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No. 31

REPORT OF THE MULTINATIONAL STUDY IN METHODOLOGIES FOR SETTING FAMILY PLANNING TARGETS IN THE ESCAP REGION

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC



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BANGKOK, 1976



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PREFACE

1. In the ESCAP region, most of the national family planning programmes have been assigned demographic goals in terms of specific amounts of reduction in crude birth rates or population growth rates. These programmes have also set targets of the number of acceptors of different family planning methods to be recruited in order to achieve these demographic goals. The predetermined targets are generally used as a criterion in monitoring the past and current progress of the family planning programmes and as a mechanism for making appropriate adjustments.

2. Since the mid-1960s, several countries have attempted to set acceptance targets compatible with their long-term demographic goals. In keeping with this development, ESCAP first commissioned research work on the measurement of the impact of contraception which was undertaken by Professor Robert G. Potter,[1] a consultant from Brown University. In this research, three computer programmes (PROJ5, ABREV1, ABREV2) were developed to measure the impact of contraception on birth and growth rates.

3. In order to extend the benefits of these developments to the countries of the region, ESCAP undertook, in collaboration with Brown University, a "Multinational study in methodologies for setting family planning targets", in which eight countries of the region participated, namely, India, Indonesia, Malaysia, Pakistan, the Philippines, the Republic of Korea, Singapore and Thailand. The main objectives of the study were to estimate the long-term demographic impact of existing family planning acceptance targets; and the additional number of acceptors annually by method required to reach the predetermined demographic goals in case the existing targets fall short of the goal. Another objective, perhaps equally as important as the other two, is the transfer of computerized target-setting technology to the evaluation personnel in the participating countries.

4. In order to explain the ETSS (ESCAP Target-Setting System) methodology and report the results of computer analysis of data provided by the participating countries, ESCAP organized the Study Directors' Meeting at Bangkok from 24 to 30 September 1975. This report summarizes the results of the meeting as well as the study project. Part One of the report presents the summary of the proceedings of the Study Directors' Meeting. This part will be of interest to family planning administrators as it provides general information on the ETSS methodology and the main points raised by the national Study Directors and their recommendations in the use of this methodology. Part Two contains three of the background papers prepared by experts before and after the meeting. These technical papers not only set the theoretical context of the ETSS methodology but also explain the computer programming procedures used for this study project. Part Three presents a list of comprehensive materials and guidelines to those who are interested in using the ETSS computer programme for target-setting for national family planning programmes.

5. It is hoped that this monograph will be useful to policy-makers, administrators and researchers in, as well as outside, the ESCAP region, especially to those who are actually involved in improving and refining the target-setting practice for their respective national family planning programmes.

6. This project was financed by UNFPA. ESCAP is indebted to Professor Robert G. Potter of Brown University, who, supported in part by the Ford Foundation and the Population Council, provided technical assistance to the project, and to Mrs. Sharon Kirmeyer, also of Brown University for her skilled programming efforts. The Population Council also assisted by providing technical consultation for the project.

1/ *Some Techniques for Measuring the Impact of Contraception*, Asian Population Studies Series No. 18, 1974.

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Part One
Report of the Study Directors' Meeting

I. ORGANIZATION

1. The Study Directors' Meeting for the Multinational Study in Methodologies for Setting Family Planning Targets in the ESCAP Region was held at Bangkok from 24 to 30 September 1975. The session was organized by the Population Division of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) as a part of its methodologies study project, with financial assistance from the United Nations Fund for Population Activities (UNFPA).

A. BACKGROUND AND PURPOSE

2. By 1974, most of the developing countries in the ESCAP region had formulated their demographic goals in terms of specified reductions in crude birth rates or population growth rates, as a part of their developmental strategies. In order to achieve the demographic goals, these countries had organized national programmes of family planning, and in most instances had set target numbers of acceptors of different family planning methods to be recruited in each case.

3. The demographic goals had been usually formulated by economic planners, and synchronized with economic development goals. The operational feasibility of achieving those goals had not been the major consideration. In most instances, the full achievement of family planning targets specified by the countries had not needed to be consistent with the demographic goals. There was a gap between what was desired in terms of crude birth rates or population growth rates, and what was likely to result from the achievement of the family planning programmes. There was an imminent need to study systematically the relationship between acceptor targets and the stipulated demographic goals.

4. ESCAP had therefore undertaken the Multinational Study in Methodologies for Setting Family Planning Targets in collaboration with eight countries in the region, namely India, Indonesia, Malaysia, Pakistan, the Philippines, the Republic of Korea, Singapore and Thailand.

5. The Target-Setting Project had begun with the collection of data from the participating countries, and with comparison of the relative merits of several target-setting methodologies being developed independently, including the computer models (PROJ5) previously developed by Professor Robert G. Potter of Brown University, United States, through an ESCAP project funded by UNFPA.

6. In the course of the study, it had been observed that a computer model labelled TABRAP, developed by Dorothy Nortman and John Bongaarts of the Population Council, served the purposes of the study well by helping to determine annual numbers of contraceptive acceptors required to realize a specified reduction in either the crude birth rate or the crude rate of natural increase.

7. Further modification of TABRAP had resulted in another major computer programme, entitled CONVERSE, which had helped in determining the degree of reduction in birth rate or growth rate that might be expected from established acceptor targets.

8. As a result, the two computer programmes had formed the main body of methodology developed in the Target-Setting Project, which had also included seven smaller ancillary programmes. With the creation and refinement of the ESCAP Target-Setting System (ETSS), the methodology had been applied to eight national family planning programmes in the ESCAP region by (a) examining the adequacy of current acceptor targets, and (b) specifying annual acceptor targets that would be required to achieve a specified demographic goal. The current Study Directors' Meeting was convened in order to report the ETSS methodology and the results of computer analysis of data provided by the participating countries.

9. Accordingly, the objectives of the Meeting were: (a) to discuss the methodology developed by the ESCAP secretariat in consultation with Professor Potter for the setting of family planning acceptor targets in countries of the region; (b) to study the computer programmes written for the project; (c) to discuss the basic data requirements for the application of the methodology and possible modifications to the methodology; and (d) to discuss the feasible applications of the methodology in the countries participating in the project, and to identify the types of assistance that could be provided by the secretariat.

B. ATTENDANCE

10. The participants at the Meeting included Study Directors or their alternates from the eight countries participating in the study, two consultants and two contributors who had worked on the computer programmes for the project, and three observers. The list of participants is in annex I.

C. OPENING ADDRESS

11. The Meeting was inaugurated by Mr. Carl M. Frisen, Chief of the Population Division. Mr. Frisen reviewed the background and objectives of the project, which had been undertaken by the Fertility and Family Planning Section of the Division beginning July 1974 with a view to developing a comprehensive and systematic methodology of target-setting. The results would assist the countries of the region in setting or revising family planning targets commensurate with their demographic goals, and in estimating the demographic impact of past, current and anticipated acceptance of contraceptive techniques. Earlier, the Population Division had developed, in collaboration with Professor Potter, a component projection method for estimating the impact of contraception on the fertility levels of the population;[1/] the technique was expected to be usefully modified and expanded to tackle the problem of target-setting.

