

(CATALOG NO. 134)

# SWP-137

This paper is prepared for staff use and is not for publication. The views are those of the author and not necessarily those of the Bank.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

Economic Staff Working Paper No. 137

November 1972

## EVALUATION OF FAMILY PLANNING PROGRAMS USING SERVICE STATISTICS

This paper was prepared in answer to increasing interest in the Bank in the work of family planning programs. It presents a method of evaluation which uses statistics originated in the program itself and tries to evaluate the output of a family planning program in terms of births averted. Two steps are taken: firstly the conversion of acceptors of contraception into time-protection by the use of continuation rates; and, secondly the conversion of time-protection into births averted using specific fertility rates. Male contraception and abortion are also considered. The paper ends with an appendix in which the case of Tunisia has been taken to illustrate the methodology.

Population and Human Resources Division

Prepared by: Roberto Cuca



## TABLE OF CONTENTS

	Summary and Conclusions	i
I.	Introduction	1
	Objectives of Family Planning Programs	3
	Potential Fertility	4
	Problems of Evaluation	7
	Service Statistics	11
II.	Methodology	12
	Birth Control Methods	14
	Abortion	14
	Male Contraception	16
	Continuation Rates	16
	Fertility of the Users	21
III.	Additional Factors to be Considered	22
	Program Costs	23
	Maximization of Objective Functions	25
	Data Needs for Evaluation	25
	Limitations of the Method	26
IV.	Appendix: An Example of Evaluation, The Case of Tunisia	27



EVALUATION OF FAMILY PLANNING PROGRAMS USING SERVICE STATISTICS

Summary and Conclusions

- i. Renewed awareness of the accelerating rate of growth of population has encouraged many countries to adopt policies supporting family planning in the last decade and efforts in this direction are likely to continue. Because of the novel features of this activity more research is needed on the evaluation of family planning programs, in terms of benefits and costs for the achievement of the specific population goals of each nation.
- ii. Several approaches are advocated in the growing literature for the evaluation of family planning programs, and the present paper draws upon them to develop a practical framework. Since the objective of family planning programs is to reduce the number of births, a good measure of the achievements of a program is the number of births averted as a consequence of the program. This is the measure used in this study. The basic data necessary for this evaluation consists of data easily obtained, in principle, by the program from the users and refers mainly to their demographic characteristics and their continuation in the program after acceptance of the services. However, it cannot normally be assured that the total effect upon fertility of a program is equal to the number of births averted by the services delivered by the program. The existence of a program affects the users of the services most directly, but it also affects fertility elsewhere. It may encourage others to change their procreative behaviour by example, or through the effect of informational or educational services. This might well be a positive effect.

iii. There will also be negative or neutral effects upon fertility because some program users will substitute contraceptive services from an official program for methods previously obtained from other sources. There may well be a net gain in human welfare, because official services can, or should be superior to those from private sources. (This will be particularly important in cases where safer methods are substituted for unsatisfactory forms of abortion). This substitution effect is one of the more difficult elements to estimate and no attempt is made to do so in this paper.

iv. The evaluation method consists essentially of determining the period of time that each cohort of women is protected from pregnancy by the program and the conversion of this time-protection into an estimated number of births averted. The amount of protection is estimated from a knowledge of the proportion of women continuing in the program after varying periods of time from the moment of acceptance. This information can be obtained through direct follow up of all acceptors, or through the use of continuation functions with parameters estimated from sample survey data.

v. The transformation of time-protection into births averted depends on the fertility assigned to each cohort of women and on their contraceptive practices in the absence of the program. In the absence of the program, if women would not have practiced contraception, the protection given by the program would avert a maximum number of births, equivalent to the natural fertility of the users. On the other hand, if the participants would have practiced efficient contraception in the absence of the

particular program, the effects of the program would have been nil.

A middle position has been taken which assumes that the users would have had the same fertility as that of women in the population as a whole with the same demographic characteristics.

vi. The method has been developed basically for the evaluation of contraception practiced by women, but abortion and male contraception have also been taken into account and a method of estimating the births averted by abortion comparable to births averted by contraception has been considered.

vii. The paper emphasizes the need for programs to improve the collection of data from users in order to provide the minimum data required for evaluation. These data consist basically of the number of women continuing in the program in each period and their demographic characteristics. It would also be advisable to collect data on the different socio-economic characteristics of the users.

viii. Although the paper deals mainly with the evaluation of family planning programs from the point of view of births averted, some consideration is also given to the need for cost accounting. This would allow the administrators of the program to maximize the benefits of the program by a comparison of inputs and outputs for each method and to decide on the best mix required to achieve better overall results.

ix. Finally the appendix presents an evaluation of the family planning program of Tunisia (1964-1970) as an example of the method proposed. This example is not worked out completely month by month but it provides an illustration of the use of the method for those who

do not have time to devise a method and work it through its entirety. One objective of the method is to provide a way to evaluate the program without the use of electronic data processing facilities; the present method can be used on a yearly basis, or on a monthly basis, (as was done in the example) with the assistance only of a desk calculator.

## EVALUATION OF FAMILY PLANNING PROGRAMS USING SERVICE STATISTICS\*

### I. Introduction

1. The last decade has seen an increase in family planning programs in a growing number of countries.<sup>1/</sup> Many private, governmental and multi-national organizations are becoming more and more interested in assisting the efforts made to control population growth. Since 1968, the World Bank has publicly declared its interest in the financing and operation of programs designed to reduce the fertility of the countries concerned, in order to reduce the rate of growth of population and in this way to facilitate the process of economic and social development.<sup>2/</sup>

2. The interest of the Bank, as that of other institutions, is based on the recognition that excessive population growth tends to retard the achievement of economic development goals. The less developed countries have high rates of population growth because of the rapid decrease in mortality not compensated by corresponding decreases in fertility. The high rates of population growth retard the rate of growth of income per capita and, in consequence, make more difficult the saving and investment process. Hold-<sup>3/</sup>ing investment down means retarding the growth of the Gross National Product.

---

\*The paper draws upon the work of David Miller and Philip Kreitner, former members of the Population and Human Resources Division and their assistance is gratefully acknowledged.

<sup>1/</sup> Information on the countries with official antinatalistic policies can be found in Nortman, Dorothy "Population and Family Planning Programs: A Factbook". Reports on Population/Family Planning, The Population Council, N.Y., June 1971.

<sup>2/</sup> McNamara, Robert S., Address to the Board of Governors. The World Bank Group, September 30, 1968. Washington, D.C., p. 11 ff.

<sup>3/</sup> Coale, Ansley J. and Hoover, Edgar M. Population Growth and Economic Development in Low Income Countries. Princeton, Princeton University Press, 1958.

3. The desire for a rapid increase in the standard of living in all countries has then provided the impetus for the development of national programs of family planning. Governments are now becoming more and more aware that a reduction of population growth will be of great help in solving the problems concomitant to the process of development.<sup>1/</sup>

4. Consideration of birth control as a help in improving economic and social conditions has also become more important at the family level. Some families are already showing that they wish to limit the number of children they want to have. Evidence of this can be found in the answers given to fertility studies, in the high incidence of abortion, and in the use of existing family planning facilities. Thus, the initial opposition to family planning on the basis that this would mean inducing people to do something they did not want to do is not warranted anymore. Parents want small families and need to have available the necessary services to reach their ideals.

5. There has been a great deal of discussion about the benefits of population control for the individual and for society as a whole but no agreement has been reached as yet on the quantification of these benefits. This is due to the lack of a comprehensive framework explaining the inter-relations of population and development variables.<sup>2/</sup> If it is difficult

---

<sup>1/</sup> A sample of the official government positions is presented in: The Population Council "Government Policy Statements on Population: An Inventory". Reports on Population/Family Planning. The Population Council, N.Y., February 1970.

<sup>2/</sup> Many articles have been written on this subject. For a review of the literature see Robinson, Warren C. and Horlacher, David E. "Population Growth and Economic Welfare". Reports on Population/Family Planning. The Population Council, N.Y., February 1971.

to measure the exact benefits of population control one reason is that it is equally difficult to assess the results of a particular family planning program.<sup>1/</sup> In order to evaluate a family planning program it is necessary to know the objectives of the program, its achievements and costs, and the way it compares with other family planning programs.

6. The principal problems for the evaluation of a family planning program are the lack of a clear and easily applied methodology, and the lack of data. This paper tries to present a simple way to measure the achievements of a family planning program through the use of the data obtained in the program. The method here presented is not a new method of evaluation, but rather a different presentation of methods already in existence, a presentation which makes it easy for the administrator of family planning programs to estimate the achievements of his program, in terms of births averted, and how that program compares with other programs. The following sections will explain the difficulties of measuring achievements, and set out the proposed methodology. An appendix will present an example of the practical application of this evaluation.

#### Objectives of Family Planning Programs

7. Different governments and institutions spell out the objectives of their family planning programs in different ways. While some put as a final objective the achievement of economic development, others set their eyes on the protection of the health of women and children. Some programs aim to reduce abortion and in the same vein some want to protect the private

---

<sup>1/</sup> For a review of the literature on evaluation see: Reynolds, Jack. "Family Planning Program Evaluation, Status, Problems, Prospects". Paper presented at the annual meeting of the Population Association of America, Washington, D.C., April 23, 1971.

right of women or of families to decide on the number of children they may have.

