overlap
1979	5.19	5.19	5.19
1980	6.27	7.11	6.57
1981	8.71	9.42	8.86
1982	10.62	11.68	11.03
1983	12.84	14.10	13.34
1984	15.01	16.56	15.71
1985	17.14	18.96	18.62
1986	19.06	21.11	20.13
1987	21.16	23.48	22.58
1988	23.26	25.26	24.67

Source: Computer output based on the model

Rates of discontinuation do not greatly affect the required level of contraceptive use as shown in Chapter VI. It was observed that at the low discontinuation rates 24.82 percent of married women users were required at the low discontinuation rates in 1978. This is only slighlty lower (22.36 percent) at the actual discontinuation rates.

Table 7.5 also summarizes the level of use among married women during the 1979-1988 period at the low discontinuation rates. In 1979 users were estimated as 5.19 percent of married women. This rises to 25.82 percent.

Some contraceptive use does not contribute to the prevention of births because some of it overlaps with the period of post-partum amenorrhea. Without the overlap fewer users among married women are required. In 1988, for instance, 24.67 percent of married women are required.

7.5 Acceptor Recruitment Strategies, 1979-1988

Because different methods have different characteristics and are accepted in different proportions in different age groups, it was shown in Chapter V that different method mixes would require different number of acceptors. Of the 15 method mixes, obtained from different combinations of the four methods, the method mix consisting of the "other" method required the least number of acceptors. The pill and injection mix, on the other hand, needed the highest number. It was observed further that some method mixes required greater program efforts depending on the popularity of the methods. In Kenya the pill is the most popular method and method mix without this method requires the greatest program effort. One program strategy would, thus, be to increase the acceptance of the pill.

The number of required acceptors in this case is illustrated by assuming that the acceptance rate for the pill increases linearly from 67 percent in 1979 to 90 percent in 1989. The acceptance rate for the "other" and injection methods are assumed to decrease to zero during the same period, while that for the IUD decreases from 19 percent to 10 percent.

The number of acceptors required is summarized in Table 7.6. This shows that the number of acceptors under this strategy would be 5,217,362 or 41.2 percent more than would be required if the acceptance rates by methods are allowed to remain at the 1979 level during this period. This reflects the poor continuation rates for the pill as compared with the three other methods.

TABLE 7.6 ACCEPTORS REQUIREMENTS UNDER THE PILL STRATEGY

Year	Acceptors	Year	Acceptors
1979	139,562	1984	547,988
1980	279,329	1985	623,392
1981	312,878	1986	716,776
1982	393,646	1987	821,252
1983	464,815	1988	917,274
Total			5,217,362

Source: Computer output based on the model.

However, the number of users needed would be lower if this strategy is adopted. Table 7.7 below shows the proportion of married women users during this period. This shows that 18.17 percent of married women would be users under this strategy in 1978.

TABLE 7.7 PERCENT OF MARRIED WOMEN USERS UNDER PILL STRATEGY

Year	Users	Year	Users
1979	5.19	1984	11.82
1980	6.82	1985	13.43
1981	7.14	1986	14.88
1982	8.48	1987	16.45
1983	10.19	1988	18.17

Source: Computer output based on the model

Another program strategy would be the introduction of a low discontinuation method, sterilization. Since such a non-reversible method would be unpopular among young women it was assumed that its age distribution would be the same as for the injection. The proportion of acceptors for this method is assumed to increase linearly from 0 percent in 1979 to 14 percent in 1988, while acceptors of injection and "other" methods decrease linearly to zero over the same period. The discontinuation rate was taken as r = 0.001. The overlap of use with post-partum amenorrhea was assumed to be high and thus estimated to be the same as that of IUD (0.132 years).

The number of acceptors required are summarized in Table 7.8. This shows that a total of 4,682,973 acceptors would be required under this strategy. This is about 34.4 percent higher than the 3,070,202 acceptors required under the present method mix. The table also show that acceptance rate among married women is higher. In 1988 25.29 percent of married women acceptors would be needed under this strategy.