D. OFFICERS

12. The Meeting was conducted in an informal manner, and no election of officers took place. Mr. Sook Bang, Chief of the Fertility and Family Planning Section, Population Division, served as moderator.

E. DOCUMENTATION

13. Five working papers and three background papers were furnished to the participants, and are listed in annex II.

II. THE ESCAP TARGET-SETTING SYSTEM

A. METHODOLOGY

14. The Meeting recalled that the original objectives of the project had included development of a comprehensive methodology based on the component projection technique; writing computer programmes which would facilitate ease of computation and application to data compiled from the eight participating countries; and provision of any requested assistance in implementing the methodology in the countries. The following sets of tabulations were to have been prepared as a minimum for each country.

(a) Acceptors needed each year to achieve a specified reduction a in the crude birth rate or the population growth rates in T years (also, tables for varying levels of a and T, enabling each country to choose its acceptor targets);

(b) Ratios for "conversion" of one family planning method to another, in terms of demographic effectiveness, which would enable administrators to distribute acceptor targets among various methods;

(c) Projections of future acceptance of family planning methods.

(d) Estimates of births averted per acceptor, specified by age and method in each of a series of years.

15. The Meeting noted the modifications and improvements made in the course of the project, and the further needs for refinement of and addition to the methodology that had become apparent. A major change was the increase in the number of output tables, from the four originally envisaged to more than fifty. The nine computer programmes developed had acquired the collective label ETSS.

16. The data compiled from each of the eight countries had been used as inputs in the various computer programmes for ETSS. The results were analysed and presented in the form of country reports.

17. The Study Directors reviewed their Governments' current systems of target-setting. The most sophisticated methodology used in the setting of family planning targets in any country involved five sequential steps: (a) the path of crude birth rate reduction desired during a five or ten-year period would be specified; (b) from knowledge of the current level of the crude birth rate and of desired future trends in the rate, estimates of the annual numbers of births to be averted would be made under certain assumptions; (c) the estimates of births averted would be translated into couple-years of contraceptive use required during the target period, year by year; (d) based on continuation rates of different methods, the estimates of couple-years of protection needed year by year would be converted into the numbers of acceptors of different family planning methods needed to be recruited; (e) the total national acceptance needed would be distributed as targets among clinics or regions on the basis of population size and various other factors. The meeting noted that the basic steps adopted in the existing target-setting practices were far from uniform from country to country, and that the assumptions made and the number of factors taken into account differed widely from country to country.

1/ *Some techniques for measuring the impact of contraception*, Asian Population Studies Series No. 18, 1974.

18. While some countries would define a specific pattern to be followed by the crude birth rate in future years, most would specify goals in terms of desired levels of the crude birth rate or crude rate of natural increase to be sought at the end of five or ten years. Similarly, some countries would use more detailed information on the age pattern of acceptance, method-mix, etc. in relation to acceptor characteristics than would other countries. The conceptual definitions adopted for the term acceptor also differed widely from country to country. While in some countries the definition of acceptor would denote the number of persons recruited for the first time by the programme (each acceptor being counted only once in life), others would use the concept for only one segment of acceptance of a particular method. In the latter case, a person could become an acceptor many times. In one country the concept of the "notional acceptor", which attempts to take into account the continuation rates of different methods, had been used.

19. The Meeting noted that the general technique adopted in ETSS was that of component projection, wherein a given population with a specified age-sex-marital status distribution was projected year by year in two ways: first, with the age-specific fertility schedules without contraception additional to the level prevailing at the beginning of the target period; and second, on the basis of levels of crude birth rates considered desirable year by year in the future in pursuing the demographic goal. With both the assumptions, the same trend of life expectancy in the future was assumed. The numbers of births to be averted in each year were determined uniquely in that exercise. The number of births to be averted in any one year was subsequently converted to couple-years of contraceptive use. Thereafter, couple-years of use to be achieved were considered in two parts: first, the protection obtained by past acceptors continuing use; and second, the protection from a fresh crop of acceptors recruited in the previous calendar year. The first part of that use could be estimated from previous acceptance and continuation rates (which latter factor took account of mortality and all other reasons for discontinuation). The second part provided the basis to estimate the number of acceptors needed in the year prior to a desired crude birth rate goal.

B. DATA REQUIREMENTS

20. The Meeting also noted that ETSS incorporated a number of programmes to take into account such factors as continuation rates, "conversion" of one contraceptive method to another, and estimates of births averted by different methods. The basic data needed for the application of ETSS computer programmes could be grouped under the three major headings of demographic setting, demographic goal, and programme factors. The full data requirements for each of these categories were detailed in the paper prepared for the Meeting by Professor Potter.

21. The data needed for the application of ETSS were obtained from censuses, vital registration, surveys, and other sources, such as follow-up studies. The reliability of the information available from such sources varied widely from country to country. The Meeting recognized that many of the parameters used in ETSS methodology varied with time, and that there was therefore a need to revise targets periodically on the basis of fresh, basic information and the actual performance of the family planning programme.

C. ETSS PROGRAMMES

22. ETSS computer programmes included two main programmes, namely, TABRAP and CONVERSE, and seven auxiliary ones.

23. TABRAP and CONVERSE were at the core of ETSS. The former estimated the number of acceptors needed year by year to achieve a predetermined crude birth rate decline, and the latter estimated the impact on the birth rate of a given pattern of acceptance.

24. The seven auxiliary programmes served the following special purposes: (a) CONTINUE and (b) CONTINU2 assisting in the estimation of parameters for continuation rates; (c) MORT modifying continuation rates as a function of the joint probability of survival of an acceptor and spouse; (d) MACHO projecting the male population year by year on the basis of a mortality schedule and births obtained from TABRAP and CONVERSE to yield total population vital rates; (e) COMPETE tracing the results of competition among different methods of family planning as reflected in the numbers of users and of births averted over time; (f) TABLE4 providing couple-years of protection and births averted per acceptor of a particular method, as a function of age at acceptance, time since acceptance, and continuation rates; (g) RATIOS giving the ratios of the numbers of births averted of any method of family planning to that of a "standard" method, year by year. Relationships between programmes are shown in Figure 1.