8. The difference in the final objectives clearly determine the way in which family planning should be provided. It is clear that for some it is convenient to advertise and promote the use, even with payment of rewards for the practice of birth control. Other objectives imply that the program should only give information and provide the means for family planning, without in any way trying to convince people to practice contraception. In these circumstances, the evaluation of the achievement of a program has to take into consideration the planned objective.

9. In most programs the immediate objective of family planning is the reduction in the number of potential births,<sup>1/</sup> but this is not always true of programs whose objective is only to satisfy the desires of the women or families with respect to family size. In practice, it can be said that all effective programs will tend to reduce the number of births and, eventually, to a reduction of the rate of growth of population to a rate lower than the potential given by the fecundity and mortality conditions of the society. The problem of evaluation reduces then to the calculation of the number of births a given program averts during a specified period of time.

#### Potential Fertility

10. The number of births in a given place and time is determined by various factors which can be classified as demographic, biological and cultural.<sup>2/</sup> The principal biological variable is fecundity. Different

---

<sup>1/</sup> Potter, Robert G., Jr. "Estimating Births Averted in a Family Planning Program." Paper presented at the annual meeting of the Population Association of America, Washington, D.C., April 23, 1971.

<sup>2/</sup> A good source for the understanding of the factors affecting fertility can be found in United Nations, Department of Social Affairs, The Determinants and Consequences of Population Trends. United Nations N.Y., 1963

groups of people can have different levels of fecundity, which is expressed as the maximum number of children they can have in the absence of birth control.<sup>1/</sup> Fecundity is a function of age and as such changes with it between more or less well defined intervals. It is null before menarche and after menopause, and changes with age between those two limits. After a pregnancy there is a period of infecundity which depends on the outcome of the pregnancy. After an abortion the period of infecundity is about one month. It is longer after a live birth, depending upon such factors as to whether the woman breast-feeds her newborn child or not, and for how long.<sup>2/</sup>

11. Cultural variables are here understood to include economic, social and psychological factors, and their effect is to make fertility lower than fecundity and this is achieved by some form of conscious birth control. Negative attitudes of society towards extramarital intercourse or remarriage of widows, levels of income and social position, and changing values, seem to have been, historically, the principal determinants producing a fertility lower than that possible given the fecundity of the population.<sup>3/</sup>

12. Among the demographic factors affecting fertility, the most important are the age structure of the female population, the mortality of that population, and the average age at marriage and its duration. The age structure of the female population determines the proportion of that population which is in the childbearing age groups and, more particularly, in the high

---

<sup>1/</sup> Espenshade, Thomas J. "A New Method for Estimating the Level of Natural Fertility in Population Practicing Birth Control", Demography, Vol. 8, No. 4, Nov. 1971, pp. 525-536.

<sup>2/</sup> Ryder, Norman B. "Fertility" in Philip M. Hauser and Otis Dudley Duncan, The Study of Population: An Inventory and Appraisal. Chicago, Ill., The University of Chicago Press, 1959, pp. 400-436.

<sup>3/</sup> United Nations, Department of Social Affairs. The Determinants and Consequences of Population Trends. United Nations, N.Y., 1953.

fecundity age groups. The higher that proportion, the higher the number of possible births, and vice versa. The age at marriage, especially for women, is very important as a determinant of fertility because in most societies marriage is a license for motherhood, and the longer women delay marriage the fewer children they can have biologically.

13. The length of marriage is also important for fertility because if marriages on the average last longer, families are more stable and have more time to have children. Where divorce and separation become frequent, the time for bearing children, even when remarriage is accepted by society, is shortened. High mortality implies that fewer women survive to the child-bearing ages and that less time is spent in those ages by the society as a whole, so that fewer children are born per woman in a society than in a society with somewhat lower mortality. Also, high mortality reduces the duration of marital unions.

14. It can thus be concluded that, given its demographic characteristics, a society has a potential number of children to be born, and that this potential can be affected by cultural conditions which reduce the number of actual births below the potential. Once the members of a society decide to reduce their actual fertility, family planning can help to accomplish that desire by providing the means of birth control. On the other hand, family planning programs can also, by influencing the values of society, create the desire for lower fertility, and then provide the means for the fulfillment of that desire. The immediate effect of family planning programs, therefore, can be measured in terms of the number of births averted as a result of the program; that number is equal to the difference between the expected number of births that a society would have in the absence of a program, and the actual number of births which that society has once the program has been started.<sup>1/</sup>

---

<sup>1/</sup> Shultz, T. Paul, "Effectiveness of Family Planning in Taiwan: A Methodology for Program Evaluation". Nov. 1969 (mimeo).

Problems of Evaluation

15. In order to facilitate the discussion it is necessary to distinguish between three possible totals of births that can occur to a society: (1) a potential number of births when nobody in the society practices birth control, which will be referred to as the natural fertility; (2) an expected number of births that will take place in the absence of the specific program being evaluated. (Some women can be practicing birth control by alternative means); (3) the actual number of births that would occur if the specific program were in existence. In this case some women will practice birth control because of the program and some because of other conditions of the society.

16. On this basis there are two possible approaches to the calculation of the number of births averted by the program: (1) to estimate the difference between the expected number of births that would happen if the program were not in existence and the actual number of births that will happen once the program is in existence: (2) estimate the number of women who will practice birth control as a consequence of the program and apply to them their natural fertility rate to give the number of births that would have occurred in the absence of the program.

17. The first approach implies knowledge of the births which would take place with and without the program. It is clear that both quantities cannot be obtained from a registration system because if the program does not exist it is impossible to know the number of births that would occur in its absence and if the program exists it is impossible to know how many births would have occurred if it had not existed.

18. The usual approach in this case is to assume that a given number of women will practice birth control in the absence of the program which

would avert a given number of births; then those births are deducted from the total number of births averted in order to know how many births were averted by the program. The estimation of the number of women who would have practiced birth control in the absence of the program is converted into the basic problem.

19. The present knowledge of the interrelationships between socio-economic variables and fertility is not good enough to make it possible to quantify the changes in the number of women practicing birth control as a result of changes in those variables in such a way that the part remaining can be easily identified with particular family planning programs. Attempts to solve this problem have been based on comparisons between two regions with the same basic cultural backgrounds and characteristics. In one there is a family planning program and in the other there is no program and the two regions are isolated from each other's influence. Assuming parallel development in the two regions, changes in the number of birth control users in the region without the program are assumed to be due to reasons not having anything to do with a family planning program. Changes in the number practicing birth control occurring in the region with the program are assumed to be due to all kinds of reasons, including the program. The differences in the changes in number of users between the two regions can then be assigned to the program.<sup>1/</sup> The difficulty with this approach is that it is not easy to find regions that are similar, both in background and development, to the region with the program. Secondly, even if similar regions are found, the necessary data is not always available or reliable, especially in under-developed countries.

---

<sup>1/</sup> Ozbay, Ferhunde and Shorter, Frederick C. "Turkey: Changes in Birth Control Practices, 1963 to 1968". Studies in Family Planning. The Population Council, N.Y., March 1970.

20. To solve some of these problems, it is possible to use sample surveys in an effort to elicit information as to how the birth control practices of the respondents have changed during a given period of time, why these changes have taken place, and what has been the influence of the program on them. This system usually entails the problem of necessary repetitive interview sessions which by themselves can affect the behavior of the respondents.<sup>1/</sup>

21. The direct estimation of the number of births averted by a program, on the other hand, assumes knowledge of the number and characteristics of the persons who were induced by the program to practice birth control and who would not have done so if the program had not existed.<sup>2/</sup> It is not sufficient to assume that the women receiving the services from the program are the ones who have been affected solely by that program. It is possible that some women who would have practiced contraception in the absence of the program find now that it is advantageous to use the services of that program because those services are less expensive or better. Other women who would not have practiced birth control if the program were not in existence, but who do so because of the program, may find that it is better for them not to use the services of the program. Sample surveys, therefore, are also necessary with this approach. The objective of those surveys will be to ascertain which women are affected by the program and in which ways.

22. If sample surveys can be made which investigate the practice of birth control, the reasons for it and the determining factor in beginning

---

<sup>1/</sup> Stycos, J. Mayone, and Marden, Parker G. "Honduras: Fertility and an Evaluation of Family Planning Programs". Studies in Family Planning. The Population Council, N.Y., Sept. 1970.

<sup>2/</sup> Chow, L.P., Change, M.C., and Liu, T.H. "Taiwan: Demographic Impact of an IUD Program". Studies in Family Planning. The Population Council N.Y., Sept. 1969.

its practice, the way is open to apply any of the two approaches discussed. The first approach requires still more information, basically on the total number of children born. If a complete system of vital statistics does not exist and if censuses or enumerations have not been taken that give a clear indication on the number of births per year, it will not be possible to use that approach. The second approach on the other hand, requires only the knowledge of the proportion of users of the services given by the program who are practicing because of the existence of the specific program, and the persons not using program services who were influenced by the existence of the program. This, coupled with knowledge of the natural fertility of the population, is enough to render an estimate of the number of births averted by the given program.