More women acceptors are required under the above strategy because as was shown in Chapter V potential fertility is highest among women in age group 20-24 and then decreases in older age groups. The replacement of "other" method acceptors with older women acceptors would thus require more acceptors since on the average each acceptor prevents less births if all other factors are the same. The replacement of "other" methods with sterilization has yet another effect. "Other" method acceptors are on the average young women. These women have thus a longer time through which their fertility is affected. The sterilization acceptors, although most of them remain in the program, have only a few years in which their fertility is affected. Thus on the average each acceptor of "other" and injection prevents more births than each acceptor of sterilization.

TABLE 7.8 ACCEPTORS AND ACCEPTANCE RATES UNDER THE STRATEGY INCLUDING STERILIZATION AS ONE OF THE METHODS

Year	Percent	Acceptors	Year	Percent	Acceptors
1979	6.79	139,226	1984	20.24	508,722
1980	12.99	278,565	1985	21.37	561,225
1981	13.80	308,730	1986	22.87	626,173
1982	16.43	382,822	1987	24.09	686,434
1983	18.26	442,223	1988	25.29	748,853
Total					4,682,913

Source: Computer output based on the model

The number of users needed is, however, slightly lower (22.65 percent MWRA) than the 23.26 percent needed in the present method mix. Table 7.9 shows both users and users as a percent of married women.

TABLE 7.9 USERS AND USERS AS PERCENT OF MARRIED WOMEN UNDER THE STRATEGY INCLUDING THE STERILIZATION AS ONE OF THE METHODS

Year	Percent	Users	Year	Percent	Users
1979	5.19	106,509	1984	12.95	325,445
1980	6.81	103,156	1985	15.22	399,602
1981	7.23	161,714	1986	17.46	477,853
1982	8.76	204,092	1987	19.99	569,436
1983	10.83	262,183	1988	22.65	670,477

Source: Computer output based on the model.

Fewer users required reflects the effect of ageing of the users. At low rates of discontinuation acceptors use a longer time than at high discontinuation rates. Thus, each user at the low discontinuation rates averts on the average fewer births than each user at high discontinuation rates. With the strategy including sterilization as one of the methods more acceptors are required. This implies that each acceptor remains in the program for a shorter time than at the actual method mix strategy and thus averts more births on the average. Hence, the need for fewer users under this strategy.

7.6 The Impact of the Program, 1979-1989

To achieve the demographic target in 1989 it was estimated that the female crude birth rate be reduced from 56.3/1000 in 1979 to 43.3/1000 in 1989. A total of 2,173,313 births will need to be averted to reduce the crude birth rate to this level (see Table 7.10). This table shows the number of births which will need to be prevented during each year of this period. These are the births to be prevented by on-going users and acceptors of the previous year.

TABLE 7.10 PREVENTION OF BIRTHS, 1979-1989

Year	Prevented Births	Births prevented by new acceptors
1979	72,261	25,344
1980	97,216	41,908
1981	125,018	47,517
1982	155,762	59,266
1983	189,443	69,409
1984	226,167	81,516
1985	263,239	91,254
1986	303,526	105,024
1987	347,006	118,240
1988	393,675	132,999
Total	2,173,313	

Source: Computer output based on the model

According to this table the number of births to be prevented during each year is not constant but increases by about 5 times. In 1979, for instance, 72,261 births needed to have been prevented. This increases to 393,675 births in 1988. The increase in prevented births follows the increase of users. These were shown to increase about 5 times.

The number of births to be prevented by new acceptors of each previous year are also illustrated. Of the 72,261 births required to be prevented in 1980, new acceptors in 1979 were required to contribute 25,344 (35.1 percent). In 1988 new acceptors will be required to contribute 132,999 (33.8 percent) of prevented births. The increase in prevented births by new acceptors follows the increase in new acceptors.

7.7 The Effect on Population Size, 1979-1989

The population size will be smaller if the demographic target is achieved. Table 7.11 shows the female population projected assuming no new acceptors between 1979-1989 and the population if the target is achieved. According to this table the female population is projected to increase from 7,706,075 in 1979 to 12,026,487 if no new acceptors are recruited during this period. With the required program the female population is projected as 11,202,312 in 1989. This represents a reduction of 6.4 percent in the female population size.

