ESTIMATING CONTRACEPTIVE CONTINUATION FROM AGGREGATE CLINICAL DATA

BY

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D . C L A R A T I O N

THIS THESIS IS MY ORIGINAL WORK AND HAS NOT BEEN PRESENTED FOR A DEGREE IN ANY OTHER UNIVERSITY.

.....Samgard..... DATE: 18th Feb. 1991

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THIS THESIS HAS BEEN SUBMITTED FOR EXAMINATION WITH MY APPROVAL AS A UNIVERSITY SUPERVISOR.

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ABSTRACT

The thesis attempts to examine one very persistent problem with the use of contraceptives, namely, contraceptive continuation.

Many developing countries have launched family planning programmes with the aim of recruiting contraceptive acceptors not only for the purpose of limiting fertility but also to improve the health of both the mother and the child. These family planning programmes have indeed had a substantial impact by way of promoting the use of modern contraceptive methods for purposes of curbing human fertility. Among the methods popularly used both in the developed and developing countries are oral contraceptives, also called pills, injectables, intrauterine devices (IUDs), foaming tablets and jellies, cervical caps and diaphragms.

Many researches have been conducted on the continued use of these family planning methods using diverse approaches and the concept of continuation rate or conversely, discontinuation rate has become associated with many contraceptives. Contraceptive use-dynamics serve as a major measurement of a family planning programme quality since client satisfaction with methods is reflected in continuation rates while client skill at using methods is reflected in failure rates.

In any family planning programme, it would be desirable to recruit a large volume of contraceptive acceptors and that these contraceptives provide protection against pregnancy for some considerable time of a woman's reproductive lifetime.

This study presents a simple method of estimating contraceptive continuation rates which applies to aggragate programme acceptor data. The method uses counts of new and continuing contraceptive users from a number of clinics for every year since the clinic started operation. These data are then fitted in the discrete geometric continuation model. In order to estimate the continuation rates of pills, IUDs and injectables, Family Planning Association of Kenya (FPAK) data was used. To further supplement information on continuation rates, a sample of contraceptive users was analyzed to determine the demographic, social and economic factors associated with contraceptive continuation rates and also to estimate the average duration a contraceptive method is used by acceptors.

It is argued in this thesis that many factors interact to influence contraceptive continuation and using the continuation model developed by Hammerslough (1988), it is estimated that 50 per cent, 70 per cent and 60 per cent of pill, injectable and IUD users respectively will continue to use these methods after one year. The procedure presented in this study has very little data requirements and is designed in a way that family Planning Programme administrators will find it a tool easy to use for evaluation.

CHAPTER 1

INTRODUCTION

1.1 Overview of family planning programmes

The second half of the twentieth century has witnessed a marked increase in government use of policy instruments to effect demographic, social and economic change. This phenomenon has become more widespread in both the developed and developing countries.

Most governments use National Family Planning Programmes as a measure directed towards influencing human reproductive behaviour. Usually, these programmes have set demographic targets against which to measure achievement. For instance, in Kenya, the Government launched a five-year (1974-1978) family planning programme to reduce the high annual rate of natural increase of 3.5 percent (in 1975) to 3.25 percent (in 1979). In addition, 640,000 new family planning acceptors were to be recruited in order to avert some 150,000 births[1]. However, this family planning programme had limited success since instead of a decline in the population growth rate, a significant increase occurred that raised the rate to about 3.8 percent in 1979.

In 1984, the Kenya government yet again outlined a number of goals to guide policy and programme planning. These targets, outlined in sessional paper No.4 of 1984, included:

(i) reducing population growth rate from the current 3.8 percent (in 1979) to 3.3 percent by 1988,

(ii) encouraging Kenyans to have a small family,

(iii) reducing mortality further particularly the infant and child mortality, because such reductions would ultimately lead to lowering the fertility.

It is therefore important, consequently, that the tools for evaluating the effect of family planning programmes be focussed to the point where they can be used with reasonable facility and efficiency and with some reasonable degree of confidence as to the validity of the results that they produce. A national family planning programme is a wide assortment of activities geared towards some ultimate objective(s). The achievement of the final goal(s) therefore depends necessarily upon accomplishments at different levels or, in other words, upon attainment of a variety of sub-objectives. Each of these sub-objectives can be subjected to evaluation; and as a good administrative practice, this task should be done periodically as a guide to operational strategy.

The contraceptive prevalence survey conducted in Kenya in 1984 revealed that contraceptive prevalence is too low (15 per cent) and this phenomenon has hindered the achievement of targeted demographic objective of reducing fertility levels. There are three central problem areas in any family programme; the problem of determining the annual

numbers of contraceptive acceptors, the effectiveness of contraceptives and the continuation of contraception.

1.2 Focus of the study

This study focuses on estimating contraceptive continuation using a model developed by Hammerslough, C.R. (1988)[1] and also incorporates service statistics data to explain some patterns of continuation. The model is a simple geometric continuation curve with parameters for the probability of an acceptor actually beginning contraceptive use and for the annual discontinuation rate.

The study uses data on the number of new and continuing contraceptive users served each year by Family Planning Association of Kenya (FPAK). Information on demographic and socioeconomic characteristics of a sample of contraceptive users and the period of use of the contraceptives was also collected.

The immediate objective of this study is to determine the patterns of contraceptive continuation rates and the possible factors associated with such patterns.

The ultimate objective is to provide policy makers and programme administrators with substansive information about contraceptive use and disuse and also to enable them assess the performance of family planning services. The resulting information from the research can also be

used to develop educational strategies and modify existing service delivery approaches so that contraceptive continuation rates may be improved and hence family planning programmes become more effective in realizing desired demographic goals.

1.3 Statement of the Problem

For a long time now, family planning programmes have been in operation worldwide but the developing countries are yet to achieve the relatively high contraceptive prevalence rates of the developed countries. Many researches have been undertaken to identify the factors sustaining the high fertility rates especially in Africa and Asia and it is apparent that social, economic and cultural factors explain the high fertility rates in these regions.

Many scholars have advanced various methods as appropriate tools for assessing family planning programme impact on fertility but most of these methods often make assumptions about contraceptive practice. For instance, the "Standardization approach", "Standard Couple-Years of Protection" (SCYP), "Component projection approach" and the "Analysis of reproductive process" are evaluation procedures that incorporate assumptions about contraceptive continuation (United Nations, 1979).

The most widely used procedure of estimating contraceptive continuation is that advanced by Mauldin et al. (1967) which is based on a decay function composed of a negative exponential model and was first applied to life table data. However, life tables usually deal with discrete time points, not continuous functions.

Life table approaches to modelling contraceptive continuation require more elaborate data collection and this can hinder programme evaluation, especially when the data are not reliable. The method outlined in this study requires annual clinical reports of the number of new and continuing clients for each method. Availability of these data may also allow the extension of the model to incorporate additional information on the characteristics of clients or programmes. The method may also make contraceptive continuation rates a more useful policy planning and programme evaluation tool. This is because the approach allows easy routine calculation of continuation rates by the programme administrators.

1.4 Justification of the Problem

Family planning programme designers need demographic models as tools for determining how many annual acceptors are required to reach demographic policy objectives. In addition, contraceptive continuation models are needed for evaluating the effectiveness of individual clinics,

programmes or even whole service-delivery approaches. This is because, for example, it should concern programme managers if the clients of one clinic discontinue at a much higher rate than clients of another.

Programme evaluators often use birth-averted figures to calculate cost-effectiveness as well as to assess service quality. Contraceptive continuation models help in the estimation of the number of couple-years of protection afforded by each unit of contraceptive supplied by the programme to clients and consequently enables comparison of contraceptive protection delivered by different contraceptive methods to each acceptor. It is due to this necessity for contraceptive continuation models that one that needs simple data on the annual number of acceptors and continuers is applied so that government policymakers can readily plan to achieve desired objectives.

Further, many governments of developing countries consider fertility reduction to be an important component of the overall strategy for improving standards of living. Family planning programmes aimed at increasing contraceptive prevalence are the most widely used approach to bringing fertility reductions. Due to the keen national and international interests in the progress that is being made toward reducing fertility, extensive monitoring of trends in fertility and contraceptive use

and acceptance has been and is being undertaken mainly by national family planning associations and other non-governmental organizations.

National surveys like the Fertility Surveys and Demographic and Health surveys do provide the necessary data however, family planning programme statistics, which typically include estimates of the annual numbers of acceptors of different contraceptive methods are also important sources of such data[3].

In addition to the important role these data play in the monitoring and management of family planning programmes, they have been used for evaluating the demographic impact of family planning programmes and for target setting (UN, 1982; Nortman D.L. et al., 1978; Laing, 1982; Chandrasekaran and Hermalin, 1976; Ross and Forrest, 1978; Bongaarts, 1984).

Generally, the data reported by clinics, which are often referred to as "service statistics", are not much concerned with what happens after acceptance-whether the acceptor actually used the method and for how long, whether she (or he) shifts to other methods, the reasons for shifting or "Dropping out", and so fourth - since the record-keeping system must be kept as simple as possible.

Potter and Phillips (1980) remark that despite consistent evidence that non-exponential models can improve contraceptive continuation fit, most life tables

of contraceptive continuation have been based on the modified exponential function of Mauldin et al. (1967). They identify two factors which account for this popularity:

> First, when the data are cumulative proportions retaining their IUD, ordinary least-squares estimate of the two parameters of the modified exponential typically result in coefficients of determination that exceed 0.95. Second, alternatives to the modified exponential are relatively more difficult to estimate. Maximum likelihood methods are required which model the changing conditional monthly termination rates into cumulative rates. Each model requires a unique specification of nonlinear simulteneous equations which must be solved for two or more unknown parameters[4].

They conclude that the fit of the modified exponential model is generally adequate and that the additional efforts involved in the estimation of the more complex models is unjustified[5].

Subsequent studies have shown that deviations from the actual observations do result when a constant rate of termination is assumed. The conditional termination rate suggests a decreasing function of time, rather than a constant. Avery (1973) notes that since most published IUD life tables are based on two years of experience or less, extrapolation from these using the Mauldin et al. (1967) procedure will lead to serious underestimates of long-term IUD use[6].

Mauldin et al (1967) model is given below:

$$P_{(t)} = ae^{-rt}$$

Where

$P_{(t)}$ is the proportion still using at time t,

a is the proportion of acceptors who actually begin the use of the method,

r is the continuation rate in a unit of limiting time, t.

Hammerslough (1988) notes that:

> The adjustment factor 'a' compensates for the fact that some clients never use the method they receive. For example, some proportion of inserted IUDs are immediately removed or expelled; the pack of pills may never be opened; a husband may not use the condoms his his wife obtains at a clinic'.

1.5 Conceptual framework

Most family planning projection models help in assessing the impact of birth control programmes on fertility. Knowledge about contraceptive continuation helps determine the expected duration of contraceptive protection for each new acceptor and in addition, models relate the provision of contraceptives through public family planning programmes to fertility declines in the population served.

Information about the number of new family planning acceptors recruited each year, as well as on new acceptor behaviour and intentions, is essential in order for

family planning programmes to be effective. The volume of new acceptors, their demographic characteristics and their cumulative longevity in the programme are the key determinants over time of the level of contraceptive practice in a community and hence the degree of a programme's successs. For example, if new clients using modern contraception for the first time are primarily higher parity older women, the demographic effects of helping these women to prevent or delay subsequent pregnancies will of necessity be quite limited. Conversely, if clients are primarily lower parity younger women, the long-term demographic effects might be far more dramatic.

In addition to knowledge on age and parity, information is needed on whether a programme is reaching women in different socioeconomic circumstances. Again, the demographic implications would be very different depending upon which class is affected by the family planning programme. The motivation of new acceptors too, will produce different demographic results depending upon whether the acceptor is interested in spacing or preventing births.

Thus, the characteristics and intentions of new contraceptive acceptors are significant factors in determining a programme's appeal and probable long-term impact. Although this would seem difficult to implement,

such information would enable monitoring of programme activities to ensure more adequate and effective coverage of the population at risk, and still, planners would be provided with greater direction and focus than they would otherwise have.

The present study focuses on studying contraceptive acceptors and consequently, contraceptive continuation rates as part of the elements of Laing's (1982) Means-Ends chain of programme operations and objectives (figure 1.).

A number of approaches employed in the study of contraceptive continuation are discussed in chapter 2. These approaches are generally classified into three groups; continuation models, life-table techniques and surveys. These methodologies have different data requirements and estimates of contraceptive continuation rates computed by these methods may vary from country to country and even within a country (Jain, A. 1989).

Among the most recent and robust methods of estimating contraceptive continuation rates are the life-table and Laing's calendar-status techniques (discussed in chapter 3). The data requirements of these two approaches are however a major shortcoming in their application particularly in the developing countries.

The model presented in this study for estimating contraceptive continuation rates is a simple geometric continuation curve with only two parameters. Its data requirements are only counts of new and countinuing contraceptive acceptors in a given clinic since its inception.

The following hypotheses about contraceptive continuation are investigated:

1.6 Hypotheses

1. Contraceptive continuation rates are higher among clients of higher socio-economic status than those of lower socio-economic status.

2. Contraceptive continuation is higher among clients of older ages than among younger clients.

3. Contraceptive continuation rates are higher among clients of higher parity than among those of lower parity.

4. There is no significant difference in the continuation rates for pills, IUDs and injectables.

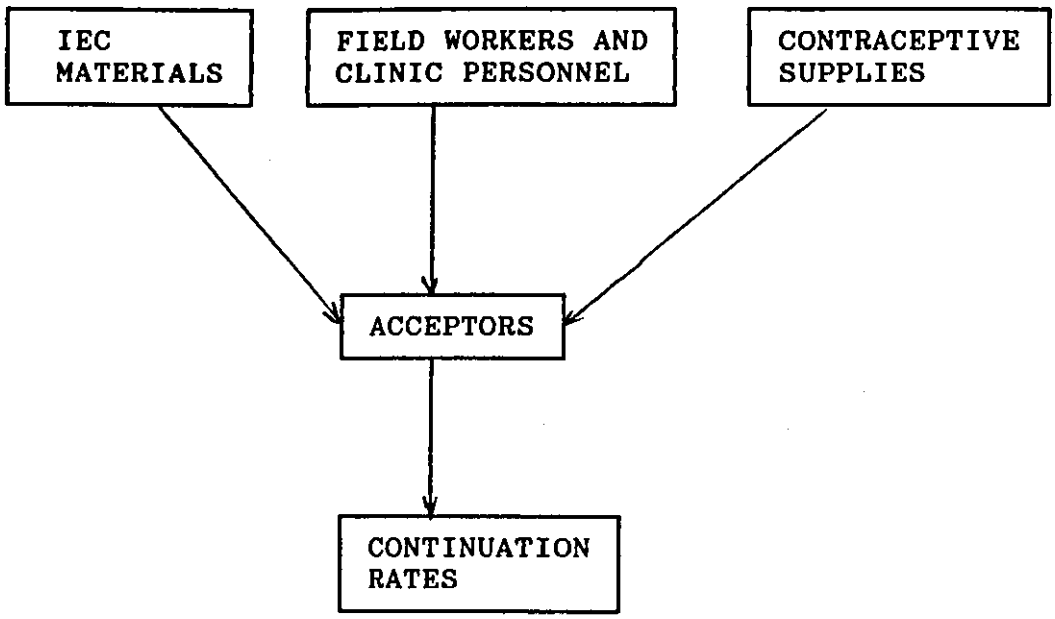


Figure 1. Theoretical framework

The operational model below has been modelled from figure 1.