23. Many developing countries lack reliable vital registration systems or complete censuses and enumerations of the population which make it impossible to apply the first approach, but because the services provided by a specific family planning program make it easy to keep records of the users of those services, it is easier to rely on the second approach in the evaluation of those services.

24. Due to these circumstances, methods of comparison of results have been developed using statistics of the services provided. One such method, developed by Wishik, measures "Couple Years of Protection"; it starts by assuming that the effects of the program are only those effects related directly to the services.<sup>1/</sup> Spillover effects are not taken into account. The important feature is to determine the amount of time that the woman is protected against the risk of pregnancy. "One Couple Year Protection" means that a woman has been protected for an entire year, or that the protection given to several women adds up to one year.

<sup>1/</sup> Wishik, Samuel M. "Indexes for Measurement of Amount of Contraceptive Practice", Paper presented at a meeting of Expert Group on Assessment of Acceptance and Use-Effectiveness of Family Planning Methods, UNECAFE, Bangkok, Thailand, June 1968.

25. The objective of that method is to present in a figure the effect of the program, but as the protection given to the different couples is not weighted according to their particular characteristics of age, parity, fertility, etc., this method is necessarily incomplete. The method can give an idea of the amount of services rendered but not of their effects. The other problem with this method is that one year of protection given to a couple is assumed to be as effective as one day of protection given to 365 couples with the same characteristics which is clearly not true.

#### Service Statistics

26. A family planning program is usually able to collect some information on its clients. Such information is usually medical, often demographic, and sometimes of an economic or social character. Age, marital status and parity are easy data to collect. Also, when the program charges a fee for services which vary according to family income, patients may have to declare their family incomes, as well as place of residence and, perhaps, occupation of the household members.<sup>1/</sup> These data permit the classification of patients according to different characteristics in different moments of time and thus, if a continuous record is kept for each patient who ever entered the program, the number of births averted may be estimated. But some or most patients come to the program, receive some services and never come back to it because they do not need the services to continue their practice of birth control or because they have decided not to practice it any more or because they move to private doctors.

27. This means that some of the patients are lost and with them the data on the achievements of the program related to them. Since this is a real threat to the evaluation system more follow-up processes have to be

---

<sup>1/</sup> Ross, John A., Walter B. Watson, and Robert J. Lapham. Handbook for Service Statistics in Family Planning Programs. Third edition. The Population Council, N.Y., 1971.

devised in the program, by which some of that information can be obtained. This can take the form of sample surveys of the patients dropping out, or simply a periodic visit to all of them for as long as they remain in the childbearing ages or practice birth control.

28. The other problem with service statistics is that they do not measure the potential fertility of the women receiving the services. This problem is not too bad if the natural fertility of the general population is known according to different characteristics. The fertility of the general population can then be applied to the program, weighted according to the characteristics of acceptors, making some allowance for the fact that these women are in the program, and because of that some of them would possibly practice some kind of birth control even if the particular program did not exist.

## II. Methodology

29. The process for estimating births averted described below makes use of service statistics and assumes that the total effects of the program come only from the services provided by the program. This assumption implies that the women practicing birth control and using the services of the program are all practicing birth control because of the program. The data needed are the number of users of family planning in the program classified according to age, parity, desired family size and socio-economic characteristics, the proportion of the women in the program who would have practiced birth control if the program had not existed and according to the characteristics mentioned above and the natural marital age specific fertility rate. If the program is going to be evaluated according to sub-divisions then the data will have to be presented according to those sub-divisions. Usually one of the sub-divisions is the method in use so the data should be given classified by method. In general data on the number of users at a given moment of time is not available and data

exists only on the number of acceptors by period of acceptance. In order to obtain an estimate of the number of users it is necessary to have also continuation rates. Continuation rates can vary according to age of the woman, method in use, parity and other variables. If data on actual users is not available, the number of acceptors with their continuation rates, for each cohort of women should be available.

30. The first step in the process of evaluation is to determine, following Wishik, the number of user-months that a group of women, with a given set of characteristics, live during the period of evaluation. If the evaluation is made month by month, the easiest way will be to obtain the number of women at the beginning and at the end of the month of evaluation, to add those two numbers and divide by two. This process assumes that the dropping out of women and the recruitment of new women are uniformly distributed during the month or that the number is the same at each moment of time in the month in question. The result of this operation is in reality an estimate of the average number of Couple Months Protection given by the program during the month of evaluation.

31. The second step is to determine the number of births averted. This is done by multiplying the number of user-months already obtained by the respective current monthly specific fertility of women nine months older. When this is done for all possible groups of women in the program, the result is a table giving births averted according to each set of characteristics. The total number of births averted is just the sum of the births averted by the women in all possible groups. This number of births averted should be multiplied by a factor of effectiveness according to the contraceptive method in use. If correction is not made, the assumption is that the methods are one hundred per cent effective.

32. Each month of the program has then an estimate of births averted nine months later. Adding up the results for several months gives results for longer periods as desired. This process is in essence very simple and can be carried out very easily on a desk-calculator, or if necessary, by hand. Some adjustments are necessary according to the methods of birth control in use by the program, according to the clients, and according to the information available. These difficulties will be discussed in the following sections.

#### Birth Control Methods

33. The above methodology applies basically to all contraceptive methods used by females (IUD, Pill, Diaphragm, Jellies, etc.) but not to abortion or, to contraceptives used by males. The problems of these birth control methods will now be discussed and recommendations made so that the treatment for each method is compatible with the general methodology.

34. Abortion: Abortion is obviously not a contraceptive technique because, when practiced, it implies that conception has already taken place. Abortions are usually made in the second or third month of pregnancy and thus the birth averted would have occurred six or seven months after the abortion. Besides this, because of the abortion, the woman is subject to an additional risk of pregnancy which would not have existed if the woman had permitted the pregnancy to continue to full term. This is of course a negative achievement of any program and has to be accounted for as such.

35. If it is assumed that an abortion is made, on the average, at the end of the second month of pregnancy, and that the anovulatory period after abortion is one month, while pregnancies carried to term take nine months on average and that the anovulatory period after giving birth is four months, it follows that a woman having an abortion will have ten more

months of conception risk than if she had not had the abortion. Those ten months go from month two to month eleven after the abortion. These are negative months of protection, somewhat reduced by the risk of death, infecundity or non-exposure by the aborting woman.

36. The positive protection given by the abortion can be estimated in the following way. A woman with given characteristics who is two months pregnant will give birth to one child seven months later if she does not have an abortion, or if a stillbirth does not occur. Since there are spontaneous abortions and stillbirths, as well as multiple births, the number of births per woman two months pregnant is on the average less than one, or equal to one minus a wastage proportion "w".

37. If it is assumed that there is no wastage in the first two months of pregnancy, it can be said that in order to prevent a number of births (1-w) it is necessary to provide a number of Couple Months Protection (CMP) to a group of women, with specific fertility  $f_i$ , nine months before. This implies that dividing (1-w) by the specific fertility  $f_i$ , gives the number of Couple Months Protection needed to avert the number of births (1-w), i.e., the number of months of protection given to a woman who has an abortion.

38. Thus, when an abortion is performed, the immediate protection in months is given by  $CMP = \frac{1-w}{f_i}$ ; the month after the abortion is performed the amount of protection will be zero and from month two to eleven after the abortion the amount of protection given will be very close to minus (1-a) Couple Months Protection, where "a" represents the percentage of women dropping out because of death, infecundity or non-exposure. This fraction will vary with age of the woman and other characteristics.

39. In order to facilitate the calculations, it is advisable to algebraically add the two effects in the month in which the abortion takes place so that the only thing that has to be done is to multiply the number of

abortions by the expression  $\frac{1-w}{f_i} - (1-a)$  in order to obtain the number of Couple Months Protection. Then, to find the number of births averted seven months later, the number of Couple Months Protection is multiplied by the respective specific fertility rate ( $f_i$ ) of women seven months older.

40. Male Contraception: When the program provides contraceptive services for males, the effect is to protect the woman who lives with the man receiving the services. In this case all the calculations refer to characteristics of those women and not to the characteristics of the male. If, because of death of the woman, divorce or separation, the male patients change partners, the calculations should refer to the new woman receiving the indirect services and not to the old partners who are supposedly unprotected after the divorce or separation, or who are not important anymore for the program, because of death.

#### Continuation Rates

41. Because of the nature of the services provided it is often not possible to identify the women in the program at all times. Persons who have sterilizations may never come back to the program after the operation. Women who get an IUD may return only when they lose it or once a year for a medical check-up. Women who are using contraceptives which require monthly supplies may decide that it is more convenient for them to buy the supplies in a nearby drugstore instead of getting them from the program. Problems like this usually mean that it is not possible to keep a continuous record of the number of women who are protected by the program.

42. This problem is often overcome with sample surveys in which the proportion of women who joined the program and who continue to use the protection from the program is studied. These studies usually provide

information on the proportion continuing for different periods according to various characteristics of the woman, normally known as continuation rates.