Table 7.11 also shows the female population during each year of this period. The female population is only reduced by about half of the prevented births. As explained in Chapter V, this is because the prevented births include both sexes.

TABLE 7.11 THE EFFECT OF THE PROGRAM ON THE FEMALE POPULATION SIZE, 1979-1989

Year	Female pop. without prog.	Female pop. with required prog.
1979	7,706,075	7,705,075
1980	8,047,774	8,041,844
1981	8,426,436	8,398,512
1982	8,813,901	8,745,420
1983	9,205,531	9,080,615
1984	9,599,343	9,403,553
1985	10,056,317	9,767,376
1986	10,549,323	10,147,606
1987	11,042,383	10,514,053
1988	11,535,253	10,886,166
1989	12,026,487	11,202,312

Source: Computer output based on the model

7.8 The Program's Effect on the Age-Specific Fertility Rate (ASFR) and Total Fertility Rate (TFR)

Table 7.12 shows the ASFRs in 1979 and 1988 if the demographic target is achieved. It is observed that fertility was high in Kenya in 1979. The ASFR in 1979 represents a TFR of 8.0 births which is slightly lower than the 1979 estimate (8.3 births) because the fertility of women in the age group 45-49 is not considered by the model.

In 1989 ASFR would be lower in all age groups as shown in Table 7.12. However, these reductions are not the same in all age groups. According to this table ASFR is reduced by only 5 percent in age group 15-19 whereas in age group 40-44 ASFR is reduced by 44.4 percent. This reduction decreases as one descends to the younger age groups.

The above reduction is ASFRs reduces the TFR to 5.8 in 1989. This represents a 27.5 percent reduction in the TFR.

TABLE 7.12 PROJECTED CHANGES IN AGE-SPECIFIC FERTILITY RATES

Age Group	ASFR 1979	ASFR 1989	% Reduction
15-19	0.160	0.152	5.0
20-24	0.410	0.345	15.9
25-29	0.388	0.267	31.2
30-34	0.315	0.189	40.0
35-39	0.228	0.135	40.8
40-44	0.117	0.065	44.4

Source: Computer output based on the model.

7.9 Changes in the Female Population Growth Rate

In 1979 the female population growth rate was estimated as 4.1 percent per annum by the model. This would be reduced to 3.2 percent per annum if the target is achieved. This growth rate is lower than the targeted growth rate (3.4 percent per annum). The reason for this difference is because of the assumptions made in estimating the crude birth rate from the population growth rate. To get the former, the population was assumed to be stable. However, the discrepancy between the targeted and resulting growth rates is small.

7.10 Conclusion

The objective of the analysis in this chapter was to estimate the required number of users and acceptors of contraceptives during 1979-1988. It was shown that a total of 3,070,202 acceptors will be required to achieve the demographic goal. It was further observed that acceptors increase from 105,531 in 1979 to 522,174 in 1988. This increase was shown to be more or less linear. The age distribution of the acceptors showed that over half of the acceptors will be contributed by the age groups 20-24 and 25-29. The analysis of the acceptors by methods showed that the pill acceptors will be substantially higher than acceptors of the three other methods. It was shown that 2,074,923 pill acceptors out of a total of 3,070,202 will be needed.

The rates of discontinuation were noted to have a considerable influence on acceptor requirements. It was shown that the number of acceptors would be reduced substantially if acceptors adopt low discontinuation rates (r = 0.196). The acceptors load would be reduced by over 40 percent. A further reduction in acceptors load was noted if all acceptors are non-amenorrheic.

The level of contraceptive use required during each year of the 1979-1988 period was estimated. It was shown that in 1988 about 23.26 percent of married women users are required. The level of use increases by about 5 times during this period. The rates of discontinuation do not affect the number of users greatly. At the low rates of discontinuation the level of use is only slightly higher (25.26 percent of married women). Without the overlap of use with post-partum amenorrhea the level of use is still lower (24.67 percent).