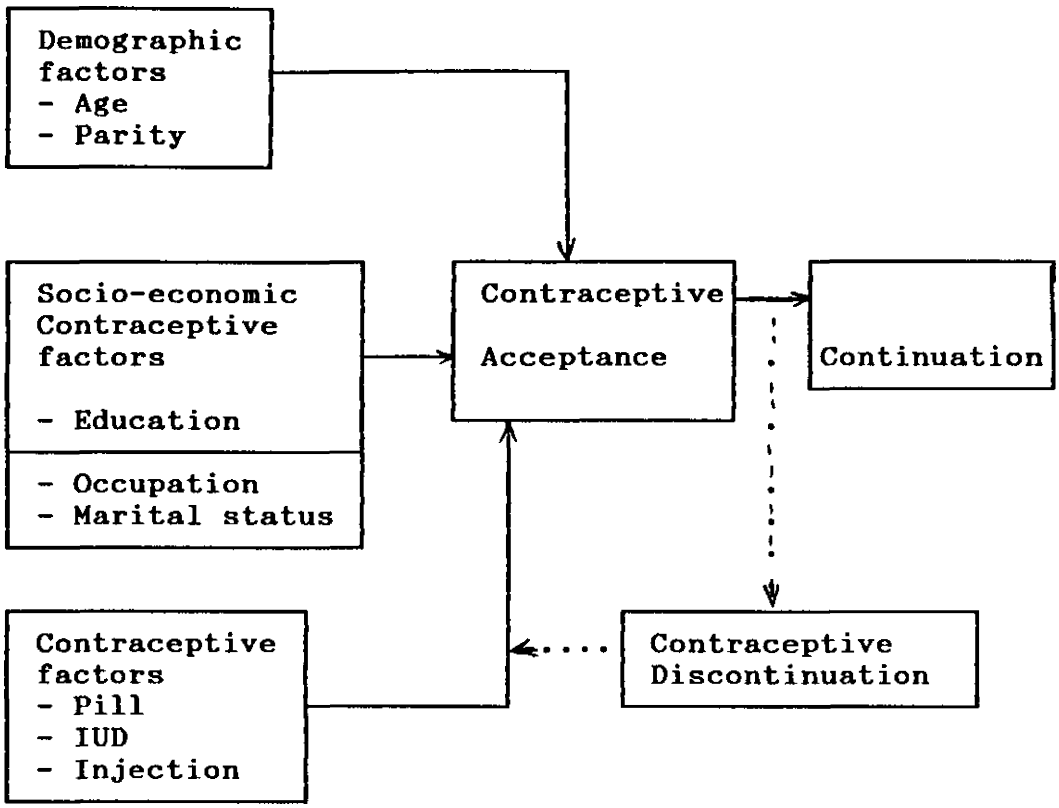


Figure 2. Operational model.

In the above model solid lines depict relationships that are adequately supported by empirical evidence while broken lines represent hypothesized relationships that currently do not have an adequate empirical base (Jain, A. 1989). It should also be noted that acceptance and continuation rates depend upon each other and are affected by a number of other factors (motivation of the users being paramount).

1.7 Objectives

The following objectives are to be achieved in this study:

1. To estimate the parameters of the model $P_t = as^t$
2. To determine the optimal values of a and s in the model.
3. To estimate the standard errors of a and s.
4. To estimate the confidence intervals of a and s.
5. To determine continuation rates for pills, IUDs and injectables.
6. To determine the demographic, social and economic factors associated with contraceptive continuation rates.
7. To estimate the average duration a contraceptive method is used by acceptors.

1.8 Methods of Contraception

There are several methods of contraception available for family planning adoptors and while a mention will be made for the rest, only pills, injectables and IUDs are described at length.

Two broad groups of methods of contraception can be distinguished: clinic and supply methods as opposed to all others-the non-supply, or "traditional", methods. Methods requiring supplies or clinical services include male and female sterilization, intra-uterine devices, oral pills, injectable hormonal contraceptives, condoms and female barrier methods (diaphragm, cervical cap, spermicidal foams, creams, jellies and sponges). This group includes the highly effective methods that have revolutionized contraceptive practice over the past few decades, and the methods most often offered by family planning programmes. The non-supply, or "traditional", methods, includes rhythm or periodic abstinence, withdrawal (coitus interruptus), abstinence, douching and various folk methods.

1.8.1 The Pill

There are various types of pills and they are a simple and easy-to-use method of birth control. The woman swallows one pill each day. The pill works by keeping the woman's ovaries from releasing an egg as long as she takes the pills on schedule. The pills contain

female hormones-oestrogene and progesterone - which a woman produces when she is pregnant. These hormones, produced mainly in the ovaries and the placenta, prevent the eggs from maturing and thus are not released by the ovaries.

Experts[8] recommend that the woman should take the pill at the same time each day. If she forgets to take the pill for a period of twelve hours, no harm is done. However, if she forgets to take the pill for a whole twenty four-hour day, she may be able to become pregnant and she should therefore use some other method of birth control for the rest of that period(month).

The oral contraceptive pill has been in use since early 1960s and is now one of the most popular contraceptives used by women in many countries. Its effectiveness and relative safety have made the pill not only an acceptable, but often a preferred method of contraception for many women. Although the pill is a safe contraceptive method, a good proportion of pill users may experience some side effects. These side effects range from fairly minor to severe complications. The minor effects include Nausea, weight, gain, headaches, spotting, acne and depression. Some of the severe effects include blood clotting, varicose veins and hypertension.

1.8.2 The Injectables

Injectable contraceptives contain certain hormones, progestins, such as medroxyprogesterone acetate (Depo provera-DMPA) which work on an intramuscular delivery system. The contraceptive is slowly absorbed from the site of injection and can provide upto several months of protection after a single treatment. Just like progestins in pills, the progestins in the injectables prevent pregnancy by suppressing ovulation, including thin atrophic endometrial lining, and producing a thick cervical mucus that is diffucult for sperm to penetrate[9].

While injectables are highly effective, they are burdened by complaints of side effects such as painful menstruation, absence of menses (dysmenorrhea), weight gain, nausea, dizziness, headaches, nervousness, chills, excessive flow of milk (galactorrhea), lessening of libido, acne etcetera.

1.8.3 The IUDS

IUDs are small metallic or plastic structures of various shapes, including rings, spirals, T-shapes, 7-shapes, and others. It is exerted by an expert into the woman's uterus or womb. In order to insert it, the expert straightens it out so that it looks like a piece of heavy cord. This is done by pushing it into a long hollow plastic tube (inserter) which is open at one end and has a pusher or plunger at the other end. Most IUDs

have a thin nylon thread fastened to them and hangs out of the uterus, through the cervix, and into the vagina. This thread facilitates the IUDs removal whenever the woman wishes. Not every woman can use the IUD successfully. Sometimes the IUD comes out of the uterus or the woman has more pain or bleeding than is usual.

IUDs can be classified as either inert or bioactive devices. The inert devices are of stainless steel or plastic such as Lippes Loop. The bioactive devices are on the whole smaller than the inert ones, and have copper in or round them or contain progesterone which is delivered slowly into the uterus[10]. Whereas inert devices can be left in the uterus indefinitely, the bioactive ones have to be changed when their active life comes to an end.

It is generally understood that the presence of the IUD in the uterus prevents a fertilized egg (blastocyst) from implanting itself to the wall of the uterus and growing into a baby. Considerable research effort is being expended to try to improve the efficacy and retention rates of biochemically inert IUDs by alterations of their material or design. Contraceptive medicaments have already been incorporated into IUDs that have acceptable retention characteristics. High contraceptive effectiveness ensues only for duration of drug release. This period extends from the clinical

CHAPTER 2

LITERATURE REVIEW

2.1 Family Planning

The term family planning has a wide variety of usages. However, family planning is widely used to refer to the deliberate effort of couples or individuals to regulate fertility by delaying or spacing births and/or limiting their numbers. It implies deliberate action to avoid conception or a live birth. Family planning has been practiced in one form or another throughout man's history, but it was not publicly advocated until early in the 19th century, and then only by private groups[12].

In recent years, family planning has received much attention by governments of both the developed and developing countries. Family planning Programmes have therefore received and continue to receive governmental funding and administration as it has been recognized that family planning programmes form part of a wider set of activities aimed at fostering economic and social welfare at both the individual, societal and national levels.

Due to the weight that family planning programmes carry, researchers have strived to develop evaluation approaches to such programmes in order to ascertain their effects. Despite the great deal of attention the evaluation of the performance of the programmes, the

methodologies are still controversial and the results inconclusive. This is due to a wide range of constraints, not all of which are unique to family planning.

2.2 Evaluation of FP Programmes

With family planning programme evaluation, we could view it broadly as a process that includes measurement of goal achievement, feedback of information for adaptive decision-making, and examination of a wide variety of processes to determine how and why a programme was or was not successful. Implicit in this viewpoint is an interest in the evaluation of programme activities and tasks and examination of unexpected and undersirable effects as well as expected and desirable ones.

Raynolds (1972) notes that programme evaluation is concerned with two broad areas, measure of programme performance (effects, effectiveness and efficiency) and explanatory examinations of programme processes to determine how and why a programme was or was not successful[13].

Performance measures are quite familiar since they relate to the attainment of goals in most cases. Effects measures are the most familiar of all. They are measures of the outcomes or impacts of programme effort. Reynolds (1972) has described three levels of effect:

(1) Primary effects (changes in awareness, knowledge, attitudes, motivation);

(2) behavioural effects (trial or adoption of a particular form of behaviour); and

(3) status effects (changes in fertility, health, economic and social status)[14].

The present study pursues the behavioural effects identified by Reynolds. Evaluations of changes in behaviour have been measured largely in terms of contraceptive acceptance and continued use[15].

There have been some careful follow-up studies conducted to determine contraceptive continuance. These studies have uncovered high method discontinuation rates (Jones and Mauldin, 1967; Ross et al. 1970). In their report[16], Ross et al (1970) point out the role family planning service personnel and the limitation of funds play in influencing the determination of contraceptive continuation rates. Of particular importance is the role information and education about contraceptives can play to sustain the participation of acceptors in any given family planning programme.

2.3 Studies on contraceptive continuation

In assessing the extent to which the population makes use of the services offered, it is important to determine the number and characteristics of acceptors, trends in acceptance and rate of acceptance. Another

level of evaluation focuses on how the use of a method from a programme compares with the previous behaviour of the acceptor, the length of time an acceptor makes use of contraception, and the action taken after termination of use.

Navarro (1979) commenting on contraceptive discontinuance notes that four out of every ten acceptors stop using contraceptives after one year[17]. In other words, 40 percent of contraceptive acceptors discontinue use of a method after 12 months. Whereas some researchers see the problem of high drop-out rate as a regular and foreseeable feature of any family planning programme, some administrators see it as indication of a failure of the programme. What is not clear is, whether the failure is with the client or the programme. The views about contraceptive discontinuance by biomedical researchers and the social scientists complicate the whole subject. Whereas the former ascribe the problem to physiological effects of the different contraceptive methods, the latter attribute this to the social, cultural and psychological situation of the acceptors.

John Ballweg and Donald MacCourquodale (1971) conducted a study on the trends and patterns of contraceptive use in the Philippines based on interviews with 1321 acceptors and found that after one year of acceptance, a little over half continued with the

original method, one-fifth shifted to other methods, while slightly less than one-fourth stopped altogether. In terms of continued use of contraceptive methods, the IUD was found to have the highest continuance rates, followed by the pill and rhythm[18].

John E. Laing's reports on National Acceptors Surveys (NAS) of 1972, 1974 and 1976 present more extensive studies on the analysis of contraceptive use. One of his approaches, the cumulative first-method continuance/discontinuance rates provide some indication of which methods were likely to be discontinued. His findings indicate that after a 12-month period, 52.2 percent of pill acceptors and 32.5 percent of IUD acceptors stopped using their chosen first methods.

Many other studies on contraceptive continuation and discontinuation have been done using different study designs but many concurr that IUDs so far have higher continuation rates than any other methods. IUD studies (Grady et al. 1983; Villegas et al., 1975; Phillips, 1978) have established IUD continuation rates in the range 68.2 to 87.2 per cent after one year. Grady et al. (1983) reports a one year continuation rate of 74.1 percent for pills among married women in the United States while Phillips (1978) reports a very low rate of 52.3 per cent in the Philippines.

Unlike pills, continuation rates for injectables appears not to vary so much. Ward and Winter (1975) note that despite injectables being burdened by several complaints, their use still increases and the continuation rate for injectables is 60 percent or more for at least one year. Narkavonnakit et al (1982) interviewed a national sample of Thailand women who had used DMPA (Depo provera) and found that 59 per cent continued to use DMPA after one year and this rate dropped to 39 per cent after two years. However, a larger sample, but based only in cne province of Thailand showed higher rates than those found by Narkavonnakit's study[19].

Whereas Ward and Winter (1975) remark that continuation rates for injectables are influenced by age, parity, social and cultural attitude of users, accessibility of services and availability of alternative methods, Phillips (1978) on the other hand, using a multivariate technique, established that pill continuation is more strongly associated with administrative processes than with socioeconomic variables or demographic characteristics.