43. When continuation rates are available the number of women being protected by the program at a certain moment of time can be estimated as a function of the women starting the program or continuing in it. Those continuation rates supply the information on the number of women in the program at different times and according to different characteristics; they also take account of the effectiveness of the contraceptive so that no correction for this factor is necessary at the end. Until now studies have concentrated on continuation rates for the use of the IUD and the pill, but not for other types of contraceptives.<sup>1/</sup>

44. The algebraic function most commonly used to exemplify continuation rates is  $R=ae^{-rt}$ , where "R" means proportion continuing in the program "t" periods after starting and assuming that the rate of decay or dropping out is "r" per period, when the proportion (1-a) drops out immediately after starting use.<sup>2/</sup> Other types of functions can be used as long as they give a good representation of the way in which program users abandon the program.

45. With the function  $R=ae^{-rt}$ , (assuming that new acceptors come at mid-month,) those continuers at the end of the month of acceptance will be equal to  $A_1ae^{-.5r}$ , where  $A_1$  represents the number of acceptors. The continuers at the end of the second month will be equal to  $A_1ae^{-1.5r}$ . Those continuing at the end of each successive month after the second

---

1/ See for example, Chen, F.L., M.C. Chang, T.H. Sun, and George P. Cernada. "Taiwan: First Island-Wide Pill Acceptor Follow-up Survey", Studies in Family Planning. The Population Council, Dec. 1970.

2/ See: Taylor, Howard C. and Bernard Berelson. "Comprehensive Family Planning Based on Maternal/Child Health Services: A feasibility Study for a World Program". Studies in Family Planning. The Population Council, N.Y., Feb. 1971. Specially the Appendix prepared by Dorothy Nortman.

will equal the continuers at the end of the previous month multiplied by  $e^{-r}$ .

46. It follows that the amount of Couple Months Protection in each month can be obtained by integrating the function. During the first month the protection is equal to  $A_1 \frac{a}{r} (1 - e^{-.5r})$  Couple Months. The amount of protection provided during the second month is equal to  $A_1 \frac{a}{r} e^{-.5r}(1 - e^{-r})$  Couple Months. The protection from the third month on for each month is then equal to the amount of protection given the previous month multiplied by  $e^{-r}$ .

47. In conclusion, the amount of protection for a given month is equal to the amount of protection given the month before to persons who have been in the program for two or more months multiplied by  $e^{-r}$ , plus the number of acceptors the month before multiplied by  $\frac{a}{r} e^{-.5r}(1 - e^{-r})$ , plus the acceptors in the given month multiplied by  $\frac{a}{r} (1 - e^{-.5r})$ .

48. A similar type of function is that in which the number of acceptors continuing in the program is equal to  $A_1(1-r)^t$ . If acceptors in a month are equal to  $A_1$ , the number of survivors at the end of the first month will be equal to  $A_1(1-r)^{.5}$  if it is assumed that they come at mid-month. The survivors at the end of the second month will equal  $A_1(1-r)^{1.5}$  and after  $n$  months the survivors will be equal to  $A_1(1-r)^{n-.5}$ .

49. The amount of protection per acceptor given in the first month will be equal to  $\left[ (1-r)^{.5-1} \right] / \log_e(1-r)$  Couple Months. The protection in the second month per acceptor in the first month, will be equal to  $\left[ (1-r)^{.5}(-r) \right] / \log_e(1-r)$  Couple Months. The protection in the third month per acceptor will be equal to the protection given in the second month multiplied by  $(1-r)$ . The protection per acceptor in month  $n$  will be equal to  $\left[ (1-r)^{n-1.5}(1-r) \right] / \log_e(1-r)$ .

50. In a given month the amount of protection given to all acceptors will be equal to the amount of protection given during the month before to persons with two or more months in the program multiplied by  $(1-r)$ , plus the number of persons entering the program the month before multiplied by  $\left[ \frac{(1-r)^5(-r)}{\log_e(1-r)} \right]$ , plus the acceptors in the present month multiplied by  $\left[ \frac{(1-r)^5-1}{\log_e(1-r)} \right]$ .

51. These formulations seem complicated but they are in reality very simple and can be simplified still more by approximating the protection and making it equal to the arithmetic mean of the survivors at the start of the month and the survivors at the end of the month. Introducing a variation into the second type of function to take account for immediate rejection it can be assumed that the first month the survivors decrease by the full  $r$  proportion. With these two variations the amount of protection in the second type function would become for any month equal to the amount of protection given the month before times  $(1-r)$  plus the acceptors the month before and in the present month times  $(1-r)/2$ . This is a good approximation and very easy to follow in practice.

52. An example can clarify the situation. Let us assume that during the first five months of the program the acceptors with a given set of characteristics were 500, 700, 1,000, 950, 1,200. Let us also assume that the first type of function takes the form  $R = .95e^{-.02t}$  and that  $r$  for the second formulation is equal to .02. The following table shows the protection in Couple Months given each month for all persons in the program.

COUPLE MONTHS PROTECTION

Month	$R=ae^{-rt}$		$R=(1-r)^t$		$R=(1-r)^t$ but with average persons in program, and decay of r the first month	
1		236.33	247.52	247.52	245	245
2	465.60 <u>330.86</u>	796.46	490.10 <u>346.53</u>	836.63	240.1 <u>588</u>	828.1
3	456.38 651.83 <u>478.63</u>	1,580.86	480.30 686.14 <u>495.05</u>	1,661.49	811.54 <u>833</u>	1,644.54
4	1,086.27 931.19 <u>449.02</u>	2,466.48	1,143.11 980.20 <u>470.30</u>	2,593.61	1,611.65 <u>955.5</u>	2,567.15
5	1,977.51 884.63 <u>567.18</u>	3,429.32	2,080.84 931.19 <u>594.06</u>	3,606.09	2,515.81 <u>1,053.5</u>	3,569.31
Total		8,506.45		8,945.34		8,854.10

53. The differences in the results are due basically to the assumption about immediate rejection. The first formulation assumes .05 immediate rejection, the last formulation assumes about 1 percent immediate rejection and the second formulation assumes no immediate rejection. Which formulation to use and which assumptions to make depend on which formulation fits the known results better and what is the taste of the user. Proper adjustments to the functions would produce similar results.

54. The most important thing to notice is that the rate of decay is a function of the characteristics of the women in the program and thus a different value of  $r$  should be used for each different cohort of women, where a cohort is defined as a group of women with a set of common characteristics. When this is done the final result will be the number of Couple Months Protection given to each cohort of women.

Fertility of the Users

55. Once the number of Couple Months of Protection has been determined for each cohort of women in the program, be it by a system of record-keeping or by the use of continuation rates on the number of acceptors, the next step is the assignment of the specific fertility rate corresponding to each cohort in order to determine the number of births averted by the program.

56. This is a difficult problem and one that does not have any clear solution. If the women in the program would not have practiced birth control in the absence of the program, the solution would be to give them the biological fertility corresponding to each age group. If, on the other hand, all of them would have practiced effective birth control in the absence of this specific program, they should be assigned a fertility equal to zero and in this case the effect of the program would be nil.

57. The answer seems to lie between those two extremes and depend on the characteristics of the users. The best approach seems to be to give to each woman the fertility of the general population with the same characteristics, in the year of evaluation. If the group of women in the general population with a given set of characteristics "z" would not have practiced birth control each woman would have had, on the average, the biological fertility. Practicing birth control they have only x percent of that biological maximum. It seems proper to assume that if the program had not existed, the women currently in the program would have had a fertility equal to x percent of the biological maximum for that particular group, and that is the fertility averted by the services of the program.

58. This is what makes it particularly important to classify the women in the program and the women in the general population by as many characteristics as possible. The more characteristics of classification the easier it will be to compare a woman with corresponding women in the general population and the easier it will be to assign them the corresponding fertility.

59. Since the more detailed is the classification the more costly it becomes and the more difficult it is to handle the data, a compromise on a given level of classification has to be reached at that point in which the marginal cost of evaluation and the marginal benefits of that evaluation are equal. In any case a minimum set of characteristics seem to be needed for a useful evaluation. They are: the age of the users, their parity, and the number of children desired.

### III. Additional Factors to be Considered

60. There are some additional points that have not been considered above and which are necessary to keep in mind when the evaluation is made. The first point is related to age. It is necessary to remember that the age of the woman in the month for which the protection is given is equal to the age of the woman when she entered the program plus the number of months she has stayed in the program. Furthermore, the age of the woman at the time the birth is averted will be, on the average, equal to the age of the woman in the month of protection plus nine months, or seven months if it is an abortion; the age-specific fertility rate to be used should be the one corresponding to the age of the woman at the moment the birth is averted.

61. A second point to remember is that the specific fertility rates referred to above are specific fertility rates per month and not per year as they are usually presented. To obtain those rates the annual specific

fertility rates have to be divided by twelve. An alternative is to divide the number of couple months protection by twelve to obtain Couple Years of Protection and then use the normal annual specific fertility rates.