Two program strategies were considered. In the first, the acceptance of the pill is increased to 90 percent during this period. It was observed that the required number of acceptors under this strategy is higher by about 41.2 percent. However, it was shown that the number of users is smaller. Only about 18.17 percent of MWRA users are needed in 1988.

The other method considers the introduction of sterilization as a program method. It was shown that the acceptors needed in this case are fewer than under the above strategy. However more users would be needed under this strategy. In 1988, for instance, 25.29 percent of married women users would be required.

A total of 2,173,373 births would need to be prevented to achieve the target. This reduces the female population size by about 6.7 percent from the projected 12,026,487 to 11,202,312 in 1988. The age specific fertility rates would be considerably reduced in some age groups. In the age group 40-44 the ASFR would be reduced by 44.4 percent. The reduction in ASFRs would result in a 27.5 percent reduction in TFR in 1989 to 5.8.

CHAPTER VIII

CONCLUSION

This study had three main objectives: the assessment of the impact on fertility of the Kenyan national family planning program during the 1969-1979 period; the assessment of the program performance required during the 1969-1979 period to achieve the demographic goal of a population growth rate of 3.0 percent per annum in 1979 and the estimation of contraceptive users and acceptors required to achieve the demographic goal of a population growth rate of 2.8 percent per annum at the turn of the century. To achieve these objectives two models CONVERSE and TABRAP were utilized. CONVERSE was used to assess the impact of the program during the 1969-1979 period. TABRAP was used to estimate contraceptive users and acceptors during the periods 1969-1979 and 1979-1989 needed to achieve the demographic goals.

Both demographic and family planning program data were required for the above assessment. The former were mainly obtained from the 1969 and 1979 censuses. The latter were mainly obtained from the National Family Welfare Centre. A summary of these data and estimating procedures for non-available data are detailed in Chapter IV.

The choice of CONVERSE and TABRAP in this study was preferred for a number of reasons. First, the methodology of the models enables the program impact on fertility to be assessed directly from the family planning program data.

By doing so, the methods isolate the program influence on fertility from that due to the non-program factors discussed in Chapter I. Several of these factors were seen to have an influence on fertility in Kenya and hence the need to isolate the program impact on fertility. Secondly, both CONVERSE and TABRAP recognize the fact that methods are accepted in different proportions among age groups and that the rates at which these methods are discontinued vary in different age groups. The model also recognizes the fact that fertility is a function of age. Thus, although the models require more input data, the assessment of the impact is more accurate than of most of the assessment methods discussed in Chapter III.

The findings of this study are summarized in Chapters V, VI and VII. In Chapter V the program's impact on fertility between 1969 and 1979 was discussed. It was shown that the program had some depressing effect on fertility although there was an overall rise in fertility during this period. A total of 276,936 births were estimated to have been prevented during this period, and thus the female crude birth rate rose to 51/1000 instead of 53.1 in 1979. The female population CRNI was also seen to have been lower by about 2/1000 points. The female population was lower by about 1.4 percent.

One of the reasons advanced to explain the poor performance of the program during this period was the low acceptance rate of contraceptives in Kenya. It was shown in Chapter VI that at the estimated actual discontinuation rates about 1,940,827 acceptors or about 4 times those recruited during this period would have been required to achieve the demographic goal in 1979.

To achieve the demographic goal in 1989, women acceptors will need to be substantially higher than those recruited during the 1969-1979 period. The analysis in Chapter VII showed that about 3,070,202 acceptors or about 6 times those recruited during the 1969-1979 decade will need to be recruited during the 1979-1989 decade. Thus the recruiting staff will be required to be increased about 6 times if this number is to be attained.

One consequence of the low acceptance rate was the low level of contraceptive use during this period. In 1978, for instance, it was observed that there were only 5.2 percent of MWRA users whereas about 22.36 percent were needed to achieve the demographic goal. In 1988 about 23.36 percent MWRA users will be required to achieve the demographic goal in 1989. Thus, supplies of contraceptives will need to increase by about 5 times, among MWRA by 1988, to satisfy the required use.