Whereas there is a concensus between many studies that IUDs have a relatively higher continuation rates than other methods, it is also evident that there are many other factors that are likely to affect the

calculation of contraceptive continuation rates, the major one being the study design. Indeed, both surveys and models help in ascertaining the programme impact and the evaluation of the programmes themselves.

The deliberations at the last two world population conferences (1974 and 1984) has led to increased government interest in and support for family planning programmes. Consequently, family planning programmes have expanded and there has been increased collection of data on contraceptive practice[20]. Survey data indicates that globally, in 1983, roughly half of all couples with the wife in the reproductive ages were currently using some form of contraception[21]. However, the proportion in developed regions (70 percent) was much higher than in the developing regions (45 percent).

In Africa, contraceptive prevalence is generally low. Except for Mauritius which had the highest contraceptive prevalence of 75 per cent in 1985, most other countries had prevalences of less than 48 per cent while others had a near absence of use (5 per cent or less of married women) in Cameroon, Cote d'Ivoire, Lesotho, Mali, Mauritania, Nigeria and the Sudan.

In both developed and developing countries, clinic and supply methods have become more predominant over time. However, a comparison of the prevalence of specific methods shows quite a diversified state of

affairs. For instance whereas sterilization accounted for 41 per cent of total contraceptive use in the United States in 1982, it accounted for only 15 per cent in Japan in 1986.

In Kenya, the proportion of pill users has been higher than users of any other methods. In 1977/78, pill users accounted for 29 per cent of all current users, sterilization (male and female) 14 per cent, IUDs 10 per cent and injectables, 8 per cent. Between 1978 and 1984 the proportions of pill and injectable users decreased substantially while the proportion of IUD users increased. However, between 1984 and 1989, the decrease was only in the proportion of IUD users (see Table 1).

Table 1

Percent distribution of All Women and Currently Married Women currently using specific contraceptive methods, 1977/78 KFS, 1984 KCPS and 1989 KDHS.

Method Currently	1977/78 KFS[a] Currently Married	1977/78 KFS[a] All Women	1984 KCPS[a] Currently Married	1989 KDHS[b] All Women	1989 KDHS[b] Currently Married
Unweighted No.	388	6581	4627	7150	4765
Total	100.0	100.0	100.0	100.0	100.0
Any Method	7.0	15.0	17.0	23.2	26.9
Pill	29	19.3	18.2	19.8	19.3
Injection	8	2.7	2.9	11.6	12.2
IUD	10	16.7	17.6	12.9	13.8
Female sterilization	14	12.7	15.3	15.5	17.5
Male sterilization	0	0.0	0.0	-	-
Rhythm	16	25.3	22.4	-	-
Abstinence	16	17.3	15.9	30.2	27.9
Other	7	4.0	5.3	8.2[d]	7.4[d]

Source: a. Kenya Contraceptive Prevalence Survey, 1984

b. Kenya Demographic and Health Survey, 1989.

c. Questions on current use of contraception were directed only to currently married non-pregnant fecund women.

d. Includes other, condoms and withdrawal

The United Nations (1989) remarks that:

> "Modern contraceptives are becoming more widely used and it is likely that this trend will continue as the availability of these methods improves. At the same time there is need for new contraceptives with fewer side effects and greater ease and convenience of use. No single method is suitable for all persons, and the type of method needed can change with age and special circumstances such as breast-feeding. The more effective methods the pill and the IUD for example, can have unpleasant side effects, and for some persons use of these methods is inadvisable for medical reasons. Methods without these drawbacks tend to be less effective and to have other disadvantages-inconvenience of use or interference with intercourse. As a result, method switching and discontinuation are frequent. For example, a review of numerous follow-up studies showed that a year after starting use, the median proportion of pill acceptors still using that method was 45 per cent and after two years, 29 per cent. For IUDs the proportion of continuing users was 66 per cent at one year and 56 per cent at two years"[22].

2.4 Models of contraceptive continuation

High acceptance rates in a family planning programme have little value unless the acceptors continue to use the methods adopted for a reasonable period of time. Most family planning programmes concentrate their efforts on influencing large numbers of couples to begin contraception while giving little attention to problems of continuation and termination. The tacit assumption, only occasionally made explicit is that continuation rates would not be a great problem with say, the IUD, since theoretically it could remain in place for years

and its use requires no recurrent decision. Only discontinuing use requires decision[23].

Hammerslough (1988) notes that:

> "In order to realistically model the person-years of protection supplied by family planning projects, it is necessary to estimate the expected person-years of protection for each acceptor. One assumption would be perfect compliance and continuation. However, in real family planning programmes not all acceptors actually begin using the method they are given, and those who do use will eventually discontinue. In addition, contraceptive methods do have an intrinsic risk of failure.[24]

The life table approach is one methodology that has been widely applied to an increasing range of problems and has been the object of numerous studies as well (Freedman, 1969, pp. 459). The single-decrement life table was applied by Potter (1966) to both follow-up and retrospective studies of contraceptive effectiveness. Tietze, who contributed in many ways to this technique, took the next step of computing rates of IUD loss specific to different causes of termination, but these rates were not additive. Shortly thereafter a procedure to make specific rates additive was devised, on a collaborative basis, by Tietze and Potter. Both these two types of rates, additive and non additive, belonged to a larger set of rates, associated with the multiple-decrement life table (Potter, 1966 and 1967; Ross et al., 1969; Tietze, 1967; Tietze and Lewit, 1968).

Chow (1968) in a study on the demographic impact of an IUD programme analysed the returned coupons for IUD insertions in Taiwan using cross tabulations to examine the characteristics of IUD acceptors before and after acceptance. Chow found that the modal age of acceptance was in the age group 30-34 and that despite the fact that the Lippes Loop was a device which provided a hope of successfully controlling human fertility, it fell short of original expectations because of high terminations[25]. Calculations from the IUD follow-up interview revealed that, on the average, the first segment of an IUD stayed in the uterus for an average of 33.4 months.

Potter et al. (1972) used a deterministic model designed to trace the consequences of the depletion of eligible contraceptors by previous acceptance when the age composition of the parents and the disposition to accept among eligibles, are both held constant. They note that:

> Naturally, trends in the numbers and ages of new acceptors have consequences for trends among current users of the same contraceptive programme. The association between characteristics of of users and new acceptors will be especially close when discontinuation rates are high, and therefore continuation with the method brief[26].

Their findings were that:

(1) Even when given a rapidly growing population and a constant disposition to accept among eligible couples, the number of new acceptors may decline for several years before commencing its long-term rise;

(2) Under the same conditions, the number of current users may rise for a time, decline, and only then begin a second increase;

(3) The mean age of users may either rise or decline as time elapses, depending on the combination of parameter values chosen i.e. minimum age of acceptance M, acceptance rate f, discontinuation rate W, and intrinsic rate of increase, r.

Critics of the life table methodology lament its elaborate data needs and in the less developed countries where data collection systems have not been fully developed, the need for methods of extrapolating contraceptive continuation are therefore apparent.

Life table analyses of follow-up data typically show that the conditional monthly probability of discontinuation, that is, the probability of terminating the method during the month for those still practising it at the beginning of the month starts at a relatively high level and decreases rapidly for a few months; it then decreases more slowly or, more rarely, tends to remain constant, as the period of use increases[27].

Extrapolation requires a mathematical curve, that yields proportions continuing use as a function of duration since acceptance. Such curves would depend on two or more parameters in terms of which the monthly probabilities of discontinuation are formulated. It is desirable that the curve:

(1) should fit life table rates over the period of effective observation well;

(2) yield a plausible extrapolation in terms of constancy or continued terms of conditional probabilities of termination, and

(3) yield extrapolations that are as insensitive to length of observation as possible.

Bongaarts (1986) used a simple negative exponential model and found that the model underestimates the mean duration of use. In other words, the model overestimates discontinuation rates[28].

The best known and widely used among the continuation curves is the negative exponential proposed by Mauldin, Nortman and Stephan (1967), namely

$$P_{(t)} = ae^{-rt}$$

where

a is a constant denoting the proportion who do not discontinue immediately after acceptance,

r is the annual discontinuation rate

t is the time elapsed in years since acceptance

e is the natural logarithm base, 2.718...

P(t) is the proportion of acceptors still using t years after acceptance.

If this decay function is integrated over duration, one obtains

$$R(0,T) = \int_0^T ae^{-rt}dt$$

$$= \frac{a}{r}(1-e^{-rT})$$

R (O,T) is the mean duration of use within the first T months following acceptance. For instance, if a = 0.97, r = 0.02 and T = 120, R(0, 120) = 44.1 months. As T , R $\frac{a}{r}$, the estimated retention "life time" of the device.

The parameters a and r are estimated by first generating life table values of P(x) where x is a series of time intervals; then using least squares regression to estimate In P(x) = In a - rx.

Mauldin et al. (1967) were able to show that retention rates of IUDs varied over a wide range, from 55-60 per cent to as high as 85 per cent after 12 months. They note that this range is affected by many characteristics of the wearer-age, parity, education, residence, expectations; by the type and size of the device; by the skill and attitude of the inserter; and by the quality of data on which the rates are based.

The U.S.A. data they used showed that slightly more than half the women continue to wear IUDs at the end of four years.

Further, IUD discontinuation due to "expulsions" decreased sharply with age and with parity. Other studies by Potter (1969) and Chow (1968) support these observations. With "removals", rates decreased with age, parity, and time, but these relationships were much less pronounced than is the case with expulsions.

In a variety of settings and with a variety of methods, the modified exponential curve has been found to fit the life table values of contraceptive continuation rates reasonably well (Laing, 1982 pp. 90). However, Laing (1982) notes that:

> When extrapolated beyond the duration covered by available continuation rates, the negative exponential curve generally tends to underestimate continuation, since it assumes constant monthly continuation rates whereas monthly continuation rates usually tend to increase with time following acceptance[29].

The tendency of the negative exponential curve to underestimate use has been demonstrated and quantified empirically by Kulkarni and Potter (1976), using long-term (nine-year) continuation data from Taichung,

Taiwan. They calculated a and r on the basis of 12, 24, 36, 48 and 60 months following acceptance. The five sets of parameters values were then converted into R(0, 120) values and compared with the actual observed R(0, 120) values to obtain the percentage deviations. They found that for an observation period of twelve months, the shortfall was one-third while for 60 months of observation, the curve underestimated woman-months of retention by about ten per cent.

Subsequent efforts to model contraceptive continuation have made increasingly sophisticated curve fitting approaches to life table data. Kelly (1971), recognizing that continuation rises with age of the user, added a parameter for age in the exponential model, i.e.

$P_{(t)} = ae^{-\underline{k}t}$ where is the age parameter. This function gave a slightly better fit than the Mauldin et al. function when applied to a small Puerto Ricoan experience. However, within five-year classes, Kelly's function reduces essentially to the modified exponential function of Mauldin et al[30].

Liu et al (1972) used a mixture of two different negative exponential functions to analyse contraceptive continuation. They recognized that a temporary decline of conditional risks followed by a levelling off within a year could be expected from a sample of acceptors composed of two types: a minority of high-risk couples

most of whom are eliminated by termination within a year and a majority who, because of much lower risks become dominant after a year so that thenceforth the sample exhibits an essentially constant conditional rate of device loss.

Liu et al. (1972) therefore presented a three parameter model to formalize the above situation. In their model, the high-risk group has a constant conditional risk of termination, r_1 (per year); the low-risk group has a constant conditional risk r_2; while a proportion p of the initial cohort belong to the high-risk group.

After a few months, the high-risk minority are lost to discontinuation, leaving behind a homogeneous low-risk remainder who exhibit constant monthly probabilities P_x. However, Liu's function has the disadvantage involving three parameters, which requires the solution of three simulteneous non-linear equations in order to obtain maximum likelihood estimates, a formidable task.

With the process thus represented as a mixture of two negative exponentials, operating in continuous time,

$$P_{(t)} = P\, e^{-r1t} + (1-P)e^{-r2t}$$

and $$R = \frac{P}{r_1}(1-e^{-r1t}) + \frac{1-p}{r_2}(1-e^{-r2t})$$

Both the Mauldin et al and Liu et al functions are conventionally fitted by a least squares procedure (after first passing through logarithms) applied to the monthly proportions P_1, P_2, ...P_n derived from a life table analysis.

Potter and Avery (1975) note that both the Mauldin et al. and Liu et al. techniques tend to underestimate mean retention time, the Mauldin et al. method slightly more than the Liu et al. method, and both more markedly when the observation period is short[31]. The underestimate falls below 10 per cent at an observation length between 36 and 48 months for the Liu et al. technique and between 48 months for Mauldin et al. procedure. At longer durations (84 and 96 months) the Liu et al. technique overestimates retention.

Srikantan and Siddiqui (1973) considered a negative exponential curve to which is added a positive constant. The curve is given by the formula

$$P_{(t)} = a + be^{-rt}$$

Where

a is a lower asymptote

b is the difference between the y-intercept and the lower asymptote,

r is the constant decay rate (In Kulkarni and Potter, 1976).

The reasoning is that over a medium-range time period the number of users, rather than declining to zero at a constant rate, would approximate a decline to some lower asymptote higher than zero.

Miller et al. (1975) applied this formula for "all contraception". They assumed the y-intercept (a+b) to be 0.95 for the IUD and 0.90 for the pill. However, it was found that the lower asymptotes were quite erratic[32].

Potter and Avery (1975) made generalizations of Liu et al. technique so that instead of a mixture of two homogeneous populations, a continuous probability distribution of termination risks could be ascribed to the cohort of acceptors. This generalization, named the Type III-exponential assumes that:

(1) Each couple is subject to a continuous fixed risk of discontinuation per unit of time,

(2) those fixed risks vary among acceptors,

(3) discontinuation is a random event,

(4) the sample of experience is large.

The two-parameter density of discontinuation risks is:

$$f(E) = \frac{a^k}{k} e^{-aE} E^{k-1} \qquad a, k > 0,\ E > 0.$$

The density becomes L-shaped when k<1. The mean of the discontinuation risks is given by k/a, the variance

by k/a^2. Taken over the density f(E), the proportion Q(t) expected to discontinue by time t is

$$f(E)\ (1-e^{-Et}) = 1 - (a/a+t)^k$$

while the proportion P(t) expected to continue to duration t is the complement, or $(a/a+t)^k$ which is a simple two-parameter function of duration since acceptance.