62. When the evaluation is considering methods, as it should, a change in method implies for the purposes of evaluation, that the woman dropped out of one method and is a new acceptor to the other. This, of course, produces a bias in favor of the second method because the protection given during its use is in part due to the fact that the woman had adopted the first one, but precise treatment of this subject would introduce added complications and would not produce great advantages.

63. A further point to be considered is the moment of time in which the woman starts receiving protection from the program. It was said above that a woman has a period of infecundity while she is pregnant or for a period following the end of pregnancy which depends on the outcome of the pregnancy. Some family planning programs make special efforts to recruit women who have just had an abortion or given birth because these women seem to be more receptive to the idea of family planning. In this circumstance some women accept and start using a contraceptive method while they are still infecund. For purposes of evaluation the women should be considered effective new acceptors in the month in which on average they regain their fecundity and not in the month in which they start using the method.

#### Program Costs

64. The principal problem in the evaluation of costs is that of discrimination between capital costs and current costs of a program. If capital costs are accounted as current costs in the period they occur, the effect will be to inflate the costs of the program for that period and to deflate

that cost in subsequent periods. If, on the other hand, current costs are treated as capital costs, the total cost for the period in which these costs are incurred is deflated, and the cost in subsequent periods is inflated. So a correct separation of costs is necessary in order to have a clear vision of the march of the program. As in any organization the basic problem here is that of how to account for amortization or depreciation of capital costs. The solutions are not precise in any case but accepted accounting practices must be adopted in this respect.

65. A second problem with cost accounting is the assignment of costs to subprograms. A subprogram is defined here as a division of the main program in terms of geographical areas or in terms of contraceptive methods in use. How should the program account, for example, for visits made by social workers or doctors to women who do not adopt any method? How should expenses be accounted for when a woman has a general examination, adopts a contraceptive method and then changes to another? How should the time of doctors, nurses, etc., be allocated amongst different contraceptive methods? Better yet, how should advertising expenses be allocated among methods or areas?

66. There are some fairly clear accounting conventions and alternatives that must be studied carefully. The end result of these analyses should be to determine, as exactly as possible, what is the cost of each birth averted according to method used, the age of the mother, and to time of the woman in the program. This is also important for the payment of incentives where incentives are considered necessary.

### Maximization of Objective Functions

67. The problem of evaluation, for the purposes of this paper, is focussed on the important objective of maximizing the number of births averted when a budget has been determined, or of minimizing the cost of the program when the objective is given.

68. The director of a program should first be able to determine what are the different method-mixes necessary to obtain a given number of births averted, and consequently different amounts of births averted. He should also be able to determine the unit costs for each contraceptive and consequently the best ways of expending a given budget.

69. Knowledge of unit costs and of possible method-mixes would allow the program to concentrate its efforts in a given method-mix which maximizes the product with a given budget or minimizes the costs with a given objective number of births averted. Furthermore, he would then be able to adjust to situations in which the unit costs of one contraceptive change relative to the others, or when the desires of the community change the possible method-mixes. This maximization problem can be applied by methods, as explained above, or can be applied by geographical subregions or any other kind of sub-divisions that are needed.

### Data Needs for Evaluation

70. In review it can be said that the evaluation will be better the more and better data is available on the characteristics of the general population and the users of the services of the program, but the recommended requirements are:

1. The fertility of the population classified by age, marital status, parity and desired family size. The family income, education,

and places of residence and origin are helpful but not absolutely necessary for a basic evaluation.

2. The number of users of the services of the program per period of evaluation classified in the same form as (1).
3. In the absence of (2) it is necessary to have the number of acceptors in the program classified by the same characteristics as in (1), and their corresponding continuation rates.
4. A system of cost accounting that divides costs according to sub-programs such as centers, methods and characteristics of the users.

#### Limitations of the Method

71. The method of evaluation discussed in this paper is by no means a new method, but is rather a different presentation for working purposes of the methods proposed by other researchers. The limitations in the method are given by the availability and quality of the data. For different cohorts of women there is a basic characteristic that distinguishes the user from the non-user of family planning, and additional characteristics that distinguish the user of the program services from the users of other programs or of private services. Until these differentiating characteristics are identified it is not possible to expect an exact solution to the problem of evaluation. As such the method will give better results the more characteristics are used to identify the users and the non-users of the program services. The advantage of this presentation is to make the method simple and workable as to get an approximate idea of the true benefits of a program.

APPENDIX

AN EXAMPLE OF EVALUATION: THE CASE OF TUNISIA

A-1           The family planning program of Tunisia has been chosen as an example for evaluation both because the World Bank has a special interest in that program and because the data presents problems which permit a better explanation of the methodology. The program in Tunisia started in 1964 and there are statistics of the services rendered until December 1970. The data available is presented in Tables 1 to 7. Those tables show the number of IUD insertions and reinsertions, the number of new pill acceptors and pill users, the number of condom and jelly users. The number of abortions performed and the number of tubal ligations. It also presents the number of persons visiting the program looking for services; this number is divided between new patients and old patients. All this information is classified according to the month and year in which the service was given.

A-2           The same information is also given by geographical division of the country but this example will only be concerned with the total national program. The method, in any case, will apply in the same form to each subprogram as for the entire program.

A-3           The evaluation will be done according to method and month. Age distributions of acceptors are not available so assumptions have to be made in order to take age into consideration, at least in an indirect way. The final results will be in terms of births averted, classified by month, method used, and by age when that is possible. Amount of Couple Months of Protection will be presented as an intermediate result.

COUPLE MONTHS OF PROTECTION

IUD Users

A-4 In order to estimate couple months protection given by the IUD to its users it was assumed that 2.5 percent of users at the beginning of a given month would drop out for any reason during that month. It was also assumed that new IUD users would start at the middle of the month and that 2.5 percent would not be in the program at the end of the month of insertion. These assumptions were based on a study published in Studies in Family Planning in April 1967, which fit a function of the type  $R=ae^{-rt}$  to Tunisian IUD users and determined values of  $a=.952$ , and  $r=.242$  per year. The assumptions are not exact but conform approximately with the found decaying pattern. Re-insertions were considered as first insertions.<sup>1/</sup>

A-5 In this circumstance the number of months protection each month were calculated by taking the number of months protection provided the month before and multiplying by 0.975, plus the number of acceptors during the month before and the month of evaluation multiplied by  $(1-r)/2=.4875$ .

A-6 Since there was no age distribution of users but it was known that the average age of new acceptors in 1966 was 33 years four months, it was assumed that this average age had been constant since 1964 and so the survivors of a new group of users would be 35 years on the average, one year and eight months after starting in the program, and obviously would enter the age group 40-44 after 6 years and eight months in the program.<sup>2/</sup> This last age movement is not important because the evaluation period only covers

---

1/ Maulding, W. Parker, Dorothy Nortman and Frederick F. Stephan. "Retention of IUD's: An International Comparison" in Studies in Family Planning, The Population Council, N.Y., April 1967.

2/ Ministère de la Santé Publique - Direction de la P.M.I. et du Planning Familial: Statistiques des Activités du Programme de Planning Familial 1964-1970. (mimeo 1971).

6 years and six months so nobody, on the average, would enter the age group 40-44 before the end of the evaluation period. The program, having started in July 1964, starts to have two age cohorts in February 1966.

Pill, Condom and Jelly Users

A-7 Special treatment had to be given to the users of pills, condoms and jellies because it was not known how many new users there were each month. (In the particular case of pills there was information but it was not reliable). The number of pill users in a given month should be equal to the number of users the month before, plus the new acceptors minus the ones dropping out during the month. The maximum number in a given month would then be equal to the users the month before, plus the new acceptors; but this is not consistent with the statistics, in which sometimes the maximum number is higher than it can possibly be.

A-8 As with the information for pills, the users of condoms and jellies vary in number from month to month without any logical explanation. The reason for this seems to be that what is counted as users each month are not really the actual number of users but the number of persons who received supplies during that month. So, it is possible for some users to receive more than one month's supply during the visit, then they do not have to come back for supplies the following month so the number of presumptive users drop to go up again when the users come back for more supplies. There is also the possibility that in some cases the women or men buy their own supplies outside of the program. A further explanation applicable to users of condoms and jellies but not to pill users, is that the supplies provided can be used in less than a month or more than a month, so the person supposedly comes back only when his or her supplies are almost finished, no matter how long it has been since the last visit.

A-9 In order to use the information it was assumed that the data given as users were really users and that when they dropped out they would not come back to the program. They were also considered to be users for the whole month in which they are reported so the number of couple months protection were considered to be equal to the number of users reported.

A-10 As there was no information on the age of the women using any of these three methods they were assumed to be on the average aged 30-34 all the time.

#### Tubal Ligation

A-11 The case of tubal ligation was treated in similar fashion to the IUD case. The number of couple months protection given each month was equal to the number of months protection given the month before to women having ligations two or more months before multiplied by  $(1-r)$ , plus the number of tubal ligations made the month before and in the month of evaluation multiplied by  $(1-r)/2$ . The rate of decay was considered to be of 2 per thousand per month, assuming that this would cover death of the woman, termination of the union or infecundity.