It was shown that the rate of discontinuation has a considerable effect on the number of acceptors required to achieve a given level of use and hence a given demographic impact. In Chapter V, it was shown that the program impact would have been nearly doubled to 443,300 births prevented, at the same number of acceptors, if the acceptors discontinued at lower rates. Thus, to achieve the same impact acceptors would have been reduced by nearly half.

The influence of discontinuation rates on acceptor requirements was illustrated further in Chapters VI and VIII. To achieve the demographic goal in 1979, the acceptance rates among MWRA would have been reduced from 18.78 percent to 11.33 percent in 1988 if acceptors had lower discontinuation rates. During the 1979-1989 period, required acceptors are reduced from 3,070,202 at the estimated rates during this period to 1,909,718 at improved continuation rates. Since those who have accepted once are more likely to remain in the program than those who have never accepted, there is need to increase the follow-up staff to retain those who have accepted.

At low rates of discontinuation, however, users accumulate much faster than at higher discontinuation rates as shown in Chapters VI and VII. Thus, if the program were to concentrate on improving continuation rates the supplies of contraceptive at each moment would be required to be more than if the program concentrated mainly on recruitment. Also, at low discontinuation rates slightly more users among MWRA are required. Thus more supplies would be needed in this case.

The reduction of the period of overlap of use with post partum amenorrhea reduces the number of acceptors and users required to achieve a given demographic impact. In Chapter V it was shown that the program's impact would have been higher by about 7.8 percent if all acceptors were non-amenorrheic. Thus, fewer acceptors would have been required to achieve the same impact. To achieve the demographic goal in 1979 only about 1,174,428 non-amenorrheic acceptors were needed. During 1979-1989 period, 1,814,741 acceptors or 41 percent less would be needed at low discontinuation rates and no overlap. About 24.67 percent of MWRA users will be required. These are actually more than the 23.26 percent required at the actual estimated discontinuation rates but lower than the 25.26 percent required at the low discontinuation rates and without overlap. The reducation of the overlap period would, thus, make the program more efficient.

The discussion on method mixes showed that some method mixes are more efficient in terms of acceptor requirements than others. During 1969-1979 period, 300,908 acceptors or 40 percent fewer would have been required to achieve the actual impact if the "other" method mix was adopted. However, because of the assumptions made in deriving this estimate, it was seen that the above estimate may have greatly underestimated the acceptors required. It was also shown that greater program effort would have been required because this method is not popular. Thus, such a method mix was considered unrealistic. Since the pill is a popular method, method mixes which include the pill were considered more reasonable. A program strategy which increases the acceptance of the pill was, thus, considered. Such a program strategy would require more acceptors to be recruited. It was shown that the required acceptors are higher by about 58 percent. Thus, the recruiting staff would be required to be higher if such a program strategy is to be adopted. The number of users is, however, lower in this case. Only 18.17 percent of MWRA are required.

The introduction of new methods which are not popular among young women would require more acceptors. It was shown that the introduction of sterilization increases the acceptor load by 35 percent during the period 1979-1988. Such methods need to be introduced only if they would be quite popular among the old women.

Demographic benefits, if the demographic goal is achieved, include: reduction of the population size by 6.7 percent for the famales. This reduction is considerable given the fact that only those below 10 years are affected. TFR is reduced to 5.7 in 1989.

National estimates of contraceptive users and acceptors during the next decade, provide useful information for planning at the national level. At the subnational level (e.g. district) similar information would be useful for planning at that level. The extension of the above analysis to sub-levels would thus be useful. The experience in this "exercise" however shows that one of the greatest obstacles towards that goal would be the availability of data. It would, thus, help a lot if such data were to be made available.