The expected retention per acceptor during interval (O,t) is $R(o,t) = (a/a+x)^k\ dx$

$= (a^k/1-k)\ [(1/a)^{k-1} - (1/a+t)^{k-1}$ which plainly increases with t to a/(k-1) in the limit.

Only the heterogeneity principle is operative in this third model with change over time being dependent on the selective removal of the more risk-prone acceptors. No provision is made for duration-dependent changes in the termination risks of individual women.

Potter and Avery (1975) note that the estimated parameter a and k of the Type III - exponential function are far less sensitive to length of observation period than are the parameters derived from either the Mauldin et al. or the Liu et al. techniques. Secondly, the Type

III-exponential predicts, even at short durations, fairly adequate values of the retention time, R.

One limitation of the Type III-exponential function is that when K<1, R (0,t) is defined only for finite values of t. Also, there is no unique value to be assigned to R(0,).

In their analysis of curve-fitting using long-term data from Taichung, Kulkarni and Potter (1976) carried out a systematic comparison of the modified negative exponential curve, the type III-exponential distribution and two other maximum-likelihood models. They found that Type III-exponential, Type I-geometric and the modified Type I-geometric curves were far better predictors of continuation than the negative exponential curve. Unfortunately, all of them involve extremely complex procedures and can therefore be employed efficiently only with the help of computers.

Kulkarni and Potter (1976) found that the Type III-exponential provided a close approximation (with less than five per cent discrepancy) on the basis of 24-month data and almost no discrepancy (less than one per cent) on the basis of 36-month or higher order data. With only 12-month data, it overestimated duration of use by 20 per cent, indicating that this technique should not be used for extrapolating from much less than two years' observation. However, one of the models they tested -

the "Modified Type I-geometric" did not deviate by more than three per cent for any duration, and for 12 months, the deviation was only 2 per cent. Hence, if extrapolation from data based on much less than two years is desired, this model should be used in preference to Type III-exponential.

This study presents a relatively straightforward method to estimate a modified geometric model of contraceptive continuation. The method requires only aggregate acceptor data for a number of years from a set of clinics. It is less demanding of data than the life table methodology. Therefore, it might make calculation of contraceptive continuation rates cheaper and more feasible. Continuation analysis may contribute to a wider range of programme and clinical contexts than it has thus far.

2.5 Studies in Kenya

Studies on contraceptive continuation in Kenya show relatively low continuation rates compared to other developing countries[33]. Studies based on clinic service statistics (Ojakaa, 1986) and follow up (Livingstone, 1975; Gachuhi, 1975) have also identified a number of determinants of contraceptive continuation.

Ojakaa (1986) used multiple regression to determine the extent to which demographic, socio-economic and types

of contraception factors influenced continuation. His findings showed that contraceptive use variables (IUD, Pill, injection) explained the highest variation in contraceptive continuation while demographic and socioeconomic variables contributed much less variation[34].

Livingstone (1975) found that for Kakamega district, 33 per cent of family planning clients never revist a clinic after first attendance. He also found that only 28 per cent of the acceptors remained in the programme after 12 months while only between 2 and 4 per cent remain in the programme after 24 months[35].

Studies by Bondestam (1972) and Gachuhi (1975) show high drop-out and low continuation rates for Kenya.

Gachuhi (1975) interviewed 160 drop-outs in Kisii and found that among several factors which influence the family planning drop-out rate, the most important are social and cultural influences, failure to follow instructions and medical problems[36].

The Ministry of Health (1976) reported that in 1973, 35 per cent of the clients discontinued visiting Government clinics after one year while 70 per cent discontinued after two years[37].

Murungaru (1982) used the TABRAP and CONVERSE computerized models to analyze the effect of family planning programmes on fertility in Kenya between 1969 and 1979. The proportions of those who continued using

the pill and the IUD between 6 months and 72 months after acceptance was obtained and then fitted in the continuous modified negative exponential curve of Mauldin et al. (1967). Using the average values of a and r, the findings from Murungaru's study show that the continuation rates for pills, injectables and IUDs are 59%, 65% and 60% respectively after one year.

Murungaru (1982) notes that the level of contraceptive use is determined by the acceptance level and the rate at which these acceptors drop out. He found that in Kenya these factors vary among the age groups. He adds that:

> Between 1969 and 1978, women in the age groups 20-24 and 25-29 contributed most of the acceptors (over 50 per cent). Discontinuation rates by methods and in each age group revealed a pattern similar to that of the acceptors. According to the estimates, rates of discontinuation are lowest among women in age groups 25-29 and 30-34 for the pill. Thus it is observed that both acceptance and continuation rates are high among women in the age groups 20-24 and 25-29. However, the contribution to the proportion of contraceptive users from these age groups advance to older ages[30].

Sanghvi (1984) did a one year retrospective study on oral contraceptive acceptance, usage and discontinuation in Nairobi and employed the lifetable technique to find out the magnitude of the problem of discontinuation and the reasons for discontinuation. The findings of the study showed that only 55 per cent continued to use the

pill after 6 months while only 40 per cent were continuing users at 12 months. The study also showed that improved educational status and socio-economic status are positive determinants for acceptance and consequently, longer continuation. Mati et. al. (1982) did a 3-year follow-up study of injectable users in Nairobi and found the continuation rates at 2 and 3 years to be 43.9% and 34.3% respectively. The sample used (96 subjects) was however small and in addition, only a specific injectable, Norethisteron Denathate (NET- EN) was under investigation.

Senanayake (1978) collected data on the worldwide usage of injectables and reports that an analysis of continuation rates in Nairobi, Kenya showed that 70.9% were still using the injectable, Depo-provera after 1 year, 55% after 2 years and 42.6% after 3 years.

Hornsby (1972) did a 17 month study of acceptability and continuation rates of family planning methods in Nairobi and found that the injectable, medroxy-progesterone acetate (MPA) had the highest continuation rate (58.7%) among older and highly parous clients. The continuation rates at the end of 1 year were 36.5% and 54.8% for pills and IUDs respectively. The study also found that there is a high drop-out of clients from the programme (only 46.1% continued to attend the clinic at the end of 1 year).

CHAPTER 3

METHODOLOGY

3.1 Analysis of Contraceptive Continuation

Analysis of contraceptive continuation, as is evident from Chapter 2, has been predominantly based on three main approaches: Continuation models, life table techniques and surveys. Results obtained by these methods are thus bound to vary and for each approach, the settings of the study may produce completely different results. For instance, the size of samples used in a survey and even its representativeness are bound to affect the calculation of continuation rates. Another problem that affects the results from surveys is the assumptions made on the contraceptive status of cases that are lost to follow up.

Unlike surveys, continuation models and the life table techniques face rather different shortcomings. As noted earlier, the quality of the data used determine the type of results obtained by these methods. In addition, analytical issues and other related aspects also affect the rates obtained by these methods.

The life table technique is probably one of the widely used techniques and there have been various modifications in its application to the study of

contraceptive continuation, and especially so to the analysis of IUD wearers. Some studies have combined the use of surveys and the life table technique (Freedman and Takeshita, 1969; P. 304). This latter approach has gained much acceptance because it is able to allow for the analysis of much richer data. Potter and Avery (1975 In Chandrasekaran and Hermalin, P. 153) refer to the approach as the Markov chain technique.

3.2 Hammerslough's Model

In the continuous negative exponential equation (Mauldin et. al. model), if we examine the ratio of continuers from one year to the next, we obtain the following relationship:

$$\frac{P_{t+1}}{P_t} = S = \frac{P(t+1)}{P(t)} = e^{-r}$$

Therefore $r = -\ln s$, where s is a discrete parameter. The negative exponential thus becomes;

$P_t = as^t$ which is Hammerslough's model. This model is a simple geometric continuation curve with two parameters, a and s. In the model,

P_t = the proportion still using a method of contraception at time t,

a = the proportion of acceptors who actually begin to use the method

s = the proportion of those users who continue to use from year to year (the probability of continuation).

This model developed by Hammerslough (1988) has the parameters a and s which are estimated on the basis of counts of all new and continuing contraceptive users served by one or more clinics for several years since they opened. Hammerslough (1988) emphasizes that clients should be linked in clinic records from year to year to determine whether they are continuing or new clients (users).

Estimation of a and s

Hammerslough (1988) discusses a number of possibilities for estimating the parameters a and s. Further, he describes a powerful procedure of deriving the variance of a and s. Also, he suggests a possible modification of the model to allow for the high discontinuation in the first year.

Estimation of a and s as suggested by Hammerslough (1988) is as follows:

Let N_i stand for new users in calendar year i of the clinic's operation. The assumption is that a clinic began operation on January 1 and that new users are seen in an even stream throughout the first year.

Let C_i stand for continuing users in calendar year i of the clinic's operation. C_1 is thus zero, because no users could be continuing from the year before.

Hammerslough (1988) argues that if the model $P_t = as^t$ is appropriate, then the expected value of C_2 is;

$C_2 = asN_1$

That is, the expected number of continuing users in the second year is equal to the proportion starting the method (a) times the proportion using for one year (s), times the number who began in the first year (N_1).

The expected value of C_3 is;

$C_3 = as^2N_1 + asN_2$

And for the fourth year;

$C_4 = as^3N_1 + as^2N_2 + asN_3$ etc

In general, for N>2

$C_n = a \quad S^{n-1} N_i$

In the present study, it was not possible to collect data on the numbers of new and continuing users since the clinics opened. This was because the need to keep counts of these users was only effected by FPAK much later after several of the clinics had started operation. It is therefore necessary to make a modification in the calculation of the expected numbers of continuing users.

There are, therefore, two important points of departure from Hammerslough's assumptions in the use of his model. First, C_1 is not zero since the data used is

that which was collected after the clinics had started operating. This implies that C_1 is the sum of all those clients who were continuing users prior to 1980 which was used as year 1 for most of the clinics.

Secondly, there are only three clinics, Eastleigh, Kisii and Pumwani which started operation during the time the categorization of clients as "new" and "continuing" was in force. Although these clinics actually started operating after January 1 of their respective starting years, no adjustment for incomplete first years of clinic operation was performed. For the rest of the clinics, the assumption thata clinic begins operating at the onset of the clalendar year did not apply and hence for all the clinics it was assumed that new clients coming to a clinic for contraceptive purposes came in an even stream throughout the year.

In view of the above, the second assumption does not present much problems due to the nature of the data. However, it should be noted that two of the recent clinics, Eastleigh and Pumwani registered very large numbers of both new and continuing clients especially during and after their second year of operation. This anomaly is likely to have a bearing on the type of results to be obtained. Eastleigh and Pumwani, being clinics located in the City of Nairobi are likely to have registered large numbers due to the large population in

the city which also experiences big streams of rural-urban migration.

Whereas Hammerslough's model would estimate C_n as

$$C_n = a\Sigma s^{n-1}N_i,$$

This has had to adjusted by a factor (s) as follows:

$C_2 = asN_1 + sC_1$

$C_3 = s\ (asN_1 + sC_1) + asN_2$

$C_4 = s\ [s(asN_1 + sC_1) + asN_2] + asN_3$

Hence $C_n = a\Sigma s^{n-i}\ N_i + s^{n-1}C_1$

Also, the above series can be written as:

$C_2 = s\ (aN_1 + C_1)$

$C_3 = s\ (C_2 + aN_2$

and in general,

$C_n = s(C_{n-1} + aN_{n-1})$ where $n > 2$

The problem now at hand is to find optimal values of a and s to fit the model so that there is minimal deviation of the observed C_n from the predicted C_n over some set of observations.

Hammerslough (1988) notes that to achieve this, a loss function (also called objective function) be constructed so that it be minimized.

One such function is the form $L(a,s) = \Sigma/C_n - C_n/$. In this function, if = 1, L(a,s) reduces to the Least Absolute Value (LAV). If = 2, L (a,s) reduces to least squares. Hammerslough (1988) concurrs with other findings that the least squares gives much influence to

large outliers and he adds that generally, such functions give more weight to large clinics as they influence the fit of the estimates.

Another function is of the form $L(a,s) = \Sigma/\ln(C_n/C_n)/$. This has the advantage that it equalizes the contribution of each component to the loss function.

In this study, Non linear Regression was used to estimate the parameters. This because in Hammerslough's model, the parameters a and s are not linear. Just as in linear regression, the values of a and s were chosen so that the sum of squared residuals is a minimum. However, in order to obtain a global minimum instead of a local one, the values were solved iteratively using the algorithm in appendix 1.

Although summary statistics for nonlinear regression are usually obtained, the usual statistical tests used for linear models are not appropriate (SPSS Update Manual Pg. B-38). The dependent variable in the model was the adjusted number of continuers while the independent variables were new clients, year, clinic, first year initial users and the dichotomous variable indicating whether the year was 1 or not. Finally, the loss function was based on the least squares procedure. This is because the parameter estimates were only determinable from the obtained minimum sum of squares.

3.3 Analytical Issues

There are a number of analytic issues considered in this study. The central issue is that of estimation, the others being the proper unit of observation for the estimation of the variance of a and s and the procedure for deriving the variance of a and s.

Hammerslough (1988) argues that an analytic derivation of the variance of a and s would be complicated because each clinic contributes a variable number of observations. As outlined earlier in the literature, contraceptive continuation is dependent upon a number of factors; demographic, social, cultural and also programmatic variables like the clinic providing contraceptive services. So if we assume that contraceptive continuation is not independent of clinic effects, then each clinic, instead of clinic-year would be the unit of observation in the analysis. If this is the case then estimates of the variances can be derived through jackknife or bootstrap estimators (Efron, 1982).

The Jackknife and Bootstrap estimates

Let a data set consist of an independent and identically distributed (i.i.d) sample of size n from an unkown probability distribution F on the real line, i.e.

$x_1, x_2, \ldots\ldots F$

Suppose the X_i's have observed values Xi's i.e. X1 = x1, X2 = x2 ....., Xn = xn, then the data set can generate useful measures, particularly the mean x and an estimate of the accuracy of x! Thus,

(1) Mean, $x = \Sigma xi/n$ (An estimate of the expectation of F)

(2) $= [\ 1/n(n-1)\Sigma(xi-x)^2]^{1/2}$ (The estimated standard deviation of x).

However, the trouble with (2) above is that it does not extend to other estimators other than X, for example the sample median.