25. The Meeting noted that the programmes were

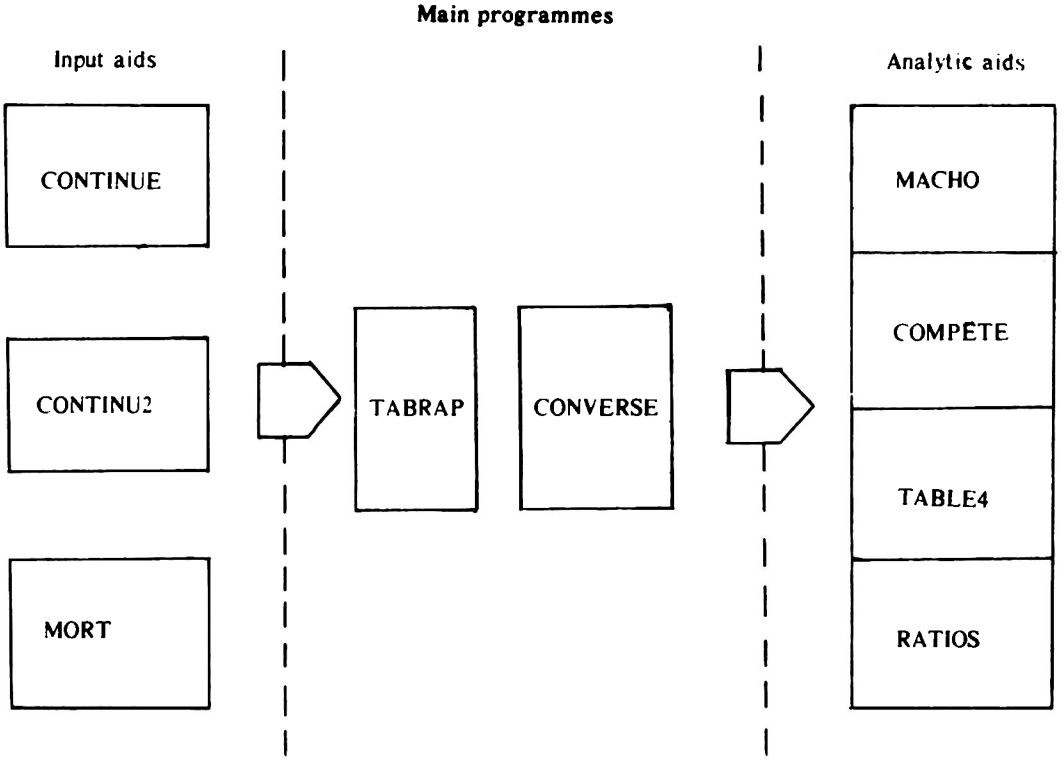


Figure 1. Division of labour

written in FORTRAN IV. When using the technique of overlaying, TABRAP and CONVERSE used less than 20,000 bytes in storage capacity each, while the remaining programmes used less than 15,000 bytes each. It was also noted that central processor unit (CPU) time for TABRAP and CONVERSE was less than one minute for each programme, after subroutines had been compiled. The detailed programmes and programme listings and cards could be supplied by ESCAP. The Population Council was currently discussing the possibility of generating tapes and card sets of the ETSS programmes for ESCAP.

26. It was pointed out to the Meeting that an auxiliary programme to deal with induced abortion had been developed separately, and that it could be supplied to interested parties by the Population Council. The methodological details of that programme were discussed.

III. CONCLUSIONS AND RECOMMENDATIONS

27. The preliminary sets of output tables obtained from the application of ETSS to country situations were discussed in detail by the Meeting. In discussing the advantages and disadvantages of application, a number of points were raised, as described below.

A. USES OF ETSS

1. Wide use of ETSS or a similar system could help promote standardization of target-setting procedures and of data collection for target-setting from country to country in the region.

2. It was necessary in each country to review annually the family planning targets for the subsequent and future years on the basis of actual performance in the past year. This could be done by judicious application of ETSS with appropriate changes in programming.

3. Although all the applications of ETSS to date had been on a national basis, ETSS could be used to allocate targets on a subnational basis as well.

4. ETSS could be used for planning and evaluation of family planning programmes. It could be used to estimate births averted by past programme activities, non-programme acceptance given programme acceptance, continuation rates, etc. Those applications might be of more immediate relevance to those countries where there was no possibility to make an immediate revision of family planning targets, for administrative or other reasons; for others, where periodic revisions of targets were needed, application of ETSS could be of timely value.

5. The methodology developed, especially the CONVERSE programme, could be used in projections of population, taking into account the impact of past contraception and the anticipated future practice of contraception.

6. ETSS could also be used as an aid in estimating the degree of over-reporting in the records system of a family planning programme.

B. LIMITATIONS TO ETSS AS CURRENTLY STRUCTURED

7. It should be possible to incorporate contraceptive use existing at the beginning of a period of ETSS analysis in the TABRAP and CONVERSE programmes in order to serve two functions: (i) to cover contraceptive practice existing at the beginning of a target period, and (ii) to facilitate year-by-year adjustment of targets by accounting for existing users by age, year of acceptance, and method used.

8. The stipulation of fixed proportions of acceptors among different contraceptive methods assumed to hold good during the entire target period, i.e. a constant-method mix, should be relaxed, and provision should be made for changing the method-mix.

9. The current system did not consider abortion as a means of averting births. Whether an induced abortion prevented births would depend on whether the abortion was substituted for any earlier contraception, and whether it was followed by contraception. It was expected that induced abortion would play a crucial role in reducing birth rates during coming years in many countries, so a methodology should be developed for evaluating the impact of abortion and for setting targets for abortion. Similary, menstrual regulation procedures, which were becoming popular in some countries, should be taken into account.

10. As currently structured, ETSS could deal with a maximum of only four contraceptive methods. A general need existed for ETSS to be able simultaneously to deal with any number of methods.

11. The problems of estimation of potential fertility of acceptors were difficult. In most developing countries there had also been some form of contraception through traditional methods in vogue, even prior to the implementation of national family plan-

ning programmes. If ETSS could not take into account such past practices, future acceptance needed to achieve any demographic goal would be incorrectly estimated. Research to estimate potential fertility rates (being fertility rates existent prior to modern contraception) should be undertaken.

12. Lack of good-quality data was one of the major difficulties faced by many countries in planning and evaluation of family planning programmes. There was a need to arrange for systematic collection of data required for ETSS, and to revise the parameters at periodic intervals.

13. Procedures should be developed for conversion of acceptors as defined in ETSS into other types of acceptors as operationally defined in various family planning programmes.

14. It was essential to redefine the concept of continuation rates as applied to such traditional methods as condoms. Couple-years of use should be related directly to contraceptive supplies needed, without going through any assumptions of continuation rates or numbers of acceptors for those methods.

C. FUTURE METHODOLOGICAL NEEDS IN TARGET-SETTING

15. Most emphatically, the issue of the setting of optimal annual targets by method, i.e. the optimal method-mix which would result in maximum demographic impact, should be faced. With the use of appropriate cost data and other data, such a determination of optimality could be incorporated into ETSS, or it could be accomplished separately.

16. Resource allocation in family planning programmes must be included in target-setting exercises to make such exercises fully comprehensive.

D. OTHER SUGGESTIONS

17. The Study Directors unanimously affirmed that ETSS should be utilized in the family planning programmes of their countries. To that end, assistance from ESCAP should be made available.

18. ESCAP should furnish a standardized, target-setting, data-collection questionnaire for family planning programmes in the region, and establish an ongoing programme to assist in routine evaluation of those programmes.