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APPENDIX I

INPUT NO. 1

Number of methods: 4
Years of projection period: 10
Initial year: 1969
Method mix: Dynamic, i.e. changing
Initial users: 0
Abortion: Not offered as a family planning program method
Name of the Program: Kenya 1969-1979

INPUT NO. 2 METHODS

IUD
Pill
Injection
"Other"

INPUT NO. 3 OVERLAP OF USE, IN YEARS, WITH POST-PARTUM AMENORRHEA

Method	IUD	Pill	Injection	"Other"
Years	0.132	0.126	0.087	0.124

INPUT NO. 4 PROPORTION OF ACCEPTORS NOT DISCONTINUING USE IMMEDIATELY

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
IUD	0.999	0.999	0.999	0.999	0.999	0.999
Pill	0.999	0.999	0.999	0.831	0.999	0.999
Injection	0.999	0.999	0.999	0.999	0.999	0.999
"Other"	0.999	0.999	0.999	0.999	0.999	0.999

INPUT NO. 5 ANNUAL RATE OF DISCONTINUATION

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
IUD	0.412	0.389	0.312	0.403	0.540	0.458
Pill	0.846	0.597	0.458	0.285	0.556	0.270
Injection	0.436	0.436	0.436	0.436	0.436	0.436
"Other"	0.196	0.196	0.196	0.196	0.196	0.196

INPUT NO. 6 PROPORTION OF ACCEPTORS OBTAINING EACH METHOD

Year	M E T H O D			
	IUD	Pill	Injection	"Other"
1969	0.110	0.790	0.060	0.040
1970	0.110	0.790	0.060	0.040
1971	0.110	0.790	0.060	0.040
1972	0.110	0.790	0.060	0.040
1973	0.100	0.780	0.060	0.060
1974	0.100	0.800	0.060	0.040
1975	0.100	0.780	0.060	0.060
1976	0.120	0.720	0.050	0.070
1977	0.140	0.710	0.070	0.080
1978	0.160	0.700	0.060	0.080

INPUT NO. 7 MARITAL FERTILITY RATES

Age Group	Year	
	1969	1979
15-19	0.395	0.575
20-24	0.438	0.555
25-29	0.389	0.454
30-34	0.336	0.368
35-39	0.259	0.268
40-44	0.169	0.143

INPUT NO. 8 PROPORTION OF MARRIED WOMEN

Age Group	YEAR	
	1969	1979
15-19	0.334	0.271
20-24	0.756	0.711
25-29	0.866	0.846
30-34	0.876	0.864
35-39	0.802	0.826

INPUT NO. 9 PROPORTION OF STERILE WOMEN

Age Group	15-19	20-24	25-29	30-34	35-39	40-44
Proportion	0.020	0.045	0.080	0.130	0.235	0.455

INPUT NO. 10 LIFE EXPECTANCY AT BIRTH FOR WOMEN

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Life Exp. (Years)	51.20	51.50	51.70	52.00	52.20	52.50	52.80	53.00	53.30	53.50	53.80

INPUT NO. 11 AGE DISTRIBUTION OF FEMALES

Age	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44
Percent	19.2	16.4	12.2	10.0	8.2	7.5	5.5	4.9	3.7
Age	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+	
Percent	3.0	2.6	1.9	1.7	1.2	0.8	0.5	0.9	

FEMALE POPULATION IN THE INITIAL YEAR: 5,460,324

CRUDE BIRTH RATE FOR FEMALES IN INITIAL YEAR: 15.00

SEX RATIO AT BIRTH: 1.00

INPUT NO. 12 YEAR 1 AGE DISTRIBUTION OF ACCEPTORS BY METHOD

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
IUD	3.40	22.90	30.40	21.80	14.00	6.40
Pill	5.70	28.60	29.60	17.80	12.50	5.80
Injection	0.00	0.00	0.00	41.40	45.00	12.90
"Other"	16.20	15.50	16.20	27.00	27.00	0.00

INPUT NO. 13 TOTAL ANNUAL ACCEPTORS AGE 15-44

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Acceptors	29,761	35,136	41,100	42,205	50,054	51,446	53,471	61,227	73,647	---

APPENDIX II

INPUT NO. 1

Number of methods: 4
Years of projection period: 10
Initial Year: 1969
Initial users: None
Abortion: Not offered as a family planning method
Name of the program: 1969-1979