The Jackknife and Bootstrap are two means that provide such extensions.

Suppose we wish to find the average of the data set by deleting the ith point. Thus we would conventionally write

$x = \Sigma xi/n$ so that by deleting the ith point we have

(3) $x_{(i)} = \Sigma_{j=i}\ x_j/n-1 = (n\Sigma xi/n) - x_i$

$$= \frac{nx - x_i}{n-1}$$

Equation (3) will generate n deleted averages and the average of these is

$$x_{(0)} = \Sigma x_{(i)}/n$$

It can be shown that $x_{(0)} = x_{(i)}$.

Hence the jackknife estimate of standard deviation is

(4) $_{jack} = n-1/n\Sigma(x_{(i)} - x_{(0)}2 +1/2$

Actually, (4) is the same as (2). The advantage of (4) is that it can be generalized to any estimator 0 = (X^1, X_2, ----X_n). The only change is to substitute O = 0 (X_1, X_2, ...X_i-1, X_i+1, Xn) for $X_{(i)}$ and $0_{(0)}$ for $x_{(0)}$.

In this study, each clinic was omitted in turn from the estimation algorithm and in each case, the parameters *a* and *s* re-estimated. The standard deviation of the N estimates then gave the jackknife standard deviations of a and s.

3.4 Life Table Method

The life table is a statistical model that was originally designed essentially to measure mortality but it is now employed by a variety of specialists in a variety of ways. Some of the areas that it has been and continue to be used include public health, demography, actuary and many others.

Basically, the life table is a life history of a hypothetical group or cohort of people as it is gradually diminished by an event like death. Thus, to delineate adequately the protection conferred by IUDs, it would be necessary to know the proportion of acceptors still wearing the device at specified intervals after insertion, and, for those not still wearing it, the time

and if possible, the circumstance of loss. If such information is available, the life table approach can be used to derive a picture of retention and loss of IUD as a function of time from first insertion. In this approach:

(i) The time period is subdivided into subintervals

(ii) Data is organized so that for each successive subinterval, the number of persons at risk of a specified event (termination) is known as well as the number of such events that befall them.

(iii) Subinterval rates are then computed as well as their complements which are interpreted as probabilities of "surviving" the subinterval without the event occurring.

(iv) Lastly, the product of the first k probabilities of subinterval survival yields the probability of surviving to the end of the kth subinterval.

The important results that are obtained by the life table approach are referred to as "rates" and these are of various types: When one or more types of events are used in the analysis of termination, the life table may be distinguished as either a single decrement or multiple decrement. The former is used to obtain "Gross" rates while the latter is used to obtain "Net" rates. Still, life table continuation rates, especially from follow-up surveys can be considered under various approaches: First

method continuation rate could be distinguished from all method continuation rate. Again, different meanings may be attached to life table rates if the focus is either on the woman or the method. In this case, if the focus is the woman, the term "extended use effectiveness" (all method) is used while the term "first method use effectiveness" is frequently used.

The differences between life table rates identified above are indeed quite useful for the interpretations of the rates obtained in any analysis. It is also important to add that all method (or contraception) differs from first method in that a contraceptive acceptor is considered still to be continuing with contraception despite one or more changes of method and hence for first method analysis, change of method is one type of discontinuation. Also, it should be noted that extended use-effectiveness, unlike first method use-effectiveness, ignores irregular practice, periods of non use, switching from one method to another and switches in source of supply. It thus evaluates service and not contraception. Also, it only assesses programme effectiveness and not method effectiveness.

3.5 Laing's calendar-status method

The calendar-status method is an analytical approach that is used in calculating both use-failure rates and

continuation rates. The method calculates an average annual continuation rate for each contraceptive method.

First, the continuation rate for a given month is calculated as a proportion of contraceptors in a given month who are still using that method in the subsequent month. Since these monthly rates tend to be high and have so little variation, an average monthly continuation rate (MCR) is computed by dividing the sum of all the numerators by the sum of the corresponding denominators. These are then converted to annual rates (ACR) expressed as percentages:

$ACR = 100\ (MCR)^{12}$.

The ACRs are, however, sensitive to the distribution of users by duration of use and may not be comparable over populations due to tendencies of discontinuation being higher in the initial months following acceptance (Jejeebhay, S. 1991).

Studies in Bangladesh and Philippines (United Nations, 1991) applied the life-table technique and the calendar-status method on the same data and the results show that the latter technique obtains higher estimates of discontinuation for pill and IUD in Bangladesh (27% compared to 20.4% for pill and 29% compared to 20.7% for IUD). The life-table technique however obtained higher estimates for Philippines than the calendar-status

technique (51.5% compared to 43.1% for pills and 30.8% compared to 19.6% for IUDs).

A study in Sri-Lanka using Laing's method shows that the annual discontinuation rates for pills, IUDs and injections are 46, 17 and 41 per cent respectively (United Nations, 1991). These results clearly indicate variability in discontinuation rates among methods of analysis and also among countries.

Analysis of the sample data which was collected from individual users was done using cross-tabulations.

This data, which was on 692 subjects, was analyzed by age, parity, marital status, education, occupation, reasons for discontinuation and alternative methods for terminators. In addition, the duration of use for all the three contraceptive method pills, IUDs and injectables combined together was tabulated against age, education, occupation and parity. For the latter, the chi-square statistic was computed and hypotheses tested.

CHAPTER 4

THE DATA

4.1 Family Planning Association of Kenya (FPAK) Data

There were two sets of data that were collected for purposes of this study. The first set of data consisted of "New" and "continuing" users of the contraceptives; pills, IUDs and injectibles. The second set of data was of a sample of clients of the same contraceptive methods.

At the end of every month, the established Family Planning Association of Kenya (FPAK) clinics submit to the headquarters, among others, reports about the numbers of new acceptors and continuing acceptors of each type of contraceptive in use. These reports are then aggregated to provide annual figures. Care is taken to record a client only once in a calendar year despite the several other visits she might make to the clinic. The annual (1984) service statistics report of FPAK describes a continuing acceptor as "an Acceptor from previous years seen at least once during the year, January-December, for contraceptive supplies, advice or examination".

Despite the above definition of a continuing acceptor, there are a number of errors that are likely to arise when determining the actual number of continuing acceptors. For instance, the recording personnel may count a continuing acceptor who changed method during the year under the most recent method. Such an error has the

effect of inflating the actual number of continuing acceptors of a particular contraceptive method. Further, the requirement by the FPAK service statistic manual that the recording personnel provide estimates of the numbers of continuing acceptors in cases where the records are faulty is another source of error on the numbers of continuing acceptors.

The table below indicates the numbers of various categories of acceptors in all FPAK clinics in the country in 1984.

Table 2. FPAK clinical Service Statistics (1984)

Contraceptive Method	(1) New Acceptors	(2) Continuing Acceptors	(3)=(1+2) Total Number of Acceptors	(4) Total Acceptor Visits
Oral	9488	19464	28952	76014
Injectable	14167	33073	47240	125216
Condom	4128	2089	6217	10412
IUD	389	6638	10531	20696
Other Methods	4210	3783	7993	12906
Medical advice	2228	1227	3455	5338
Male sterilization	11	-	11	11
Female sterilization	2227	-	2227	2227
Total all Methods	40352	66274	106626	250855

Source: FPAK: 1984 Annual report

From table 2 it is evident that in 1984, after correcting for those who came for medical advice, orals and injectables constituted over 62 per cent of all new acceptors and that among all continuing acceptors, oral and injectable continuers were well over 81 per cent. Whereas on one hand these figures indicate the popularity of these methods, the latter percentage is a pointer to their constant need for resupply.

When a client visits a clinic a file is opened for her in which her background characteristics, which include name, age, occupation, marital status, number of children alive and education level among others is recorded on the portion of the file for "first visit". Subsequent visits to the clinic by the client are recorded on the "revisit card" section.

The FPAK clinics are of two types; the static and the outreach clinics. To every static clinic, a number of outreach clinics are attached. The only difference in these types of clinics is their mode of operation. Whereas the static clinics operate on all working days of the week, the outreach clinics operate only on specific days of the week.

4.2 Aggregate Data

At the time of the study (December, 1989), there were 13 static clinics in operation with several outreach clinics attached to them. The clinics were: Phoenix, Pumwani, Eastleigh (Nairobi clinics), Nakuru, Mombasa, Nyeri, Eldoret, Kakamega, Kisumu, Embu, Thika, Meru and Kisii.

The aggregate data was retreaved from the files at the FPAK headquarters, Harambee Plaza building, in Nairobi. For all the clinics except Pumwani, Eastleigh and Kisii, data on new and continuing acceptors of pills, IUDs and injectables was collected for the years 1980 to

1989. Pumwani data was only available for the years 1983 to 1989, Eastleigh for the years 1984 to 1989 and Kisii for 1987 to 1989.

In addition to the number of both new acceptors and continuing acceptors, data on the number of transferred clients and continuing clients of all methods was collected. The latter two sets of data was necessary for the adjustment of the data on continuing acceptors of the three methods under study as it was realized that a significant proportion of "continuing acceptors" were actually from other clinics. The adjustment involved the removal of the proportion of transferred clients to continuing clients of all methods from the observed number of continuing acceptors.

In the calculation of the adjustment factor, the number of clients for all methods was used because the number of transferred and continuing clients for the specific methods under study was not available. Further, the use of such data for the calculation of the adjustment factor was strengthened by the fact that oral, injectable and IUD users account for a good percentage of all contraceptive users as evidenced in table 2 (63.1 per cent among new acceptors and 91 per cent among continuing acceptors after correcting for medical advice cases).

4.3 Sample Data

The data on a sample of Pill, injectable and IUD users was collected from first visit and revisit cards available at Phoenix and Eastleigh (Nairobi clinics).

At these clinics, client files are kept according to the year of first visit. Since it was necessary to look at the trends of contraceptive continuation, files for those clients who accepted the three contraceptives, pill, injection and IUD five years before the study were searched. Thus the files of clients who accepted the three contraceptives in 1984 were included in the study.

Initially, it was planned to include 1000 cases in the study, however, it did appear that many cases, especially for pill adoptors did not make a second visit for resupply. The sample size therefore dropped to 692 cases.

When new clients first come to the clinics, files are opened for them on which the number of the client is noted and also a number of demographic, social, marital, and economic characteristics are recorded. These files are then kept serially and not according to the method adopted for use.

When the section containing the files for 1984 contraceptive adoptors was identified, files of clients who had made at least a second visit for resupply (for pills and injectables) were identified. In the case of

IUD users, files for those who had at least revisited the clinic were also identified. These identifications were necessary in order to avoid including in the sample those who had only accepted the methods and did not come back and hence whose contraceptive status could not be ascertained for at least one month or more.

After all the possible cases for analysis were identified, systematic sampling was conducted to determine the cases to be included in the sample. Of the 692 cases in the study, 55.5 per cent were pill uers, 13.7 per cent injection users and 30.8 per cent were IUD users.

4.4 Problems with contraception data

In studying contraceptive continuation, the term "acceptor" takes a fundamental role and when distinction is made between a new acceptor, a continuing acceptor and a discontinued acceptor, more explicit definitions need to be made. In formulating such definitions, several matters should as well be taken into account.

One such matter is the source of service. Whereas some programmes might limit acceptors to those who make use of their services, other programmes may include anyone who uses contraception. For instance, if a woman who comes to the clinic for some purpose other than

family planning is found to be a pill user, should she be counted as a pill acceptor by the clinic?

A second problem arises due to multiplicity of both programmes and clinics. If a woman who has received contraception from one clinic changes to another clinic, should she be counted by both clinics as an acceptor? From the programme's standpoint, she constitutes only one acceptor, especially if her use of contraception is uninterrupted and she does not change methods, but each clinic would probably feel justified in reporting her, since both have participated in serving her.

It is true that many acceptors do change methods for a variety of reasons. It is also clear that they should be counted as acceptors the first time they accept a method. Should they be counted again as acceptors when they change methods? Further, if women who switch methods are not counted more than once per year, it remains ambiguous as to which method a switcher will be counted as using in the annual report.

A fourth matter concerns temporary versus permanent methods. Suppose a client comes to the clinic and agrees to have an IUD inserted but the doctor wants to wait until the next menstrual period to insert it and gives her some condoms to use in the interim, how should that case be counted: as a condom acceptor or as an IUD acceptor? This distinction can be important in comparing

the various method, since condoms are often offered as a temporary methods, and inclusion of such cases as condom acceptors may affect the apparent attractiveness of condoms, depending on how the data are viewed. From the standpoing of acceptances, the condom might look more popular than it is, but from the standpoint of continuation rates, it might look less satisfactory than it is among couples who select it as the method of choice.

The unit of analysis in family planning programmes is likely to affect results of continuation. Whereas in most countries the couple is considered the unit of analysis (Laing, 1982), other programmes may consider the individual as the unit of analysis. Now if an acceptor is defined as someone accepting family planning for the first time (i.e. excluding method changers) and if a couple shifts from a "female" method (like pills) to a "male" method (like vasectomy) should the shift be counted as a new acceptance? Thus what would be the unit of analysis, the couple or the individual?

Finally, clinic records are subject to high error rate. Inaccuracies may arise when, for instance, instead of asking a question, the person completing a form will infer the response; for instance, she (or he) may guess an acceptor's age rather than asking for it or infer from the fact that the acceptor has "only" two children that

her purpose in accepting is to space rather than limit her childbearing.

Inaccuracies may also arise from errors of transcription, misunderstanding of responses, misinterpretation of instructions for completing the forms and other such clinical errors.

All these problems outlined above may influence determination of contraceptive continuation and discontinuation and consequently be a source of variation of continuation rates between one study and another.

CHAPTER 5

ANALYSIS

5.1 Aggregate data

The aggregate data, as discussed earlier in section 4.2 consisted of new and continuing contraceptive acceptors for pills, injectables and IUDs. This data was collected for thirteen clinics, with ten clinics providing ten years of observation each while the remaining three providing between three and seven years of observation. Analysis of data has been done for eleven clinics in the case of pills and IUDs while all the thirteen clinics have been analysed for injectables. The reason for using fewer clinics for pill and IUD analysis is that whereas the rest of the clinics provided initial values for continuers to be entered in the regression runs, Eastleigh and Kisii had no such values.

The main objective, as was pointed out in section 3.2 is to obtain the optimal values of the parameters of the model $P_t = as^t$.