Annex I

LIST OF PARTICIPANTS

Study Directors

K.C. Seal
Ministry of Planning
Delhi, India

Haryono Suyono
National Family Planning Co-ordinating Board
Jakarta, Indonesia

Tan Boon Ann
National Family Planning Board
Kuala Lumpur, Malaysia

Jamila Naeem
Training, Research and Evaluation Centre
Lahore, Pakistan

Kwon Ho-youn
Korean Institute for Family Planning
Seoul, Republic of Korea

Manasvi Unhanand
Department of Medical Sciences
Bangkok, Thailand

Representatives of Study Directors

Margaret Loh
Singapore Family Planning and Population Board
Singapore

Arturo Batenga
Commission on Population
Manila, Philippines

Consultants

Robert G. Potter
Department of Sociology, Brown University
Providence, Rhode Island, United States of America

K. Srinivasan
Population Centre
Bangalore, India

Contributors

Sharon Kirmeyer
Department of Sociology, Brown University

Dorothy Nortman
The Population Council
New York, N.Y., United States of America

Observers

Suwanee Satayapan
National Family Planning Programme
Bangkok, Thailand

Suthon Panyadilok
National Family Planning Programme
Bangkok, Thailand

Peter Way
National Family Planning Co-ordinating Board
Jakarta, Indonesia.

ESCAP secretariat (Population Division)

Carl M. Frisen
Chief

Sook Bang
Chief, Fertility and Family Planning Section

Peter Michael
Research Associate
ESCAP Target-Setting Project

D.V.R. Murty
Regional Population Advisor

Annex II

DOCUMENTS DISTRIBUTED AT THE MEETING

1. "The ESCAP Target-Setting System: Rationale, strengths and weaknesses", prepared by R.G. Potter for the ESCAP secretariat.

2. "The ESCAP Target-Setting System: A computerized component projection approach", prepared by S.W. Kirmeyer for the ESCAP secretariat.

3. "Toward the comprehensive planning of national family planning programmes: A review of the ESCAP Target-Setting Project and complementary developments", prepared for the annual conference of the International Committee on the Management of Population Programmes, Mexico City, July 1975.

4-8. Preliminary reports on the application of the ESCAP Target-Setting System in Malaysia, Pakistan, the Philippines, Singapore, and Thailand.

Part Two

Technical Papers

I. THE ESCAP TARGET-SETTING SYSTEM: RATIONALE, STRENGTHS AND LIMITATIONS *

INTRODUCTION

A number of countries, including several from the ESCAP region, have established quantitative demographic goals: either reductions of the crude birth rate, or growth rates within designated periods. For purposes of monitoring programme efforts toward achievement of these goals, proper targets of contraceptive acceptance must be set. With so many factors intervening between goals and annual contraceptive targets, intuition is overwhelmed and has to be replaced by more formal machinery. The 13 target-setting schemes reviewed by J.A. Ross [1] show great variation in form, sophistication and data utilized.

The underlying plan of the Multinational Study in Methodologies for Setting Family Planning Targets in the ESCAP Region [2] (known as the ESCAP Target-Setting Project) has been to assemble, through the efforts of a Study Director in each of several Asian countries, the data specified in a detailed **pro forma** [3] and thereby be able to administer uniformly a target-setting methodology based on component projection. This data base permits a comparative analysis of targets of eight Asian nations, and at the present time is certainly unique.

At the same time, the ESCAP Target-Setting Project has provided the incentive to extend certain component projection methods originated by D. Nortman and J. Bongaarts.[4] As indicated by P. Michael,[5] these techniques represent an advance over the computer programme PROJ5 presented in a recent ESCAP document [6] relating to an earlier target-setting project of the ESCAP Population Division.

The objectives of the present background paper are to discuss component projection as an approach to target-setting, and more particularly to comment upon a family of computerized analyses, the ESCAP Target-Setting System (ETSS). Computer programming aspects of ETSS are covered in the background paper of S. Kirmeyer.[7]

In the following section, a list of basic factors mediating between demographic goals and contraceptive targets is enumerated. Some of the interactions of these factors are described in the next two sections, as they bear on the reduction of the crude birth rate (CBR) or the crude rate of natural increase, the rationale, scope, and principal limitations of ETSS are subsequently reviewed. Some uses of this system are identified, and finally, the importance is stressed of having the system operational on local computers, if it is to be fully exploited.

Basic factors

Three sets of basic factors have to be considered when bridging demographic goals and contraceptive targets. They are demographic setting, demographic goals, and programme factors.

Demographic setting:

(a) Size of population;

(b) Initial age-sex-marital status distribution;

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*/ Prepared by Robert G. Potter, Brown University, consultant to the study.

1/ John A. Ross, "*Methods for estimating acceptor targets to achieve specified reductions in the birth rate*", in C. Chandrasekaran and A. Hermalin eds., *Measuring the Effect of Family Planning Programmes on Fertility*, (Liege, International Union for the Scientific Study of Population, (IUSSP), forthcoming).

2/ Population Division, ESCAP "*Aide-memoire for the multinational study in methodologies for setting family planning targets in the ESCAP region*" (mimeographed), 1974.

3/ *Ibid.*, "Pro forma for collection of information for the multinational study in methodologies for setting family planning targets in the ESCAP region" (mimeographed), 1974.

4/ Dorothy Nortman and John Bongaarts, "Contraceptive practice required to meet a prescribed crude birth rate target: A proposed macromodel (TABRAP) and hypothetical illustrations", *Demography*, vol. 12, No. 2, (August 1975), pp. 471-490.

5/ Population Division, ESCAP "Toward the comprehensive planning of national family planning programmes: A review of the ESCAP Target-Setting Project and complementary developments", paper prepared for the annual conference of The International Committee on the Management of Population Programmes, Mexico City, July 1975.

6/ *Some Techniques for Measuring the Impact of Contraception*, Asian Population Studies Series No. 18, 1974.

7/ Sharon Kirmeyer, "ESCAP Target-Setting System: A computerized component projection approach", background paper prepared by S.W. Kirmeyer for the ESCAP secretariat, August 1975.

(c) Male and female age schedules of mortality, and changes over the target period;

(d) Age-specific proportions of those married among women of reproductive age, and the trend over the target period;

(e) Age schedule of marital fertility among non-users of programme contraception, and changes over the target period;

Demographic goals:

(f) Length of target period;

(g) Change in CBR (or rate of natural increase) aspired to;

Programme factors:

(h) Continuation and effectiveness of each programme method of contraception offered and the age distribution of the users of each method;

(i) Age of acceptors;

(j) Relative popularity of the different programme contraceptives, in each age class of acceptors;

(k) Potential age-specific fertility of users, had they not accepted programme contraception.

Typically, during the target period, mortality is declining. Age-specific proportions married among women of reproductive age may or may not be declining. If non-programme contraception or induced abortion is on the rise, marital fertility may be declining too; however, if private-sector birth control is not expanding and if there is improved health and a shift away from lengthy nursing practices, for example, marital fertility may actually be rising.

Most demographic goals set an objective for the terminal year of the target period, but without specifying the path of decline during the intervening years. Alternatively, the goal may be expressed as a CBR "path": for example, reducing the CBR by a constant amount annually. In this case, a CBR target for each intervening year as well as the terminal year is implied. ETSS requires that a CBR path, rather than merely a terminal goal, be set. This path can be set so as to yield smooth increases in targets from year to year.