INPUT NO. 2 METHODS

Pill
IUD
Injection
"Other"

INPUT NO. 3 OVERLAP OF USE, IN YEARS, WITH POST-PARTUM AMENORRHEA

Method	IUD	Pill	Injection	"Other
Years	0.126	0.132	0.087	0.124

INPUT NO. 4 DISTRIBUTION OF ACCEPTORS BY METHOD IN YEAR 1

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
Pill	5.70	28.60	29.60	17.80	12.50	6.00
IUD	3.40	22.90	30.40	21.80	14.00	6.40
Injection	0.00	0.00	0.00	41.40	45.00	12.90
"Other"	16.20	15.50	16.20	27.00	27.00	0.00

INPUT NO. 5 PROPORTION OF ACCEPTORS NOT DISCONTINUING USE IMMEDIATELY

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
Pill	0.999	0.999	0.999	0.831	0.999	0.999
IUD	0.999	0.999	0.999	0.999	0.999	0.999
Injection	0.999	0.999	0.999	0.999	0.999	0.999
"Other"	0.999	0.999	0.999	0.999	0.999	0.999

INPUT NO. 6 ANNUAL RATE OF DISCONTINUATION

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
Pill	0.846	0.597	0.458	0.285	0.556	0.270
IUD	0.412	0.389	0.312	0.403	0.540	0.148
Injection	0.436	0.436	0.436	0.436	0.436	0.436
"Other"	0.196	0.196	0.196	0.196	0.196	0.196

INPUT NO. 7 PROPORTION OF ALL ACCEPTORS OBTAINING EACH METHOD

Year	METHOD			
	Pill	IUD	Injection	"Other"
1969	0.790	0.110	0.060	0.040
1970	0.790	0.110	0.060	0.040
1971	0.790	0.110	0.060	0.040
1972	0.790	0.110	0.060	0.040
1973	0.780	0.100	0.060	0.060
1974	0.800	0.100	0.060	0.040
1975	0.780	0.100	0.060	0.060
1976	0.720	0.120	0.050	0.070
1977	0.710	0.140	0.070	0.080
1978	0.700	0.160	0.060	0.080

INPUT NO. 8 MARITAL FERTILITY RATES

Age Group	YEAR	
	1969	1979
15-19	0.395	0.575
20-24	0.438	0.555
25-29	0.389	0.454
30-34	0.336	0.368
35-39	0.268	0.368
40-44	0.169	0.143

INPUT NO. 9 PROPORTION OF MARRIED WOMEN

Age Group	YEAR	
	1969	1979
15-19	0.334	0.271
20-24	0.756	0.711
25-29	0.886	0.846
30-34	0.876	0.864
35-39	0.862	0.860
40-44	0.802	0.826

INPUT NO. 10 PROPORTION OF STERILE WOMEN

Age Group	15-19	20-24	25-29	30-34	35-39	40-44
Proportion	0.020	0.045	0.080	0.130	0.235	0.455

INPUT NO. 11 CRUDE BIRTH RATE TARGET

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
CBRT	49.79	48.96	48.13	47.29	46.47	45.63	44.80	43.97	43.13	42.30	41.47

INPUT NO. 12 LIFE EXPECTANCY AT BIRTH FOR WOMEN

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Life Exp.	51.2	51.5	51.7	52.0	52.2	52.5	52.8	53.0	53.3	53.5	53.8

INPUT NO. 13 AGE DISTRIBUTION FOR FEMALES

Age	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44
Percent	19.2	16.4	12.2	10.0	8.2	7.5	5.5	4.9	3.7
Age	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+	
Percent	3.0	2.6	1.9	1.7	1.2	0.8	0.5	0.9	

FEMALE POPULATION IN THE INITIAL YEAR = 5,460,321

CRUDE DEATH RATE FOR FEMALES IN THE INITIAL YEAR = 15.00

SEX RATIO AT BIRTH = 1.00

APPENDIX III

INPUT NO. 1

Number of Methods: 4
Years of projection period: 10
Initial year; 1979
Initial users: Present
Abortion: Not offered as a family planning program method
Name of the program: Kenya 1979-1989