The analysis of the data was done by nonlinear regression runs of SPSS's advanced statistics option to estimate the parameters. The data was first aggregated by summing up the data on new and the adjusted continuation for each clinic's year of observation. This implies that the estimated value of continuing users in the first year equals the sum of all continuing users for

the first year. For the second and subsequent years, the estimated continuing users is the product of a,s and the preceding value for new users plus the product of s and the sum of the preceding continuing users. Stated mathematically we have:

$$C_n = as\Sigma N_i + s\Sigma C_i,\ n > 2,\ i = 1,2,\ ----,\ n-1.$$

In the programme designed for this purpose, initial values of a, s and C_1 for each clinic were indicated for the regression runs. It was important that plausible initial values of a and s be used to avoid obtaining 'local' rather than 'global' minima of the possible response surfaces like planes, ridges, saddles or a combination of these. In order to check for this requirement, regressions which either converged on the same initial values or had only one iteration with half-steps were rejected.

Finally, estimation of the standard errors of a and s was done according to the jackknife procedure (Efron, 1982) explained in section 3.2. It should however be noted that the name "jackknife" is a broad term used to refer to techniques that offer ways of setting sensible confidence limits in complex situations. The basic idea is to assess the effect of each of the observations into which the data have been divided by "omitting" it. In the present study each clinic was dropped in turn and a and s re-fitted with the remaining clinics. The results

of this procedure are presented in tables 3,4 and 5 for pills, injectables and IUDs respectively.

Table 3 shows that the estimate for a is 0.717 with a 95% confidence interval ranging from 0.716 to 0.718. This final estimate of a was arrived at by using different values of a between 0 and 1. The estimated standard deviation of a of 0.0005 is actually verry small, suggesting that the jackknife estimates are in a cloud arround a.

As for s, the estimated value was 0.695 with no dispersion at all. These findings indicate that among clients who choose to use the pill for purposes of contraception, about 72% will actually start using and after one year, about 50% will be using the pill while 34.6% will continue using after the second year.

Table 3: Jackknife estimates of variance of FPAK pill data.

Omitted clinic	a	s	as	as^2
1	0.717	0.695	0.498	0.346
2	0.716	0.695	0.498	0.346
3	0.717	0.695	0.498	0.346
4	0.716	0.695	0.498	0.346
5	0.717	0.695	0.498	0.346
6	0.716	0.695	0.498	0.346
7	0.716	0.695	0.498	0.346
8	0.717	0.695	0.498	0.346
9	0.717	0.695	0.498	0.346
10	0.716	0.695	0.498	0.346
11	0.717	0.695	0.498	0.346
Estimated standard deviations:				
	0.0005	0.0000	0.0000	0.0000
Parameter estimates:				
	0.717	0.695	0.498	0.346
95% Confidence intervals:				
Lower	0.716	0.695	0.498	0.346
Upper	0.718	0.695	0.498	0.346

Unlike the case of pills, estimation of a for injectables and IUDs resulted in values equal to 1. The assumption is therefore that all clients who choose to use injectables or IUDs immediately begin the use of these. In other words, a new client who indicates that she wants an injectable will have this done to her, of course after the necessary tests.

Table 4 below shows the estimated values of s and its standard deviation together with the proportion of

users after the first, second and the third year of injectables use. Whereas it is assumed a equals 1, the estimated value of s is 0.703. This value indicates that about 70% of injectable users will continue using from year to year. On the other hand, we also note from table 4 that after the second year after acceptance, about 50% will still be using injectables while the corresponding proportion after the third year is only about 35%.

Table 4: Jackknife estimates of variance of FPAK injectables data

Omitted clinic	a	s	as	as^2
1	1.000	0.705	0.705	0.497
2	1.000	0.704	0.704	0.496
3	1.000	0.705	0.705	0.497
4	1.000	0.705	0.705	0.497
5	1.000	0.705	0.705	0.497
6	1.000	0.706	0.706	0.498
7	1.000	0.705	0.705	0.497
8	1.000	0.705	0.705	0.497
9	1.000	0.705	0.705	0.497
10	1.000	0.704	0.704	0.496
11	1.000	0.705	0.705	0.497
12	1.000	0.694	0.694	0.482
13	1.000	0.694	0.694	0.482
Estimated Standard deviations:				
	0.000	0.004	0.004	0.000
Parameter estimates:				
	1.000	0.703	0.703	0.495
95% Confidence intervals:				
Lower	1.000	0.694	0.694	0.494
	1.000	0.712	0.712	0.496

As for pills, there is little variation in the range of the values for s as the estimated 95% confidence interval is (0.694, 0.712).

It was assumed, like for injections that all clients who have an IUD fitted actually 'start using' the device. This necessitates that a equals 1. Many studies show that the rate of IUD removal or expulsion are usually high especially in the first year but this fact has little bearing on the definition of a.

In table 5, it has been estimated that 60% of IUD wearers will continue having the device intact after the first year while the proportion of users after the second year drops to 35%. Like for the other contraceptives, the estimate of s is precise as the 95% confidence interval is (0.531, 0.669).

Table 5: Jackknife estimates of variance of FPAK IUD data

Omitted clinic	a	s	as	as
1	1.000	0.600	0.600	0.360
2	1.000	0.602	0.602	0.218
3	1.000	0.601	0.601	0.361
4	1.000	0.601	0.601	0.361
5	1.000	0.600	0.600	0.360
6	1.000	0.500	0.500	0.250
7	1.000	0.605	0.605	0.366
8	1.000	0.602	0.602	0.362
9	1.000	0.610	0.610	0.372
10	1.000	0.601	0.601	0.361
11	1.000	0.600	0.600	0.360
	Estimated standard deviations:			
	0.000	0.031	0.031	0.034
	Parameter estimates:			
	1.000	0.600	0.600	0.350
	95% confidence intervals:			
Lower	1.000	0.531	0.531	0.274
Upper	1.000	0.669	0.669	0.426

Table 6 below summarizes the estimated proportion of pill, injectable and IUD users who continue to use these methods after the first, second and third year after acceptance.

Table 6: proportion (%) of contraceptive users continuing to use after the first, second and third year.

	METHOD		
Year	Pill	Injectables	IUD
1	49.8%	70.3%	60.0%
2	34.6%	49.5%	35.0%
3	24.0%	34.8%	21.0%

It is apparent from the above table that injectables have higher continuation rates than either the pill or the IUD. After the first year, IUD discontinuation becomes higher so that after the third year only 21% of IUD users will be using compared to 24% for pills.

The figures below show the estimated continuation curves and their confidence regions for the methods under study.

Figure 3: Estimated Proportion Continuing to Use The Pill

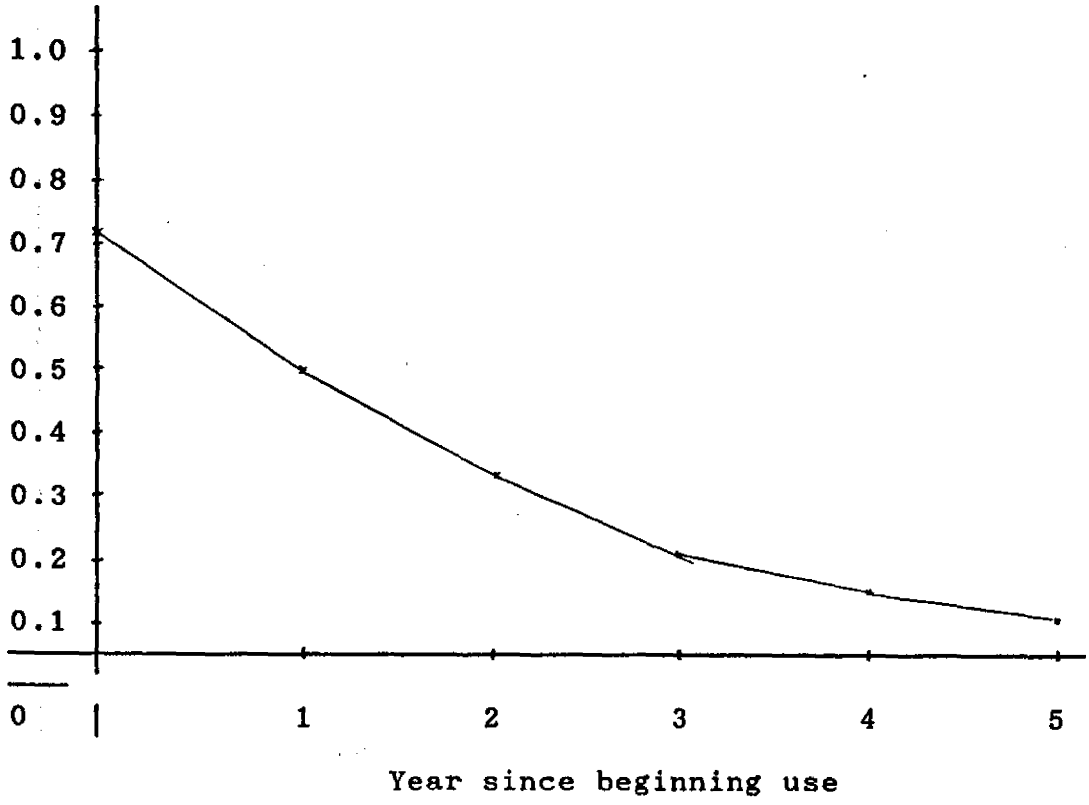


Figure 4: Estimated Proportion Continuing to Use Injectables

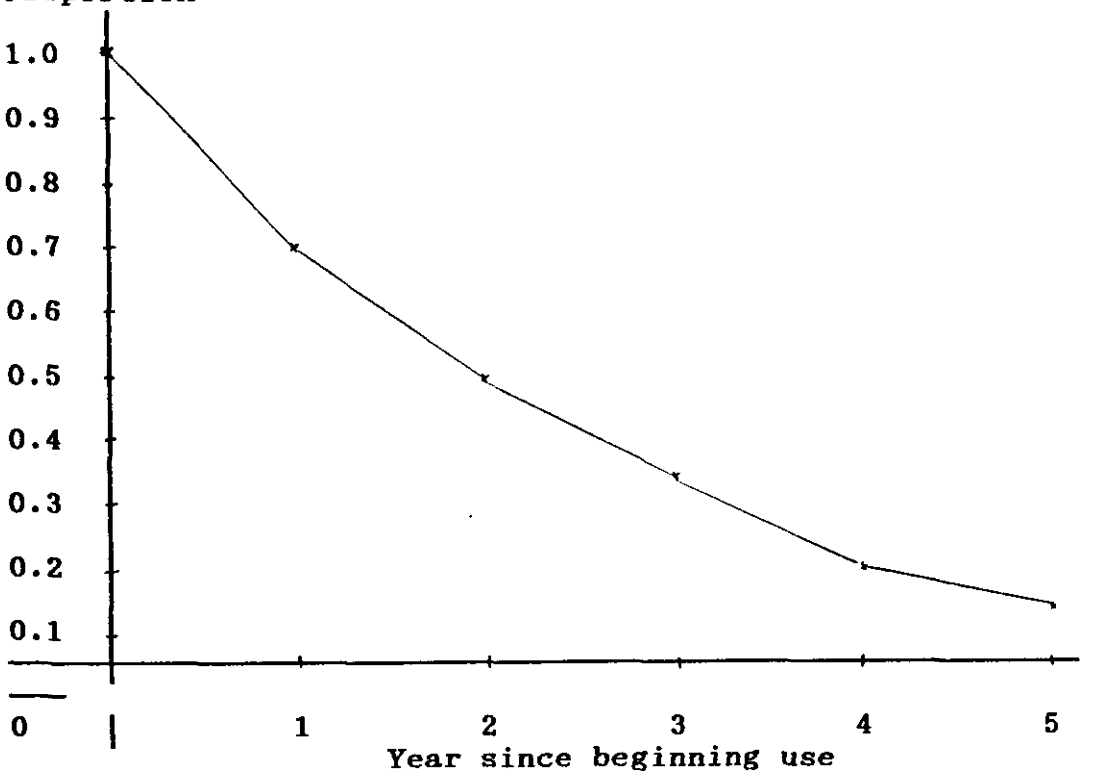
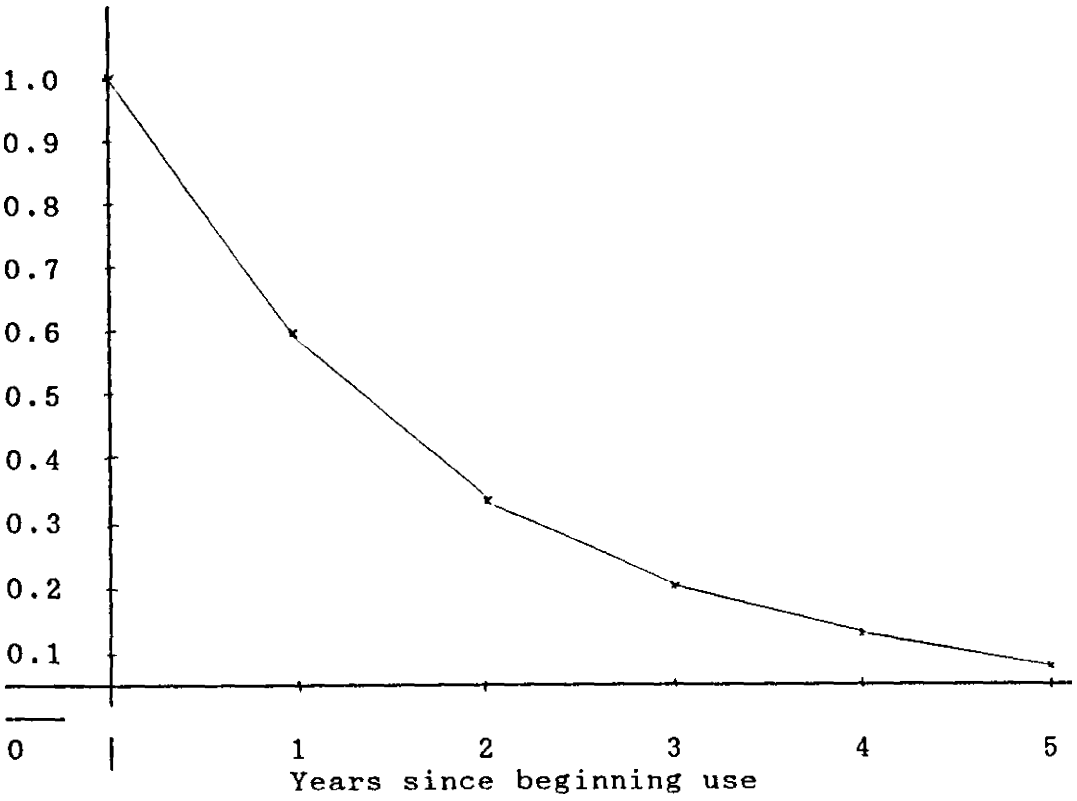


Figure 5: Estimated Proportion Continuing to Use IUDs



A comparable feature in figures 3, 4 and 5 is the rate of discontinuation especially in the first year. IUD users (figure 5) discontinue at a much faster rate followed by pill users (figure 3) while major discontinuations for injectable users is recorded after the first year (figure 4).