A-12 Women having tubal ligations each month were assumed to be 35 years old in average on the basis of information that puts that average age in 34.9 years.<sup>1/</sup> This implies that five years after the women have tubal ligations they will enter the age group 40-44. As the first tubal ligations were performed in July 1964, the first women reaching age 40-44 in the average did so in July 1969 and since then there appeared two cohorts of women - one aged 35-39 and one aged 40-44 in average.

#### Abortion

A-13 In the case of abortion it was assumed that 97 percent of second

---

<sup>1/</sup> Ibid.

month pregnancies would have terminated in a live birth seven months later. It was also assumed that there was no foetal mortality in the first two months of pregnancy. This of course implies that foetal mortality is equal to 30.927 per thousand live births caused by spontaneous abortions or stillbirths. Furthermore, it was also assumed that after abortion women would die at the rate of 2 per thousand a month or that the number of months lived by each woman in the average between month two after the abortion and month eleven after abortion was 9.89.

A-14 The women having abortions were assumed to be aged 30-34 years at the time of the abortion. The age-specific fertility per month for these women was assumed to be equal to the age-specific fertility of the Tunisian female population or 0.024775 children per woman per month. The number of couple months protection needed to prevent a birth seven months later was then given by dividing .97 by .024775 which is equal to 39.15 months; from this, the negative protection given by the program for each abortion from month two to month eleven after abortion or 9.89 was deducted. The result was a net protection of 29.26 couple months protection for each abortion. Notice that the real protection in the month of abortion is 39.15 months, the 9.89 months of negative protection are really distributed from month two to month eleven after abortion. The bias resulting of this does not affect the total achievement of the program; it only shifts the negative effect back on average of 6.5 months and this tends to be compensated by the abortions made each month.

#### NUMBER OF BIRTHS AVERTED

A-15 To obtain an estimate of the number of births averted it was assumed that the family planners in the program had the same fertility as the total Tunisian female population. Since some of the women are not exposed to the risk of pregnancy, the potential fertility of the women practicing contraception is higher than the potential fertility of the total

female population, but because it is considered that some of the women in the program would have practiced some form of birth control even if the program had not existed it is believed that the adoption of the age specific fertility of the total population is approximately correct.

A-16 The fertility per thousand women of the general female population of Tunisia in 1965 was distributed in the following form.<sup>1/</sup>

AGE SPECIFIC FERTILITY (ASF)  
Births per Thousand Women in Respective Age Groups

Age	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
ASF								
Per Year	88.4	279.2	333.3	297.3	224.8	104.8	30.3	10.9
Per Month	7.367	23.267	27.775	24.775	18.775	8.733	2.525	0.908

A-17 As the users of pill, condom, jellies, all women having abortions, and some of the IUD users were considered to be on the average in the age groups 30-34, the corresponding age-specific fertility was applied to them. Some of the women using IUDs and some of the women with tubal ligations were 35-39 years of age so they received the age-specific fertility rate per month for that age group. Finally, some of the women with tubal ligations were assigned the age-specific fertility rate corresponding to age group 40-44 as they had been assumed to be in that age group.

A-18 The number of couple months protection were multiplied by the corresponding specific fertility rates and the births averted so obtained were assigned to the program nine months later except in the case of abortion

<sup>1/</sup> Marcoux, Alain, "La Croissance de la Population de la Tunisie. Passé Récent et Perspectives" Population. Special Number, March 1971, pp. 105-123.

where the averting of the birth was assumed to be seven months later.

### Results

A-19 Tables 8-11 show how the calculations had to be carried out in order to make the evaluation month by month. The first three months of 1970 were selected to show the process because those months had two age groups using IUD's and tubal ligations and so it was easy to show how the women moved from one age group to the next. The 581 women using IUD's who passed from age group 30-34 to age group 35-39 in December 1969, were the survivors in the program of the women who had accepted IUD's 20 months before. Initially it was assumed that the average age of IUD acceptors was 33 years and 4 months which means that 20 months later they had to be 35 years of age on the average.

A-20 Results are presented month by month, according to method for the number of couple months of protection and the number of births averted only for the year 1965, in order to illustrate the form of presentation. When there are age distributions each method should present the age distributions. The amount of couple months protection provided by the program in 1965 appears in table 12. While the number of births averted per month in 1965 is shown in table 13.

A-21 The cumulated results of the program are shown in tables 14 and 15. The first of these tables show the couple months of protection given by the program since its inception until December 1970, by year and according to the birth control method used. Table 15, on the other hand, shows the number of birth averted by the program from the beginning until 1971, by year and according to birth control method used. From this table it can be seen that the Tunisian family planning program has averted about 51,000

births since its inception until September 1971. In 1966 the number of births averted was about 4,030. In 1970 that number had gone up to 12,135 for an increase of about 200 percent. The number of births averted in 1971 is only 9,773 because it only covers part of the year, including services rendered by the program only until December 1970. This implies that the protection given in 1971 can be expected to go up to about the same number of births averted as in 1970.

A-22 The rate of growth in number of births averted was about 62 percent from 1966 to 1967, it then went down to about 22 percent from 1967 to 1968; rose again between 1968 and 1969 to reach 32 percent; from 1969 to 1970 it went down to 16 percent, and the prospects for the period 1970-1971 are that the rate of growth will be very low or null.

A-23 The number of births projected for Tunisia in 1970 was 198,000. The number of births averted by the program for that year was about 12,000 which means an aversion rate of about 6 percent a year.<sup>1/</sup>

A-24 It is necessary to point out again that the estimates made here depend on the assumptions made so any change in the assumptions will mean a change in the results. The important thing is that these results are consistent with results of other studies. Vallin has estimated the number of births averted in Tunisia as 6,500 in 1967, 8,800 in 1968, 10,800 in 1969 and 13,600 in 1970. Rounding to hundreds, the estimates here obtained are 6,500 for 1967, 7,900 for 1968, 10,400 for 1969 and 12,100 for 1970.<sup>2/</sup>

---

<sup>1/</sup> See Marcoux, op. cit., p. 123.

<sup>2/</sup> Vallin, Jacques. "Limitation des Naissances en Tunisie. Efforts et Résultats". Population. Special Number, March 1971, pp. 181-204. Note that Vallin uses an assumed age distribution which takes into consideration all age groups and a legitimate age-specific fertility schedule, somewhat higher than the one used in this paper. That specific fertility rate is equivalent to assign a fertility rate of .313 annually to all women while in this paper the maximum fertility used has been .297.

A-25 Table 16 shows the relative contribution of each birth control method to the total number of couple months protection given by the program. Table 17 shows the relative importance of each method in the total number of births averted. By far the most important method in Tunisia is the IUD which contributes about two thirds of the births averted. Abortion and tubal ligations only contribute 24 percent of the total number of births averted. Condoms and jellies are relatively unimportant.

A-26 Improvement of the results can be obtained with better data. The principal problems with the data on Tunisia are the lack of age distributions of birth control users, the lack of better records on the number of actual users each month and the lack of cost accounting that permits identification of expenses and division of those expenses among methods.

A-27 The evaluation made here has not taken explicitly into consideration the effectiveness of each birth control method. The way to do this is by multiplying the final results on births averted by the effectiveness rate. The results, assuming effectiveness of 95 percent, would clearly be 95 percent of the results presented.

A-28 Of greater importance for the evaluation is the fact that lack of knowledge of the age distribution of users requires that average ages be assumed which can cause a bias in the results if they are not correct. In the cases of IUD and tubal ligation, the assumption implies that all acceptors, regardless of age or parity, drop out at the same rate, which is not realistic.

A-29 In conclusion it can be said that the quality of the results of this evaluation is a function of the quality and quantity of data and that better results can only be obtained if the data is substantially improved.

TABLE 1

Family Planning Activities by Method  
Tunisia - 1964

Months	IUD first insertions	IUD re-insertions	Pill Acceptors	Pill Users	Condom users	Jelly Users	Tubal Ligations	Abortions	New consultations	Total consultations
January										
February										
March										
April										
May										
June	11						12		379	379
July	103						33		808	1,136
August	147						20		1,394	2,250
September	167						31		953	2,279
October	106						29		982	1,919
November	258			18			133		752	2,252
December	362			33			35		892	2,405
Total	1,154			25*			293		6,160	12,620

\* Monthly average.

Source: Ministère de la Santé Publique, Direction de la P.M.I. et du Planning Familial, Service des Statistiques, Recherche et Evaluation. Statistiques des Activités des Programmes au Planning Familial - 1964-1970 (Mimeograph 1971)

TABLE 2

Family Planning Activities by Method  
Tunisia - 1965

Months	IUD first insertions	IUD re-insertions	Pill Acceptors	Pill users	Condom users	Jelly users	Tubal Ligations	Abortions	New consultations	Total consultations
January	426		5	47	366	214	21		651	1,782
February	664		16	100	463	265	25		957	2,214
March	2,086	3	27	131	543	300	52		2,529	3,904
April	1,506		34	123	511	206	25		1,798	3,549
May	1,907		64	136	580	247	10		2,250	4,484
June	1,553		15	119	556	218	36		1,859	4,361
July	1,015	8	28	171	621	168	24	4	1,266	3,564
August	643	7	10	194	485	164	20	6	819	2,913
September	629	6	14	111	537	169	29	19	841	2,781
October	739	10	53	178	565	143	45	98	1,085	3,077
November	1,055	7	43	202	674	238	40	123	1,614	3,680
December	609	9	34	205	553	167	57	92	1,003	3,233
Total	12,832	50	343	143*	538*	208*	384	342	16,672	39,542

\* Monthly average.