Basic among programme factors is the potential fertility of users of programme contraception. Regarding wives of the same ages chosen at random from the population, programme acceptors tend to have had a more recent birth, and on that account may be expected to have lower rates of secondary sterility. However, their level of potential fertility depends also on what alternative means of fertility control are available outside the programme, and what is the likelihood that they would have used them. Hence, the potential fertility of programme users can be higher or lower than the marital fertility of non-users. Age of programme acceptors and therefore of users is important because potential fertility tends to decline with age, on account of both diminishing fecundity and the increased likelihood that recourse would have been made to alternative means of birth control had programme contraception not been adopted. The procedure used for measuring potential fertility is indicated later.

Contraceptives vary both in their effectiveness of protection against pregnancy and their length of usage. In the case of IUD or pills, of virtually 100 per cent effectiveness, utility depends almost wholly on continuation. Even in the case of conventional contraceptives, less complete in their effectiveness, continuation remains a crucial dimension. No contraceptive offers protection when not in use. Regarding sterilization, both marital dissolution by divorce or death of a spouse, and the female partner passing beyond reproductive age, impose a limit on the period of useful protection by sterilization. More months of useful service are forfeited if the initial months of contraception overlap with post-partum amenorrhea, when a condition of temporary sterility is conferring protection already.

Lowering the crude birth rate

To the extent that child-bearing is confined to marriage, reducing the CBR becomes equivalent to raising the proportion of married women of reproductive age (MWRA) protected from giving birth. Based on data collected in the 1971 edition of Dorothy Nortman's family planning **Factbook.**[8] is the following regression of the CBR on the proportion x of MWRA using contraception (from all sources, private or programme) [9] :

8/ Dorothy Nortman, *Population and Family Planning Programmes: A Factbook*, Reports on Population/Family Planning No. 2 (New York, Population Council, 1972).

9/ Robert G. Potter and S.L.N. Rao, "Future family planning impact: Method and data requirements", *Economic Bulletin for Asia and the Far East*, vol. XXIV, No. 1 (June 1973), p. 77.

$$CBR = 48.0 - 0.49x$$

This relationship is only a crude approximation, as attested by the wide scatter of observations around the regression. Later in this paper it will be idealized to

$$CBR = 50.0 - 0.50x$$

for easier calculation.

What are some of the ways in which the "basic factors" cited above interact to raise or lower the amount of programme contraception needed to attain a given demographic goal? Perhaps the single most important factor is population size. The proportion of a national population which is MWRA varies usually between one seventh and one sixth. The range is fairly narrow. Hence, other factors being equal, a population of 100 million requires something of the order of 100 times the number of acceptors as a population of 1 million.

Typically, the absolute size of the MWRA group is growing during the target period. In the absence of net migration, the rate of growth is governed by the initial age-sex-marital distribution together with the initial level of mortality and its changes, over the target period. The rate of growth of the MWRA group is rapid if, owing to recent rapid population growth, the age distribution for both sexes is steeply sloped, with each successive birth cohort appreciably larger than the previous one. Annual growth rates of MWRA exceeding .025 presuppose a moderate or low initial level of mortality, and may increase during the target period if mortality is continuing to decline. Some illustrative rates of growth of MWRA are given in table 1.

Declines in age-specific proportions of women married operate to slow the growth of the MWRA group and to make its age composition older. Declining proportions married may or may not go a long way to counteract the effects upon MWRA growth of declining mortality.

Lowering the CBR means raising the proportion of women protected in an MWRA group that has been increasing in size. For example, the use of our relationship CBR = 50.0 - 0.5x to lower the CBR from 40.0 to 35.0 calls for raising the proportion of MWRA protected from (50-40)/50 = .20 to (50-35)/50 = .30. Actually, because of adverse changes in the age composition of the population, the necessary rise in proportion of MWRA protected must be larger than this. If the programme has existed n years, with $n < 15$, and has been preventing births for that period, it has thereby diminished the numbers presently aged 0 to n years but has not at all affected numbers of reproductive age 15-44. Hence the population age distribution is pushed toward a "middle heavy" form conducive to a higher CBR than would otherwise be the case. This potentially higher CBR can only be compensated by a higher proportion of MWRA protected. The more successful the programme in the recent past, the larger has been the adverse change of age composition to be expected.

If contraception is being accepted for purposes of family limitation rather than birth spacing, then acceptors may average considerably older than MWRA, and users may average older yet. Accordingly, the users' fecundity, and therefore their potential fertility, may be lower than average, requiring a higher proportion of MWRA protected on that account. However, their original motivation to accept contraception might be the result of a recent birth, assuring a greater likelihood among them of current fecundity than among women of the same age drawn at random from the population. Thus, the selectivity of users toward lower-than-average fecundity among the MWRA group may not be great.

As noted earlier, to lower the CBR means raising the proportion protected in an MWRA group the size of which has been increasing. Unfortunately, the number of new acceptors needed during the target period has to exceed, sometimes by a large margin, the number of additional users needed by the end of the target period. This disproportion is necessary to compensate for the "attritions" of discontinuation, marital dissolution by divorce or death of a spouse, and passing beyond the age of reproduction.

With respect to the demographic objective, obviously a more ambitious goal (e.g. lowering the CBR 20 points instead of 5) proportionately raises acceptance requirements. With the greater realism prevailing today, Governments seldom aspire to more than a 10-point drop in 10 years and usually, and wisely, the goal is held down to an annual drop of 0.5 point or less. The same CBR decline sought in a shorter target period, perhaps five years instead of ten, calls for fewer total acceptors, but higher annual targets. Fewer total acceptors are needed because (a) fewer users are lost to the "attritions" of discontinuation, marital dissolution, and secondary sterility; and (b) MWRA groups have less time in which to grow. However, the higher annual quotas of acceptance demanded by a fixed goal and shorter target period may be hard to achieve.

Table 1. Married women of reproductive age (15-44 years) as a percentage of the total population at beginning and end of the target period

Country	Length of target period (years)	Married-women of reproductive age as percentage of total population			Average annual growth rate of MWRA group*
		Start of target period	End of target period	Differences	
India	10	.1791	.1899	.0108	.0236
Indonesia	5	.1491	.1530	.0039	.0235
Malaysia	5	.1238	.1326	.0088	.0368
Pakistan	5	.1584	.1615	.0031	.0325
Philippines	10	.1194	.1339	.0145	.0369
Rep. of Korea	10	.1312	.1427	.0015	.0255
Singapore	10	.1186	.1502	.0316	.0374
Thailand	10	.1276	.1370	.0094	.0332

Source: Selected runs of computer programmes CONVERSE and TABRAP.

Note: * Growth rate is derived as the solution to the equation $e^{rT} = M_2/M_1$, where T denotes length of target period, and M_1 and M_2 are the numbers of MWRA at the beginning and the end of the target period.

Lowering the growth rate

If negligible net migration is postulated, then the crude growth rate and the crude rate of natural increase (CRNI) become synonymous. By definition, CRNI = CBR - CDR. With any decline of the CDR during the target period, the CRNI decreases less than the CBR. Directly contributing to a declining CDR would be any lowering of mortality during the target period. Indirectly contributing would be a change of age distribution toward the "middle heavy" shape, since this age pattern assigns greater weight to age classes having relatively low death risks.