The findings in this study about contraceptive continuation are comparable to other international findings presented by Kreager (1977). For instance the proportion of 50% pill users continuing to use after one

year is within the 12% to 76% international range while for IUDs, the estimated 42% is also within the 34% to 90% international range. Laing (1982, P.76) notes that although international data on other methods are much less extensive, continuation rates for injectables generally are comparable to those for pills. However, it has been shown in the present study that the continuation rates for injectables are consistently higher than those of pills for all years.

Hammerslough (1988) used data on pill acceptors from Family Planning International Assistance clinics, seven of which were located in Asia, eight in Africa and four in Latin America and estimated that the probability of an acceptor starting the pill is 0.78 while the annual continuation rate is 0.62. From his model, it therefore implies that approximately 48% will continue using the pill after one year while the proportion using after the second year is about 30%. These results are indeed closely comparable to the findings in the present study.

As noted in the literature, continuation rates are probabilities of use after a given period of time following acceptance and thus become cumbersome to convey and remember. A more convenient index of continuation, the mean duration of use, may be calculated from the continuation curves in figures 3,4 and 5. To achieve this, it is necessary to extrapolate the curves of-

continuation to say t years and then obtain the area under the curve.

Using the above procedure, it has been estimated that the mean duration of use for pills, injectables and IUDs is 2.0 years, 2.7 years and 2.0 years respectively within the first 8 years of use (table 7).

The mean duration of use is more meaningful for cases who have terminated the use of a given method of contraception. In the calculations, the years of use were truncated at 8 years because after this period, over 94% of contraceptive users had terminated. Although truncation yields underestimates of the mean duration of use, we however obtain values that can be used for comparison between methods of contraception.

Table 7: Mean duration of use.

Method	Mean duration of use (Years)
Pills	2.0
Injectables	2.7
IUDs	2.0

The mean durations of use of table 7 above are comparable to those found by the Kenya Contraceptive Prevalence Survey (KCPS) 1984 which established that on

the average, modern methods of contraception are used for about 2.6 years (31.6 months) while all the methods combined (traditional and modern) are used for about 2.1 years (25.1 months) on the average.

5.2 Sample data

The sample consisted of 692 cases of which 384 (55.5%) were pill users, 213 (30.8%) were IUD users and the rest 95 (13.7%) were injectable users.

Table 8 shows the age distribution at acceptance for each method.

Table 8: Age distribution

Age	PILL		INJ.		IUD	
	No.	%	No.	%	No.	%
15-19	30	7.8	0	0.0	6	2.8
20-24	198	51.6	22	23.2	85	39.9
25-29	117	30.5	31	32.6	65	30.5
30-34	32	8.3	33	34.7	47	22.1
35+	7	1.8	9	9.5	10	4.7
TOTAL	384	100	95	100	213	100

Oral contraceptive clients who were 19 years or below were more compared to injectable and IUD clients in

the same age group. The same case applies for clients who were in the second decade of their life.

Table 9 shows the parity distribution. Among pill users, over 77 per cent were of parity 2 and below. Injectables and IUD users with parity 2 and below were comparatively lower (27%) for injectables and 41% for IUD users). From the table, it is also evident that injectable and IUD clients tend to be highly parous compared to pill users. Also, the mean parity of pill acceptors (1.7) was quite low compared to the mean parity of injectable acceptors (4) and IUD acceptors (3).

Table 9: Parity Distribution

Parity	PILL		INJ.		IUD	
	No.	%	No.	%	No.	%
0	96	25.0	1	1.1	0	0.0
1	109	28.4	8	8.4	38	17.3
2	92	24.0	17	17.9	50	23.5
3	45	11.7	18	18.9	62	29.1
4	20	5.2	19	20.0	29	13.6
5	12	3.1	9	9.5	24	11.3
6+	10	2.6	23	24.2	10	4.7
Total	384	100	95	100	213	100

Table 10 shows the marital status. 51.4% of the women using oral contraceptives were single and 47.8% were married, showing that whether one was married or single did not influence the choice of the pill. On the other hand, married women among injectable and IUD users tend to opt for these methods more than any other marital status.

Table 10: Marital Status

Marital status	PILL No.	%	INJ. No.	%	IUD No.	%
Single	196	51.4	23	24.2	66	31.3
Married	182	47.8	66	69.5	143	67.7
Divorced	1	0.3	4	4.2	1	0.5
Widowed	2	0.5	2	2.1	1	0.5
Total	381	100	95	100	211	100
Not stated		3		0		2

Table 11 shows the educational level of the clients. Very small proportions of pill users (1.2%) and injectable users (2.8%) had no formal education. The majority had reached secondary school and beyond particularly for pill and IUD users (over 78%) while for injectable users, the majority had primary and secondary education (94.4%). This emphasises the importance of

formal education, and shows that the educated client was a more frequent user of contraceptives.

Table 11: Client's Education Status

Education level	PILL No.	%	INJ. No.	%	IUD. No.	%
None	4	1.2	2	2.8	0	0.0
Primary	53	15.4	29	40.2	41	21.9
Secondary	273	79.1	39	54.2	136	72.7
University	15	4.3	2	2.8	10	5.4
Total	345	100	72	100	187	100
Not Recorded		39		23		26

Table 12 shows the occupation of the clients and is an indicator of their socio-economic status. 8.9% of the pill users were professionals and 39.6% in intermediate occupation. Together, these represent the high income group and formed 48.5%. The corresponding figure was 17.5% for injectable users and 43.9% for IUD users. The skilled occupation which would form the middle income bracket contributed 11% among pill users, 23.2% among injectables users and 9.6% among IUD users. It is therefore evident that those with high or middle incomes tend to favour contraceptives, particularly pills and IUDs.

Table 12: Client's Occupation

Occupation	PILL		INJ.		IUD	
	No.	%	No.	%	No.	%
None	67	19.8	35	40.7	59	29.8
Professional	30	8.9	4	4.7	24	12.1
Intermediate	134	39.6	11	12.8	63	31.8
Skilled	24	7.1	6	7.0	8	4.0
Unskilled	13	3.9	14	16.2	11	5.6
Student	40	11.8	0	0.0	11	5.6
Other	30	8.9	16	18.6	22	11.1
Total	338	100	86	100	198	100
Not recorded		46		9		15

Table 13 shows the net rates for each reason for discontinuation expressed as a percentage of total discontinuations for each method. A total of 355 (92.4%) discontinuations were recorded for oral contraceptives, 78(82.1%) for injectables and 179 (84%) for IUD at the end of the study period.

Table 13: Reasons for discontinuation of Method

Reason	Method					
	PILL		INJ.		IUD	
	No.	%	No.	%	No.	%
Accidental Pregnancy	5	1.4	0	0.0	7	3.9
Planned Pregnancy	5	1.4	1	1.3	11	6.0
Medical Reasons	16	4.5	12	15.4	37	20.7
Personal Reasons	19	5.4	7	9.0	10	5.6
Lost to Follow Up	250	70.4	32	41.0	52	29.1
Other Reasons	1	0.3	0	0.0	37	20.7
Change of Method	59	16.6	26	33.3	25	14.0
Total Terminations	355	100	78	100	179	100

Pill users tend to get lost to follow-up than injectable users and IUD wearers. Consequently, reasons for discontinuation are better known for injectable and IUD users than for pill users. Whereas the major reason given for discontinuance of pill and injectables is change of method, IUD discontinuers indicate both medical reasons and other reasons as the major reasons for discontinuation. Another notable feature in table 13 is the proportion of discontinuers indicating accidental pregnancy as a reason for discontinuing. About 4 per cent of IUD discontinuers indicated this reason while only 1.4 per cent of pill discontinuers accidentally

became pregnant on the pill. None of injectable discontinuers became accidentally pregnant.

Among terminators, some opted for other methods of contraception as indicated in table 14 below.

Table 14: Distribution of Alternative Contraceptive Methods for Terminators

	Old Method					
	PILL		INJ.		IUD.	
	No.	%	No.	%	No.	%
Total Terminations	355		78		179	
Alternative Method	114	32.1	40	51.3	79	44.1
Pills	0	0.0	18	23.1	43	24.0
Injection	34	9.6	0	0.0	12	6.7
IUD	36	10.1	3	3.8	0	0.0
Foam/Condoms	39	11.0	17	21.8	22	12.3
Sterilization	4	1.1	2	2.6	0	0.0
Diaphragm	1	0.3	0	0.0	2	1.1
No Alternative Method	241	67.9	38	48.7	100	55.9

Of the 355 cases terminating the use of the pill, 114 cases chose an alternative method. The corresponding cases for injectables and IUD cases were 40 and 79 respectively. Among injectable terminators, one half chose an alternative method while the other half decided to discontinue completely from the clinics. Apart from Foam/Condoms, intrauterine device was the most popular alternative method for pill terminators and was chosen or

prescribed to 10.1%. More injectable and IUD terminators opted for the pill than any other method. The apparent popularity of Foam/Condoms seen in table 14 can be attributed to the fact that this form of contraception was only temporary and was used only for some interim period as the client waited to adopt the use of some other form of family planning.

5.3 Discussion

Tables 15, 16, 17 and 18 below show the distribution of Age, Education level, Occupation and Parity against the duration of use in months respectively and the corresponding calculated chi-square statistics for all methods combined.

Table 15: Age distribution by duration of use (All methods)

Duration of use (months)	Age	
	Below 24 years	25 years and Over
0-3	157	131
4-6	97	97
7-9	43	55
10-12	11	32
13+	33	36
Total	341	351

Chi-square = 14.1, df = 4

Contingency Coefficient = 0.14

Table 16: Education level by duration of use (All methods)

Duration of use (Months)	Education level	
	Primary and below	Secondary and above
0-3	58	191
4-6	33	134
7-9	19	74
10-12	8	31
13+	11	47
Total	129	477

Table 17: Occupation by duration of use (All methods)

Duration of use (Months)	Occupation None	Skilled and unskilled	Intermediate and profesional
0-3	67	30	114
4-6	42	20	78
7-9	24	16	33
10-12	13	3	13
13+	15	7	28
Total	161	76	266

Chi-square = 6.17, df = 8

Contigency Coefficient = 0.11

Table 18: Parity by duration of use (All Methods)

Duration of use (Months)	Parity One and below	Two and three	Four and above
0-3	99	119	70
4-6	80	73	41
7-9	37	41	20
10-12	9	24	10
13+	27	27	15
Total	252	284	157

Chi-square = 8.38, df = 8
Contingency Coefficient = 0.11

The calculated chi-square statistic in table 13 is significant at the 0.05 level, indicating that there is quite a strong relationship between continuation and age of the user. This is also confirmed by the larger contingency coefficient of 0.14.

However, tables 16,17 and 18 show very weak relationships between continuation and education, occupation and parity. This weakness in relationship is likely to be due to the cases that were lost to follow up (about 55%; table 13) which were not corrected for in the analysis presented in tables 16, 17 and 18.

As pointed out earlier, continuation rates indicate the proportion of acceptors who continue to use the method of fertility control to a given point in time after acceptance. Short continuation rate, or by implication, high termination rate imply an unsuitable method, a high failure rate or a failure in programme procedure. In our experience with the aggregate data, continuation rates for IUDs are disappointingly short. A probable guess as to the reason for termination would be unsuitability of the IUDs that were in use as opposed to lost to follow-up. The findings from the sample data actually support this contention.

In table 19 below, the reasons for discontinuation of IUDs are tabulated according to the duration of use.

Table 19: Reasons for IUD discontinuation by duration of use.

Duration of use (Months)	Reason			
	Lost to follow up	Expelled	Removed	Other
0-3	18	12	32	2
4-6	18	2	29	3
7-9	2	2	19	6
10-12	1	2	17	8
13+	0	0	6	5
Total	53	18	118	24

Removals were the major reasons for discontinuing IUDs (55 per cent) followed by cases lost to follow-up (25 per cent). These however reduced by time leaving probably more satisfied users to continue.

5.4 Summary and Conclusion

Family planning has been identified by most governments as an approach that can help curb the high rates of population growth especially in the developing countries. The developed countries have used family planning programmes for purposes of either spacing or limiting births with much success. One pertinent issue is the sustainance of recruits into the programmes.

In terms of the programme, it would therefore be desirable to realize high continuation rates with the methods in use. This is however a formidable task as much resources will have to be mobilized. Enough supply of contraceptives will have to be maintained, trained personnel will be required and above all, many more clinics will be required to make contraceptive services available and accessible to the population.

This study aimed at estimating contraceptive continuation rates for the popularly used methods, pills, IUDs and injectables using a model developed by Hammerslough (1988). The model is a simple geometric curve with two parameters a and s. In the model, the proportion of users still using a given method of contraception at time ti, $P_{(t)}$, is given by the equation;

$$P_{(t)} = as^t$$

Using the Family Planning Association of Kenya data on new and continuing users of each method, it was estimated that about 60 percent of IUD users will continue using this method from year to year while the same proportion for pill and injectables were both equal to 70 per cent. However, the proportions still using after one year are 50 per cent for pills, 60 per cent for IUDs and 70 per cent for injectables. These results show that the continuation rates for pills and injectables are comparable but that there is much attrition among pill

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users so that after one year, the proportion of pill users is very low compared to those of IUD and injectable users. Results from the sample data identify a number of factors associated to continuation, one being the age of the user.

Contraceptive continuation rates are useful for a variety of purposes, including estimating the demographic impact of contraceptive use, evaluation of alternative strategies used by programme managers, assessing programme quality and for the counselling of users.