Source: Ministère de la Santé Publique, Direction de la P.M.I. et du Planning Familial, Service des Statistiques, Recherche et Evaluation. Statistiques des Activités des Programme au Planning Familial - 1964-1970 (Mimeograph 1971)

TABLE 3

Family Planning Activities by Method  
Tunisia - 1966

Months	IUD first insertions	IUD re-insertions	Pill Acceptors	Pill users	Condom users	Jelly users	Tubal Ligations	Abortions	New consultations	Total consultations
January	342	4	22	192	342	124	49	93	627	2,073
February	1,317	6	35	279	356	301	89	219	1,773	4,190
March	1,169	20	36	223	700	154	84	141	1,600	4,046
April	1,182	18	45	255	707	141	90	145	1,658	4,325
May	1,205	31	52	254	512	165	109	192	1,690	4,344
June	1,276	47	43	295	464	132	78	155	1,632	4,238
July	1,468	34	37	193	407	92	62	109	1,758	3,645
August	1,112	29	27	159	361	91	37	102	1,344	2,726
September	650	25	15	135	341	306	43	92	1,104	2,590
October	870	30	13	162	240	107	36	83	1,094	2,908
November	914	33	13	164	334	99	49	90	1,155	3,604
December	572	33	12	185	312	83	40	65	741	2,828
Total	12,077	310	350	208*	423*	150*	766	1,396	16,176	41,417

\* Monthly average.

Source: Ministère de la Santé Publique, Direction de la P.M.I. et du Planning Familial, Service des Statistiques, Recherche et Evaluation. Statistiques des Activités des Programmes au Planning Familial - 1964-1970 (Mimeograph 1971)

TABLE 4

Family Planning Activities by Method  
Tunisia - 1967

Months	IUD first insertions	IUD re-insertions	Pill Acceptors	Pill users	Condom users	Jelly users	Tabal Ligations	Abortions	New consultations	Total consultations
January	734	25	11	144	297	90	51	74	949	3,103
February	1,168	37	24	173	369	78	44	61	1,406	4,016
March	1,156	34	27	164	447	73	68	108	1,459	4,200
April	1,115	39	28	149	439	91	88	135	1,465	4,376
May	1,018	58	39	177	440	102	80	165	1,412	4,552
June	504	40	18	71	448	75	61	131	822	2,794
July	630	47	21	155	383	103	73	133	978	2,985
August	522	28	73	199	435	102	60	126	887	2,682
September	576	21	75	270	351	55	63	140	924	2,854
October	937	46	99	351	472	90	90	139	1,410	4,028
November	956	34	104	423	440	108	47	70	1,325	4,124
December	341	20	72	409	306	54	17	49	563	1,821
Total	9,657	429	591	290*	402*	85*	742	1,331	13,600	41,535

\* Monthly average.

Source: Ministère de la Santé Publique, Direction de la P.M.I. et du Planning Familial, Service des Statistiques, Recherche et Evaluation. Statistiques des Activités des Programme au Planning Familial - 1964-1970 (Mimeograph 1971)

TABLE 5

Family Planning Activities by Method  
Tunisia - 1968

Months	IUD first insertions	IUD re-insertions	Pill Acceptors	Pill users	Condom users	Jelly users	Tubal ligations	Abortions	New consultations	Total consultations
January	836	29	145	601	475	115	77	115	1,030	3,622
February	1,076	76	180	636	700	150	121	113	1,349	4,503
March	768	34	255	841	602	208	66	117	1,176	4,110
April	919	45	342	1,153	586	267	136	165	1,906	5,382
May	963	62	326	1,334	800	221	161	223	1,806	5,663
June	745	40	273	1,493	1,093	277	160	222	1,729	5,545
July	782	32	447	2,034	912	234	172	271	1,740	5,713
August	733	25	524	2,257	920	176	125	202	1,668	5,435
September	574	27	473	2,463	1,075	129	128	219	1,732	6,126
October	767	48	618	2,864	1,400	225	184	206	2,370	7,744
November	713	30	621	2,792	1,459	170	197	227	2,225	7,824
December	428	27	476	2,884	1,295	147	100	166	1,701	6,319
Total	9,304	475	4,780	1,779*	943*	193*	1,627	2,246	20,432	67,986

\* Monthly average.

Source: Ministère de la Santé Publique, Direction de la P.M.I. et du Planning Familial, Service des Statistiques, Recherche et Evaluation. Statistiques des Activités des Programme au Planning Familial - 1964-1970 (Mimeograph 1971)

TABLE 6

Family Planning Activities by Method  
Tunisia - 1969

Months	IUD first insertions	IUD re-insertions	Pill Acceptors	Pill users	Condom users	Jelly users	Tubal Ligations	Abortions	New consultations	Total consultations
January	963	59	869	3,750	1,657	266	256	213	3,969	11,372
February	676	51	671	3,346	1,238	167	179	208	2,390	8,780
March	920	48	681	3,799	1,591	305	284	283	3,128	10,923
April	1,016	33	736	4,215	1,652	364	278	248	3,009	11,300
May	990	65	619	4,088	1,440	324	279	295	2,981	11,402
June	834	50	699	4,312	1,654	283	245	275	2,736	10,859
July	741	40	526	4,315	1,385	321	167	236	2,248	10,700
August	492	25	404	3,882	1,601	264	99	251	1,889	9,585
September	565	26	730	4,164	1,601	255	150	221	2,222	10,489
October	512	30	611	4,584	1,384	302	241	258	2,111	10,434
November	518	30	603	4,790	1,608	328	164	210	2,137	10,823
December	469	51	718	4,928	1,882	253	171	162	2,537	11,033
Total	8,696	508	7,867	4,181*	1,558*	286*	2,513	2,860	31,357	127,700

\* Monthly average.

Source: Ministère de la Santé Publique, Direction de la P.M.I. et du Planning Familial, Service des Statistiques, Recherche et Evaluation. Statistiques des Activités des Programme au Planning Familial - 1964-1970. (Mimeograph 1971)

TABLE 7

Family Planning Activities by Method  
Tunisia - 1970

Months	IUD first insertions	IUD re-insertions	Pill Acceptors	Pill users	Condom users	Jelly users	Tabal Ligations	Abortions	New consultations	Total consultations
January	924	56	786	5,300	2,152	306	292	228	2,971	13,848
February	1,016	46	871	5,505	1,901	288	202	219	3,141	13,824
March	1,110	74	913	6,315	2,285	380	344	259	3,600	16,050
April	1,064	60	892	6,437	2,293	410	150	204	3,281	15,804
May	999	61	885	6,661	2,471	416	265	258	3,408	17,340
June	792	40	862	6,528	2,393	374	174	251	2,984	16,425
July	625	40	661	6,354	2,291	432	143	237	2,646	15,883
August	521	36	609	5,898	2,044	276	140	211	2,157	13,913
September	601	48	601	6,024	2,233	284	176	242	2,374	14,443
October	683	48	925	6,621	2,233	342	216	216	2,990	15,851
November	417	37	899	6,429	2,219	220	132	163	2,385	13,555
December	886	72	1,055	7,342	2,520	353	305	217	3,425	17,483
Total	9,638	618	9,959	6,285*	2,254*	340*	2,539	2,705	35,362	184,419

\* Monthly Average.

Source: Ministère de la Santé Publique, Direction de la P.M.I. et du Planning Familial, Service des Statistiques, Recherche et Evaluation. Statistiques des Activités des Programme au Planning Familial - 1964-1970 (Mimeograph 1971)

TABLE 8

Estimates of Number of Couple Months Protection given by the Tunisian Family Planning Program in First Quarter of 1970 and Number of Births Averted by that Protection. IUD

	November		December		January		February		March	
	30-34	35-39	30-34	35-39	30-34	35-39	30-34	35-39	30-34	35-39
1. Couple Months Protection given month before			6,165	6,929	12,147	13,969	11,990	14,205	12,154	14,381
2. New Acceptors by month	12,647 <sup>a/</sup>	14,214 <sup>c/</sup>	520		980		1,062		1,184	
3. Users passing from one age to another during month <sup>a/</sup>			- 581	581	- 618	618	- 473	473	- 491	491
4. Line 2 plus line 3.	12,647	14,214	- 61	581	362	618	589	473	693	491
5. In line 4 add last two months by age group	12,647	14,214	12,586	14,795	301	1,199	951	1,091	1,282	964
6. Line 5, multiplied by 0.975 (continuation rate)			6,011	6,756	11,843	13,620	11,690	13,849	11,850	14,021
7. Line 5, multiplied by 0.4875 (continuation rate)/2	6,165	6,929	6,136	7,213	147	585	464	532	625	470
8. Couple Months Protection (line 6, plus line 7) <sup>b/</sup>	6,165	6,929	12,147	13,969	11,990	14,205	12,154	14,381	12,475	14,491
9. Age specific fertility rate per month per 10,000 women					247.75	187.33	247.75	187.33	247.75	187.33
10. Month in which births are being averted					October		November		December	
11. Number of births averted (line 8, multiplied by line 9)/10,000					297	266	301	269	309	271

<sup>a/</sup> Persons getting older have to be deducted from the age group they were in before and added to the new group.