It follows that a reduction of the growth rate by five points typically demands more contraceptive acceptance than a corresponding drop of CBR. Age changes which are adverse to reducing the CBR are doubly disadvantageous as regards lowering the CRNI.

Acceptor-user relationship

The point merits elaboration that more new acceptors are needed during the target period than additional users by the end. For purposes of discussion, the regression CBR = 50.0 - .50x may be adopted. This artifice of course means ignoring changes in age distribution and blinking at any differences of potential fertility between acceptors and married non-acceptors. Furthermore, let us suppose that the demographic target is to reduce the CBR **d** points in T years, during which target period the size of the MWRA group is increasing exponentially at the constant annual rate **r**. P signifies initial population size; **w** denotes the proportion of the population MWRA. Let **y** designate the proportion MWRA protected at the start of the target period. Hence, the initial CBR equals 50.0 - .50y. By the end of the target period, the level of protection should be y + 2d, yielding a terminal CBR of 50.0 - .5y - d. Required as additional users between start and end of the target period is

$$\Delta U = Pwe^{rT}(y + 2d) - Pwy$$

$$= Pwy(e^{rT} - 1) + Pwe^{rT}(2d)$$

$$= \Delta U_1 + \Delta U_2$$

ΔU_1 symbolizes the number of additional users needed just to maintain the initial CBR of 50.0 - .50y. ΔU_2 measures requirements to take the CBR down an additional **d** points when the MWRA has grown by a factor of $_e rT$.

To produce ΔU additional users by the end of the target period, more than ΔU acceptors are needed during the target period in order to compensate for the attritions of discontinuation, broken marriage and secondary sterility. There will be attrition even among those who do accept during the target period. Let **z** denote the fraction of acceptors during the target period who, at the end of the period, are still MWRA and using the same contraceptive. Let **h** denote the corresponding fraction for users at the start of the target period.

Three categories of acceptance may be distinguished. The first is that set of acceptances A_1

required to maintain the initial number of users, Pwy. Of Pwy practising contraception at the start of the target period, only Pwyh will practise it uninterruptedly and usefully to its end, meaning that Pwy(1-h) are lost to attrition; so that $A_1 = Pwy(1-h)/z$ acceptances are needed in compensation.

A second set of acceptances A_2 is needed to maintain the proportion protected at y among the MWRA, despite their growth during the target period by a factor of erT. To provide the additional $Pwy(_{e}rT-1)$ users at the end of the target period, $Pwy(e^{rT}-1)/z = A_2$ acceptances are needed.

The third set of acceptances A_3 serves to raise the terminal proportion of MWRA protected from y to y+2d. $A_3 = (Pwe^{rT})(2d)/z$.

A_1 and A_2 together compose what might be called "maintenance acceptance": acceptance needed to maintain the initial proportion of MWRA protected. A_3 defines the new acceptance required to raise the level of protection from y to y+2d.

Tending to reduce parameters h and z, and therefore to raise acceptance requirements, are higher discontinuation rates or a longer target period T. Older ages at acceptance intensify the forces of death, widowhood, and secondary sterility; but often they are also associated with higher continuation rates.

Some illustrative values of z were obtained in an earlier analysis, based on the computerized programme ABREV1, which dealt with west Pakistan in 1965, delineated by data from the Population Growth Estimation Survey.[10] Linearly increasing acceptance is assumed. IUD, oral contraception, and sterilization are assigned continuation parameters (a,k) of (.90, .25), (.90, .50) and (1.00, .015) respectively. Expected retention is therefore a/k, or 3.6 and 1.8 years respectively for the first two methods cited. The annual force of marital dissolution by death of a spouse is put at .015. Three age patterns of acceptance are considered, all averaging near 30 years. For a ten-year target period, the z-value for sterilization is found to stay in the vicinity of .89, for IUD .43, and for pills only .28. When a five-year target period is posited, the z-value for sterilization climbs to .95, and that for pills to .44. Values for h are much lower than z-values. Another example, in which the target period is eight years, produces an h-value of .614 for sterilization, but only .017 for pills. In the last case, virtually a complete turnover of programme users is occurring between start and end of the target period.

A fundamental point is that the lower the initial CBR is implying a larger y value, the greater must be maintenance acceptance $A_1 + A_2$. Indeed, it is quite possible to have $(A_1 + A_2) > A_3$ when the demographic goal is modest and the initial birth rate already considerably reduced. At the other extreme, if family planning has made little headway before the start of the target period, then both A_1 and A_2 may be taken as zero with little error.

Of course not all of total acceptance $A_1 + A_2 + A_3$ has to be accounted for by the programme. The targets can be less if private-sector birth control has played a significant role in reducing the CBR to 50 - y/2, and if it continues to expand during the target period.

Use is made of these distinctions regarding acceptance later in the paper.

The ESCAP Target-Setting System (ETSS)

In the design of the ESCAP Target-Setting Project, four key tasks were specified,[11] for each of which a computer programme has been developed:

(a) Acceptance targets needed to realize a given demographic goal (TABRAP);

(b) Impact on crude vital rates of a designated sequence of acceptances (CONVERSE);

(c) Woman-years of protection, and births averted per acceptance of a method (TABLE4); and

(d) Ratios of births averted by individual methods, relative to births averted by a standard contraceptive (RATIOS).

TABLE4 may be used alone, but is also encompassed as a subroutine within RATIOS. Several other auxiliary programmes have been developed. This system of programmes is described more fully in the background paper of S. Kirmeyer.

The strength of ETSS is that its two main programmes, TABRAP and CONVERSE, embrace the entire list of basic factors enumerated in an earlier section of this paper. The weakness of ETSS

10/ Robert G. Potter and S.L.N. Rao, *op.cit.*, chap. II.

11/ Population Division, ESCAP, "Aide-memoire", *op.cit.*

is that, in deference to data constraints and algebraic complexity, it incorporates a number of rather costly simplifying assumptions which are cited in the following section.

In TABRAP the sequence is reversed, the first step being to determine how many annual births are to be prevented, and then working back to an estimate of the number of acceptances needed to do the job, subject to enough constraints with respect to acceptors' ages, continuation rates, etc., to make the computations determinate.

In ETSS, calculations are specific with respect to age (five-year classes) and programme year. The basic sequence in CONVERSE starts with acceptance of contraception, and moves to woman-years of protection. The latter, multiplied by the age-specific potential fertility of users, generates births prevented nine months later. Births prevented, subtracted from potential births, yield allowed births. Annual allowed births divided by an estimate of the midyear population, give the crude birth rate.

Any run of CONVERSE or TABRAP produces a pair of projections. The first, utilizing straightforward component projection techniques, assumes that the contraceptive programme does not exist. Only the demographic setting factors have bearing; factors (f) to (k) do not enter at all. The second projection registers the effects of the programme with the entire list of basic factors operative. Included as a statistic from the latter projection are the annual "potential births", predicated on no births being prevented during the current year. This is equivalent to cancelling out the contraception that might have affected total births in the programme year.