The method of analyzing contraceptive continuation presented in the study requires very simple data but of very specific nature. The latter aspect was erratic and this prompted adjustments. The final results obtained however are comparable to the results obtained by other studies which used different approaches. It should also be noted that contraceptive continuation rates can not be pegged on specific values. Instead, the continuation rates for specific methods lie between a range of points.

Like other models, the model presented in this study analyzes clinical, rather than contraceptive, continuation. However, if the clinic is the sole or primary source of supply for a method in the local area, as was assumed for FPAK clinics, then the clinical continuation serves as a good proxy for contraceptive continuation. Another problem area in the application of

the model was the nature of the FPAK data which did not wholly conform to the requirements of the model. A number of the clinics had some "continuing" users without first being "new" users. Such users affect the estimates on continuation.

In view of the less data requirements for the method used in this study, proper data-keeping systems in family planning programmes should be observed. Most studies on contraceptive continuation recognize the fact that discontinuation in the initial months after acceptance tend to be high. It is recommended that if this be the case, then another parameter be introduced in the model to take care of such early terminations.

Finally, it is recommended that when clients are recruited into a programme, proper counselling should be done and the need to keep proper records should be strictly observed. Lack of promotion by clinic staff has been cited by many studies as the main reason for the relatively low use of IUDs in Africa. Counselling of IUD clients for instance, should focus on skepticisms about the ability of the device to prevent pregnancy, fear that the IUD will migrate to another part of the body etcetera. If possible, attempts should be made at making follow-ups on clients who fail to honour appointments.

A number of studies point out that clients are less likely to stop using a contraception when they have more

contacts with providers. Such contacts can successfully be achieved through follow-ups. During these follow-ups, it would be possible to find out whether clients are satisfied with the method chosen. Supplies, as appropriate, would also be arranged and clients with minor side effects would also be reassured or treated.

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REGRESSION PROGRAMME

```
rst, set up the lagged values of new .
ute lagnew=lag(new).
missing(lagnew)) lagnew=0.
en, set up dummies for which clinic it is: .
pute clin01=0.
pute clin02=0.
pute clin03=0.
pute clin04=0.
pute clin05=0.
pute clin06=0.
pute clin07=0.
pute clin08=0.
pute clin09=0.
pute clin10=0.
pute clin11=0.
pute clin12=0.
pute clin13=0.
  (clinic='Eldoret ') clin01=1.
  (clinic='Embu    ') clin02=1.
  (clinic='Kakamega') clin03=1.
  (clinic='Kisumu  ') clin04=1.
  (clinic='Meru    ') clin05=1.
  (clinic='Mombasa ') clin06=1.
  (clinic='Nakuru  ') clin07=1.
  (clinic='Nyeri   ') clin08=1.
  (clinic='Phoenix ') clin09=1.
  (clinic='Thika   ') clin10=1.
  (clinic='Pumwani ') clin11=1.
  (clinic='Kisii   ') clin12=1.
  (clinic='Eastleig') clin13=1.
Now, set up the dummy for whether year 1 or not: .
ompute y1=0.
f (year=1) y1=1.
```

		PILL	INJ	IUD
ompute	C001=	166	1229	31.
ompute	C002=	186	943	71.
ompute	C003=	28	137	13.
ompute	C004=	150	393	31.
compute	C005=	40	77	18.
compute	C006=	303	683	158.
compute	C007=	173	1039	131.
compute	C008=	53	416	31.
compute	C009=	206	59	280.
compute	C010=	2	1	2.
compute	C011=	7	1	69.
compute	C012=	0	251	0.
compute	C013=	0	1	0.

```
MODEL PROGRAM  A=.6 S=.4 .
COMPUTE chat=(1-y1)*(lagnew*a*s+chat*s) +
             (y1*(clin01*c001+clin02*c002+
             clin03*c003+clin05*c005+clin06*c006+
             clin07*c007+clin08*c008+clin09*c009+
             clin10*c010+clin11*c011+clin12*c012+clin13*c013)).
COMPUTE PRED=CHAT.
NLR CONT2 WITH NEW CLINIC YEAR clin01 to clin13
               c001  to c013
               y1 lagnew .
finish.
```

MINISTRY OF HEALTH 113 C № 238793

FAMILY PLANNING FIRST VISIT CARD

BASIC INFORMATION:

Date:.....Clinic No.:.....Client No.:.....

Client's full name:.....
Marital status:.....Age at first marriage:.....
Husband's/Father's name:.....Occupation:.....
Client's address: Box:.....Village/Estate:.....
Tribe or community:.....Sublocation/Household No.:.....
Age:.....Occupation:.....Education Level:.....
Number of Children: Living.....Ages:.....Died:.....
Previous contraceptive practice: Yes/No. Clinic:.....
Client No.:.....Method:.....Date last Visit:.....
Do you smoke: Yes/No: How many per day:.....

MEDICAL HISTORY

LMP:.....No. of bleeding days:.....
Cycle length:.....
Flow: regular/irregular.....
Date last Delivery/Abortion.....

EXAMINATION

Blood pressure:.....
Weight:.....
Urine Sugar.....
Urine Albumin.....

	YES	NO
Breast feeding:	.....	.....
Severe Varicosis:	.....	.....
Jaundice:	.....	.....
Renal disease:	.....	.....
Hypertension:	.....	.....
STD:	.....	.....
Diabetes:	.....	.....
Epilepsy:	.....	.....
Tuberculosis:	.....	.....
PID:	.....	.....
Goitre:	.....	.....
Taking medicine:	.....	.....

	Normal	Abnormal	Specify
Breasts:	.....	.....	.....
Uterus:	.....	.....	.....
Adnexa:	.....	.....	.....
Cervix:	.....	.....	.....
Ext. Genitalia	.....	.....	.....
Vaginal discharge:	.....	.....	.....
Pap smear:	.....	.....	.....

Pregnancy Test results:.....

Specify Type:.....

METHOD OF CONTRACEPTION ADOPTED

Pill: Type:.....No. of cycles:.....
IUCD: Type:.....Size:.....
Injection: Type:.....No. of months:.....
Condoms:.....No. issued:.....
Spermicides: Type:.....Amount issued:.....
None: Reason:.....

REMARKS/REFERRALS

114

C № 238793

REVISIT CARD

DATE.....PRINTED CARD No.....
NAME.....

CLIENT No:.....CLINIC No:.....
1. EXAMINATION:
   Blood Pressure.....Weight.....
   Breasts:.....
   Pap Smear (yearly):.....
   Date of last menstrual period:.....
2. METHOD AT LAST VISIT: (type).....
   .....
3. METHOD FOR NEXT PERIOD: (type).....
   cycles/quantity/size/dose.....
4. REASON FOR CHANGE or TERMINATION
   wants pregnancy/is pregnant/can't follow instructions/husband objects
   Medical complication (specify).....
   .....
   other (specify):.....
5. REMARKS/REFERRALS/ANNUAL CHECK-UP

Prescriber.....Return date.....

1

C № 238793

REVISIT CARD

DATE.....PRINTED CARD No.....
NAME.....

CLIENT No:.....CLINIC No:.....
1. EXAMINATION:
   Blood Pressure.....Weight.....
   Breasts:.....
   Pap Smear (yearly):.....
   Date of last menstrual period:.....
2. METHOD AT LAST VISIT: (type).....
   .....
3. METHOD FOR NEXT PERIOD: (type).....
   cycles/quantity/size/dose.....
4. REASON FOR CHANGE or TERMINATION
   wants pregnancy/is pregnant/can't follow instructions/husband objects
   Medical complication (specify).....
   .....
   other (specify):.....
5. REMARKS/REFERRALS/ANNUAL CHECK-UP

Prescriber.....Return date.....

2

APPENDIX 4

FPAK AGGREGATE CLINIC DATA

			PILL		INJ.		IUD	
	CLINIC	YEAR	NEW	CONT.	NEW	CONT.	NEW	CONT.
1	EASTLEIGH	1	87	0	24	0	91	0
2	EASLEIGH	2	1563	2123	504	1206	390	352
3	EASTLEIGH	3	980	2032	650	1039	180	342
4	EASTLEIGH	4	1163	2783	846	2430	283	533
5	EASTLEIGH	5	738	1675	1006	2151	303	480
6	EASTLEIGH	6	783	1448	911	1768	372	251
7	ELDORET	1	53	179	156	1329	87	34
8	ELDORET	2	44	168	210	1367	128	251
9	ELDORET	3	100	81	346	580	196	219
10	ELDORET	4	122	138	569	827	266	263
11	ELDORET	5	328	273	947	1439	246	476
12	ELDORET	6	761	619	1919	3073	374	467
13	ELDORET	7	707	999	2810	5575	227	646
14	ELDORET	8	645	1271	3514	8259	155	547
15	ELDORET	9	1087	2295	4286	7834	174	350
16	ELDORET	10	1249	1393	4355	9092	255	576
17	EMBU	1	135	188	225	952	104	75
18	EMBU	2	104	146	167	851	159	145
19	EMBU	3	109	185	236	839	201	246
20	EMBU	4	224	221	367	1000	177	329
21	EMBU	5	405	292	466	1206	234	271
22	EMBU	6	705	479	705	1517	209	344
23	EMBU	7	296	645	883	3123	143	379
24	EMBU	8	258	502	727	2795	92	412
25	EMBU	9	269	1887	441	4031	140	302
26	EMBU	10	456	1104	559	3383	279	945
27	KAKAMEGA	1	40	30	114	146	21	14
28	KAKAMEGA	2	56	23	124	125	27	25
29	KAKAMEGA	3	98	30	185	178	41	36
30	KAKAMEGA	4	101	75	416	660	110	92
31	KAKAMEGA	5	167	54	598	533	194	67
32	KAKAMEGA	6	161	127	630	1008	151	173
33	KAKAMEGA	7	129	186	797	1616	194	172
34	KAKAMEGA	8	219	119	847	1053	184	77
35	KAKAMEGA	9	232	249	726	1159	119	63
36	KAKAMEGA	10	259	315	893	2011	155	188
37	KISII	1	2	0	235	251	0	0
38	KISII	2	55	14	312	690	1	0
39	KISII	3	48	64	494	856	9	3
40	KISUMU	1	112	151	215	397	78	54
41	KISUMU	2	239	177	307	314	103	112
42	KISUMU	3	239	177	307	314	103	112
43	KISUMU	4	418	282	847	1338	145	214
44	KISUMU	5	244	201	999	1101	154	126

45	KISUMU	6	365	270	1974	1780	197	163
46	KISUMU	7	456	757	2570	3400	175	228
47	KISUMU	8	625	722	2275	3402	110	143
48	KISUMU	9	663	977	1875	3675	102	110
49	MERU	1	62	50	75	96	50	22
50	MERU	2	83	53	120	120	92	39
51	MERU	3	114	94	110	170	132	70
52	MERU	4	247	130	142	227	237	83
53	MERU	5	775	137	328	226	372	143
54	MERU	6	974	1035	674	789	459	577
55	MERU	7	1290	1413	817	2463	242	528
56	MERU	8	1538	2056	748	2066	177	444
57	MERU	9	1488	2885	564	2205	217	545
58	MERU	10	931	1768	662	2622	331	966
59	MOMBASA	1	147	362	220	817	119	188
60	MOMBASA	2	125	324	172	765	84	271
61	MOMBASA	3	116	383	115	657	118	360
62	MOMBASA	4	172	479	202	748	175	533
63	MOMBASA	5	327	501	337	692	151	486
64	MOMBASA	6	494	793	628	1364	156	478
65	MOMBASA	7	615	1145	925	1810	97	399
66	MOMBASA	8	361	834	577	2077	75	289
67	MOMBASA	9	307	510	373	1085	182	211
68	MOMBASA	10	859	955	1200	1572	189	218
69	NAKURU	1	117	198	176	1191	122	150
70	NAKURU	2	104	75	192	673	141	96
71	NAKURU	3	114	208	220	649	207	223
72	NAKURU	4	201	269	445	877	375	512
73	NAKURU	5	319	360	599	1042	491	841
74	NAKURU	6	487	592	896	1268	594	637
75	NAKURU	7	518	1029	1204	2596	447	1065
76	NAKURU	8	614	590	1339	1973	229	625
77	NAKURU	9	758	1283	1256	2533	211	366
78	NAKURU	10	648	816	1625	3204	340	243
79	NYERI	1	81	56	302	437	110	33
8.	NYERI	2	140	132	267	1293	111	188
81	NYERI	3	215	300	437	2004	139	315
82	NYERI	4	291	495	781	2870	239	356
83	NYERI	5	625	619	1634	4233	450	495
84	NYERI	6	462	420	584	2364	155	269
85	NYERI	7	401	692	352	2338	147	279
86	NYERI	8	345	770	297	1211	124	317
87	NYERI	9	390	1369	385	3051	201	672
88	NYERI	10	436	756	725	3026	431	761
89	PHOENIX	1	146	258	47	74	224	351
90	PHOENIX	2	116	395	26	123	232	789
91	PHEONIX	3	168	325	15	83	197	825
92	PHOENIX	4	652	304	174	83	408	732
93	PHOENIX	5	1698	609	349	236	312	782

94	PHOENIX	6	1007	1255	147	54	336	189
95	PHOENIX	7	3244	8281	563	495	1476	1084
96	PHEONIX	8	1094	3343	1014	1341	1256	1364
97	PHOENIX	9	1604	3081	1962	2034	2042	2742
98	PHOENIX	10	1793	2658	2330	3117	2369	3054
99	PUMWANI	1	38	8	12	1	368	79
100	PUMWANI	2	81	230	25	90	458	885
101	PUMWANI	3	389	448	126	140	412	921
102	PUMWANI	5	422	1545	318	788	24	968
103	PUMWANI	6	411	968	286	602	65	499
104	PUMWANI	7	591	1233	505	1031	232	1031
105	THIKA	1	175	2	141	1	214	3
106	THIKA	2	136	209	56	94	332	337
107	THIKA	3	145	165	39	94	332	337
108	THIKA	4	252	149	53	109	315	444
109	THIKA	5	540	483	88	135	243	461
110	THIKA	6	819	929	153	371	231	611
111	THIKA	7	843	1279	393	864	141	764
112	THIKA	8	101	1974	430	1587	139	818
113	THIKA	9	1486	2271	695	2023	136	298
114	THIKA	10	1428	1983	941	1875	146	389