INPUT NO. 2 METHODS

Pill
IUD
Injection
"Other"

INPUT NO. 3 OVERLAP OF USE IN YEARS, WITH POST-PARTUM AMENORRHEA

Method	IUD	Pill	Injection	"Other"
Years	0.126	0.132	0.087	0.124

INPUT NO. 4 DISTRIBUTION OF ACCEPTORS BY METHOD IN YEAR 1

Method	A G E	G R O U P				
	15-19	20-24	25-29	30-34	35-39	40-44
Pill	5.70	28.60	29.60	17.80	12.50	6.00
IUD	3.40	22.90	30.40	21.80	14.00	6.40
Injection	0.00	0.00	0.00	41.40	45.00	12.90
"Other"	16.20	15.50	16.20	27.00	27.00	0.00

INPUT NO. 5 PROPORTION OF ACCEPTORS NOT DISCONTINUING USE IMMEDIATELY

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
Pill	0.999	0.999	0.999	0.831	0.999	0.999
IUD	0.999	0.999	0.999	0.999	0.999	0.999
Injection	0.999	0.999	0.999	0.999	0.999	0.999
"Other"	0.999	0.999	0.999	0.999	0.999	0.999

INPUT NO. 6 ANNUAL RATE OF DISCONTINUATION

Method	AGE GROUP					
	15-19	20-24	25-29	30-34	35-39	40-44
Pill	0.846	0.597	0.458	0.285	0.556	0.270
IUD	0.412	0.389	0.312	0.403	0.540	0.148
Injection	0.436	0.436	0.436	0.436	0.436	0.436
"Other"	0.196	0.196	0.196	0.196	0.196	0.196

INPUT NO. 7 PROPORTION OF ALL ACCEPTORS OBTAINING EACH METHOD

Method	YEAR										
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Pill	0.670	0.670	0.670	0.670	0.670	0.670	0.670	0.670	0.670	0.670	0.670
IUD	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190
Injection	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
"Other"	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080

INPUT NO. 8 MARITAL FERTILITY RATES

Age Group	Year	
	1979	1989
15-19	0.575	0.575
20-24	0.555	0.555
25-29	0.454	0.454
30-34	0.368	0.368
35-39	0.268	0.268
40-44	0.143	0.143

INPUT NO. 9 PROPORTION MARRIED

Age Group	Year	
	1979	1989
15-19	0.271	0.271
20-24	0.711	0.711
25-29	0.846	0.846
30-34	0.864	0.864
35-39	0.860	0.860
40-44	0.828	0.828

INPUT NO. 10 PROPORTION STERILE

Age Group	15-19	20-24	25-29	30-34	35-39	40-44
Proportion	0.020	0.045	0.080	0.130	0.235	0.455

INPUT NO. 11 CRUDE BIRTH RATE TARGET

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CBRT	56.30	55.00	53.70	52.40	51.10	49.80	48.50	47.20	45.90	44.60	43.30

INPUT NO. 12 LIFE EXPECTANCY AT BIRTH FOR WOMEN

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Life Exp.	53.80	54.10	54.30	54.60	54.80	55.10	55.30	55.60	55.80	56.10	56.30

INPUT NO. 13 AGE DISTRIBUTION FOR FEMALES

Age	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44
Perçent	18.4	16.2	13.3	11.5	8.9	7.0	5.4	4.2	3.6
Age	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+	
Percent	2.9	2.5	1.7	1.4	1.1	0.8	0.6	0.5	

INPUT NO. 14 NUMBER OF INITIAL USERS

Method.	Pill	IUD	Injection	"Other"
Users	59,606	21,497	18,023	7,383

INPUT NO. 15 PROPORTION OF MARRIED WOMEN IN EACH AGE CLASS USING ALL METHODS COMBINED

Age Group	15-19	20-24	25-29	30-34	35-39	40-44
Proportion	0.0398	0.0728	0.0717	0.0545	0.0317	0.0165