The potential CBR, compared with the CBR of the same year from the first projection based on no programme, furnishes a measure of the adversity of age distributional changes resultant from the previous activity of the programme. If the potential CBR is greater than its counterpart without a programme, that is because the extra births prevented in earlier years of the target period have induced a relatively middle-heavy age distribution.

Some commentary on the kind of results obtained from RATIOS is in order. Woman-years of protection derived from contraceptive use are estimated by means of the modified negative exponential function of Mauldin and others.12/ Two parameters are estimated: *a* the proportion of acceptors who discontinue right away, and **k** the annual discontinuation risk among those who do not immediately discontinue. (The ETSS auxiliary programmes CONTINUE, CONTINU2, and MORT are designed to help obtain estimates of *a* and **k**.) Expected protection per acceptor during the 12-month period that can affect births in the jth programme year after the programme year of acceptance $j = 1, 2, \ldots,$ is given by the integral $a\int_{t_1}^{t_2} e^{-kt}dt$, where the limits t_1 and t_2 denote the appropriate range of duration from moment of acceptance. Annual acceptances being assumed to be concentrated at midyear, protection per acceptor as affecting the next programme year after that of acceptance is well under 1.0 even in the case of sterilization; and is reduced still further by a subtraction to allow for overlap between use of contraception and post en partum anovulation.

Obviously the annual woman-years of protection per acceptor decrease more rapidly with higher values of the discontinuation parameter **k**. Two contraceptives may show rather similar amounts of protection for the first year, especially if the method of better continuation suffers more overlap with amenorrhea. With increasing duration from acceptance, however, the ratio of annual protection time diverges, with the method of better continuation gaining an increasingly greater advantage.

The ratio of annual births averted between two contraceptives reflects primarily the ratio of annual protection time, and only secondarily reflects the age composition of users of the two methods which in turn influences potential fertility. If the method of better continuation has older acceptors and therefore older users as well as more amenorrhea overlap, then it may avert no more births, perhaps even fewer births, during the first programme year after acceptance. Nevertheless, in subsequent years its increasing advantage with respect to annual protection time eventually prevails.

A point of some practical significance follows. Between two methods of differing continuation rates, the ratio of annual births averted is not a constant, but rather a variable highly sensitive to duration from acceptance. The value of an acceptance this

12/ W.P. Mauldin, D. Nortman and F.F. Stephan, "Retention of IUDs: An international comparison", *Studies in Family Planning*, No. 18 (April, 1967), pp. 1-12.

year of an IUD or oral contraceptive relative to a sterilization, for purposes of preventing births in the last year of the target period, may be only a fraction that of sterilization, if the current year comes early in a 10-year target period. But the value may be much more nearly 1:1 if the current year is the second to last year of the target period.

Principal limitations

Naturally, it is not possible to encompass so many factors as do TABRAP and CONVERSE without simplifying assumptions. Nor should it be forgotten that component projection is merely a device to derive the numerical consequences of a set of assumptions.

Among the limitations now to be cited, the first five are less serious than the last five.

(a) It is assumed that nonmarried women do not bear children. Births are restricted to married women. Whenever this assumption seems seriously unrealistic, however, the definition of "married" can be widened to include a larger proportion of all women within chosen age classes who are at risk of conceiving;

(b) Only wives not currently practising programme contraception are eligible, at mid-year, to accept a programme contraceptive;

(c) With net migration assumed nil, the annual crude growth rate may be equated with the crude rate of natural increase;

(d) The relative popularity of different programme contraceptives among each five-year age class of acceptors is assumed to remain constant over the target period. Relative annual numbers accepting different methods change over time, but only because the relative numbers eligible to accept in different age classes are changing over time. Particularly in runs of CONVERSE, it would be of great practical interest to assess the consequences of changes in method preference during the target period. A feasible programming change could furnish this added flexibility;

(e) TABRAP offers a direct solution to the problem of deriving acceptance targets when the demographic goal is defined with a CBR path. It offers the means for only a trial-and-error solution when the goal is stated as a reduction in CRNI. Trial-and-error CBR paths are stipulated, until one is found that also closely approximates the predesignated growth-rate decline;

(f) Wives who discontinue a programme contraceptive are not distinguished from wives of the same age class who have never used programme contraception. The same acceptance rates are applied to both groups, even though it may be anticipated that rates of reacceptance among previous users exceed rates of first acceptance among those who have never used;

(g) Not out of algebraic necessity, but for lack of alternative empirical estimates, the fertility of married non-users of programme contraception is usually set equal to the age-specific fertility of all married women of a base year (most often, the first year of the target period). Sometimes a secular trend in this fertility schedule is stipulated in order to represent an expanding use of non-programme contraception and abortion, or else to reflect such non-programme factors as changing lactation practices or increasing rural-to-urban migration. Admittedly, the marital fertility measured for the base year may reflect in part the continuing practice of programme contraception accepted prior to the target period;

(h) No direct provision is made for previous programme users, that is wives accepting programe contraception before the start of the target period and continuing to practise it into the target period. Fortunately, when the target period is brief, such as five years, the initial years of a 10-year TABRAP run can be used as a "build-up period", with a decline stipulated in the CBR from a value commensurate with little or no programme contraception down to the value observed at the start of the target period. TABRAP then estimates the programme acceptance needed during the build-up to achieve this decline. In this fashion previous acceptors continuing their use of programme contraception into the target period are incorporated. However, this device presupposes the availability of data by which to estimate the marital age-specific fertility expected in the absence of programme contraception; i.e., presupposing a solution to limitation (g). When no provision for previous programme users is possible, the number of wives eligible to accept will be overestimated. Indeed, during the first year of the target period, all MWRA are being assumed eligible, though some in fact are previous acceptors currently using programme contraception;

(i) Again for lack of alternative estimates, the potential fertility of programme users is measured by the base-year fertility of all married women of

the same age class, subject to a correction. This correction is designed to register the lower rate of secondary sterility resulting from the presumption of a recent birth. More specifically, it is assumed that acceptors are not sterile at time of acceptance, though thenceforth subject to the annual risks of secondary sterility characteristic of their ages.

Whether this estimate of potential fertility is optimistic depends on what means of non-programme birth control would have been available to them had they not accepted programme contraception, and the degree of likelihood to exploit these means. Obviously, the potential fertility of acceptors is a highly speculative topic. The best that can be done is to offer a clear operational definition that can be applied uniformly from one population to another;

(j) A final and most serious limitation sometimes arises. Suppose that already at the start of the target period, the CBR is being lowered by a consequential amount of programme contraception. Furthermore, suppose that it has not been possible to incorporate a build-up period, and therefore no provision is being made for previous users of programme contraception. Furthermore, the fertility rates of wives not using programme contraception are being equated with those of all married women of the first target year. Then, the acceptor targets estimated by TABRAP as being necessary to the achievement of a given demographic goal comprise only new acceptance (designated in an earlier section as A_3), but do not include maintenance acceptance, $A_1 + A_2$. It is being implicitly assumed that the necessary maintenance acceptance is covered by some combination of expanding private-sector birth control and clinic revisits by former acceptors of programme contraception.