<sup>b/</sup> The function in use to estimate couple months protection is  $CMP_t = CMP_{t-1} (1-r) + (A_t + A_{t-1}) (1-r/2)$  where  $CMP$  = couple months protection,  $r$  is monthly rate of drop-out, and  $t$  = month of evaluation,  $t-1$  = month before month of evaluation and  $A$  = new acceptors.

<sup>c/</sup> These figures have been made up so that the estimation process can start here and yield the real results with the real figures in 1970. This was done only for the illustration here presented. Results appearing in other tables were made by evaluating month by month since the beginning of the program.

TABLE 9

Estimates of Number of Couple Months Protection  
given by the Tunisian Family Planning Program in January,  
1970, and numbers of Births Averted by the Protection in  
October 1970  
Pill, Condoms and Jellies

	Pill	Condom	Jelly
1. Users of Method during the Month	5,300	2,152	306
2. Couple Months of Protection <sup>a/</sup>	5,300	2,152	306
3. Age Specific Fertility Rate per Month per 10,000 Women	247.75	247.75	247.75
4. Number of Births Averted in October 1970	131	53	8

<sup>a/</sup> It has been assumed that the number of users for the month is correct as reported and that a user, uses the method and is protected by it during the entire month.

TABLE 10

Estimates of Number of Couple Months Protection given by the Tunisian Family  
Planning Program in first Quarter of 1970 and Number of Births Averted by that Protection  
Women Having Tubal Ligation

	1969		1970		1970		1970	
	December 25-29	40-44	January 35-39	40-44	February 35-39	40-44	March 35-39	40-44
. Couple Months Protection given month before			5,728 <sup>c</sup> /	243 <sup>c</sup> /	5,923	268	6,137	287
. New Acceptors by month	171		292		202		344	
. Users passing from one age to another during month <sup>a</sup> /	- 31	31	- 19	19	- 22	22	- 46	46
. Line 2, plus line 3	140	31	273	19	180	22	298	46
. In line 4 add last two months			413	50	453	41	478	68
. Line 1 multiplied by 0.99 (continuation rate)			5,717	243	5,911	267	6,125	286
. Line 5, multiplied by 0.499 (continuation rate/2)			206	25	226	20	239	34
. Couple Months Protection (line 6, plus line 7) <sup>b</sup> /			5,923	268	6,137	287	6,364	320
. Age-specific fertility rate per month per 10,000 women								
0. Month in which births are being averted			October		November		December	
1. Number of births averted (1 in 8, multiplied by 1 in 9)/10,000			111	2	115	3	119	3

/ Persons getting older have to be deducted from age group in which they were and added to the new group.

/ The function in use to estimate Couple Months Protection is  $CMP_t = CMP_{t-1} (1-r) + (A_t + A_{t-1}) (1-r/2)$  where  $CMP$  = Couple Months Protection,  $r$  is monthly rate of drop-out, and  $t$  = month of evaluation,  $t-1$  = month before month of evaluation and  $A$  = new acceptors.

/ These figures are the real figures for December and are the product of the evaluation since the beginning of the program. It is possible to make figures up for November which would fit the results for December, as was done with the registration for IUD method, but it was decided against because the objective here is not to show the beginning of the program but the way to work any month, assuming the month before has already been evaluated.

TABLE 11

Estimates of Couple Months Protection given by the Tunisian Family Planning Program in first quarter of 1970, and Number of Births Averted by the Practice of Abortion

	January	February	March
1. Number of Abortions Practiced	228	219	259
2. Couple Months Protection per Abortion <sup>a/</sup>	29.26	29.26	29.26
3. Number of Couple Months of Protection	6,671	6,408	7,578
4. Age-Specific fertility rate per month, per 10,000 women aged (20-34)	247.75	247.75	247.75
5. Month in which births are averted	August	September	October
6. Number of births averted	165	159	188

a/ This multiplier is equal to  $\frac{1-w}{f_1} - (1-a)$  where  $w$  is spontaneous wastage between conception and birth assumed equal to 30 per thousand;  $f_1$  is the age specific fertility rate for women 30-34, taken as .024775; and  $(1-a)$  is the number of women-months lived by women who had an abortion between month two and month eleven after the abortion.

Table 12: TUNISIA: COUPLE OF MONTHS' PROTECTION GIVEN BY THE FAMILY  
PLANNING PROGRAM IN 1965 ACCORDING TO METHOD

	IUD	Pill	Condom	Jelly	Tubal Ligation	Abortion	Total
January	1,217	47	366	214	301		2,145
February	1,718	100	463	265	324		2,870
March	3,017	131	543	300	362		4,353
April	4,694	123	511	206	399		5,933
May	6,240	136	580	247	416		7,619
June	7,771	119	556	218	438		9,102
July	8,833	171	621	168	467	117	10,377
August	9,427	194	485	164	488	176	10,934
September	9,818	111	537	169	512	556	11,703
October	10,247	178	565	143	547	2,867	14,547
November	10,874	202	674	238	589	3,599	16,176
December	11,421	205	553	167	636	2,692	15,674
Total	85,277	1,717	6,454	2,499	5,479	10,007	111,433

Table 13: TUNISIA: NUMBER OF BIRTHS AVERTED BY THE FAMILY PLANNING PROGRAM IN 1965 ACCORDING TO METHOD

	IUD	Pill	Condom	Jelly	Tubal Ligation	Abortion	Total
January							
February							
March							
April	2				1		3
May	3				1		4
June	7				2		9
July	10				2		12
August	14	1			4		19
September	21	1			5		27
October	30	1	9	3	6		49
November	43	2	11	7	6		69
December	75	3	13	7	7		105
Total	205	8	33	17	34		297

Table 14 : TUNISIA: COUPLE MONTHS PROTECTION GIVEN BY THE PROGRAM  
ACCORDING TO METHOD AND YEAR

	IUD	Pill	Condom	Jelly	Tubal Ligation	Abortion	Total
1964	2,278	51	-	-	744	-	3,073
1965	85,277	1,717	6,454	2,499	5,479	10,007	111,433
1966	188,848	2,496	5,076	1,795	13,050	40,847	252,112
1967	256,309	2,685	4,827	1,021	21,229	38,945	325,016
1968	290,056	21,352	11,317	2,319	33,794	65,718	424,556
1969	312,873	50,173	18,693	3,432	59,632	83,683	528,486
1970	329,973	75,414	27,035	4,081	87,659	79,147	603,309
Total	1,465,614	153,888	73,402	15,147	221,587	318,347	2,247,985

Table 15 : TUNISIA: BIRTHS AVERTED ACCORDING TO METHOD AND YEAR

	IUD	Pill	Condom	Jelly	Tubal Ligation	Abortion	Total
1965	205	8	33	17	34	-	297
1966	2,878	53	160	56	128	755	4,030
1967	5,120	56	119	35	284	898	6,512
1968	6,102	107	138	32	442	1,103	7,924
1969	6,526	747	349	65	734	2,000	10,421
1970	6,889	1,396	510	88	1,237	2,015	12,135
1971	5,394	1,443	512	76	1,234	1,114	9,773
<b>Total</b>	<b>33,114</b>	<b>3,810</b>	<b>1,821</b>	<b>369</b>	<b>4,093</b>	<b>7,885</b>	<b>51,092</b>

Table 17: TUNISIA: RELATIVE CONTRIBUTION BY EACH METHOD TO THE NUMBER OF BIRTHS AVERTED

	IUD	Pill	Condom	Jelly	Tubal Ligation	Abortion	Total
1965	.69	.03	.11	.06	.11	-	1.00
1966	.72	.01	.04	.01	.03	.19	1.00
1967	.79	.01	.02	.00	.04	.14	1.00
1968	.77	.01	.02	.00	.06	.14	1.00
1969	.63	.07	.03	.01	.07	.19	1.00
1970	.57	.11	.04	.01	.10	.17	1.00
1971	.55	.15	.05	.01	.13	.11	1.00
Total	.65	.07	.04	.01	.08	.15	1.00

Table 16 : TUNISIA: RELATIVE CONTRIBUTION OF EACH METHOD TO THE TOTAL PROTECTION

	IUD	Pill	Condom	Jelly	Tubal Ligation	Abortion	Total
1964	.74	.02	-	-	.24	-	1.00
1965	.76	.02	.06	.02	.05	.09	1.00
1966	.75	.01	.02	.01	.05	.16	1.00
1967	.79	.01	.01	.00	.07	.12	1.00
1968	.68	.05	.03	.01	.08	.15	1.00
1969	.59	.09	.04	.01	.11	.16	1.00
1970	.55	.12	.04	.01	.15	.13	1.00
Total	.65	.07	.03	.01	.10	.14	1.00