In like manner, results from CONVERSE would require the same undesirably narrow interpretation. The consequences of specified schedules of new acceptance are being assessed, subject to the condition that in the rest of the MWRA group there is enough family planning activity to maintain marital fertility at the base level (or else to keep it on the path being postulated for it over the target period).

The targets estimated by TABRAP can be considered to encompass total acceptance ($A_1 + A_2 + A_3$) only under two conditions: first, establishing a build-up period, together with proper estimates of marital fertility for those not protected by programme contraception; and secondly, the case where the number of previous acceptors of programme contraception has been relatively small. Then the failure to measure total acceptance ($A_1 + A_2 + A_3$) is not at all serious. Such is typically the case when a young programme has operated on a small scale prior to the present target period.

When programme contraception has played an important role in bringing the CBR from appreciably higher levels to its current base level, then possibly greater annual programme acceptance is needed to maintain that base level of CBR than is annual new acceptance to reduce it from base to aspired level. Here, the ability to estimate total programme acceptance needed rather than merely new acceptance (A_3) is of critical significance.

Uses of ETSS

Thanks to the very extensive output built into each component programme of ETSS, a number of uses can be served in addition to the four key tasks already mentioned. The following list is not intended to be exhaustive.

(a) Derivation of targets of contraceptive acceptance necessary to meet a predesignated goal:

(i) To set annual targets under the assumption that the method composition within age classes, and the relative age-specific inclinations to accept among those eligible observed during the base year (or a year close to it), remain constant over the target period (TABRAP/MACHO);

(ii) To assist in the derivation of method quotas, if they are problematic, and to analyse ratios of births averted among different methods (RATIOS);

(iii) Given a terminal CBR goal, to select an advantageous path to it (TABRAP).

A CBR path which declines slowly at first and then more rapidly toward the end of the target period may be described as an "accelerating decline", and may be contrasted with a linear decline. The former entails fewer total acceptors needed during the target period to achieve the given goal, but permits a larger total population at the end of the period and requires a higher annual quota of acceptance during the last years of the target period.

Given a demographic goal, care is needed to define a CBR path that calls for plausibly regular

rises in annual acceptance targets, rather than an irregular, up-and-down sequence of annual targets. Essentially, the first differences between consecutive annual CBRs should increase monotonically in a regular manner.

(b) Validation or recalibration of targets already set:

(i) To validate targets set by other techniques (CONVERSE). An example is the reappraisal of the provisional targets set recently for one country by use of the computer programme ABREV2;

(ii) To modify targets in response to a changed demographic goal, or in response to new information gained about the demographic setting or programme factors, as derived from interim sample surveys, a population census, or programme service statistics.

(iii) To demonstrate the variability possible within incompletely specified acceptance targets (CONVERSE/MACHO). One example concerns targets that are defined in terms of "notional acceptors". The same number of notional acceptors, implemented in terms of sterilization, commands a far smaller short-range impact than the same number of notional acceptors implemented by conventional contraceptives. The latter subtracts most of its births in the next programme year, while sterilizations spread their impact over many years and therefore exercise only a small fraction of their effect in the programme year following acceptance.

(c) Assessment of consequences of predesignated schedules of acceptance:

(i) To assess what happens with the continuation of present acceptance trends, or designated accelerations thereof (CONVERSE/MACHO).

(ii) To study the impact of hypothetical schedules of acceptance before setting goals (CONVERSE). That would entail consideration of what demographic goals might be feasible within perceived programme constraints.

(d) For a given demographic goal, a test of the sensitivity of contraceptive requirements to features of the demographic setting:

(i) When two or more estimates are available from national data for the same component of the demographic setting (e.g. marital fertility rates, mortality schedule, etc.), it is of interest to consider how sensitive are acceptance requirements to the various competing estimates. For example, results may be quite insensitive to assumptions about details of the mortality schedule, if the expectation of life is high (e.g. above 60 years), but much more sensitive if the life expectation is in the range of 40 to 50 years;

(ii) If national data are lacking for an item, e.g. the continuation rate of a method used extensively in the programme, then a range of low, medium, and high estimates may have to be constructed from the experiences of other countries with similar programmes. Naturally it is of interest to consider how sensitive are results to this range of estimates.

(e) Quantitative demonstration of interactions among relevant factors: taken in widest generality, this fifth use is the intellectual function of ETSS, facilitating an understanding of the process underlying the CBR and CRNI, within the limitations of the ETSS apparatus. Three examples may serve to illustrate this function.

(i) Even when the age-specific dispositions to accept programme contraception among eligible couples remain constant over a target period, the ages of acceptors can be expected to decline during the target period, owing to changes in the age distribution of eligible couples (as the older age classes become relatively more saturated with users). This downward trend is attenuated by lower acceptance ages, lower continuation rates, or a more rapidly rising curve of annual acceptors.

(ii) Given constant continuation rates, despite an increasing youthfulness of acceptors,

users may tend to grow older during the target period as a simple function of aging since acceptance. This trend is intensified by higher continuation, longer target period, or less rapid increase in annual acceptances.

(iii) When mortality is low, there is likely to be a large sex differential, with the life expectation for females several years greater than for males. Computed on a two-sex basis, the CDR is likely to be higher, the CBR about the same, and therefore the CRNI lower than when computed on a female-only basis. As the experience with the Thailand ETSS data has demonstrated, the difference between a single-sex (female) and a two-sex analysis can be the prediction of attaining or not attaining an official CRNI goal on the basis of a given series of acceptor targets.

Need for local implementation

The proper exploitation of ETSS requires the system to be operational on national computing equipment. The task of setting demographic goals and corresponding targets for a five-year plan might entail a period of planning activity brief enough for the computer work to be subcontracted. However, annual adjustment of the initial targets to take into account new information about the demographic setting, national objectives, or programme factors is the kind of recurrent evaluation that cannot be readily undertaken unless ETSS, or a more refined successor, is operationally available on a regular basis.

II. THE ESCAP TARGET-SETTING SYSTEM: A COMPUTERIZED COMPONENT PROJECTION APPROACH

INTRODUCTION

Statistical evaluation of family planning programmes is not a recent administrative construct. Fifty years ago, Dr. Marie Stopes in the United Kingdom and Dr. James Cooper in the United States systematically recorded clinic visits, contraceptive methods accepted and whether these methods were abandoned or proved to be failures(1). A half century ago, the societal rationale for contraception was eugenic while the personal rationale included concern over the health of the family and a woman's control over her reproductive processes. The personal argument remains as important as ever, but the once-liberal eugenic argument is now a faded anachronism. It has been replaced by concern over population growth. A critical factor in population growth dynamics, the time element, has convinced governmental bodies to initiate action and evaluate programmes which both directly and indirectly deal with the population growth issue.

The Multinational Study in Methodologies for Setting Family Planning Targets in the ESCAP Region represents one venture in initiating interaction among programme managers, demographers, public bodies, and evaluators. This venture employs computer models which can perform repeated simulations of population dynamics and of the interaction between those dynamics and strategies of fertility regulation.

Despite the relative sophistication of the models, collectively entitled the ESCAP Target-Setting System, or ETSS, and the greater sophistication of the hardware processing them, the validity of the simulations is no greater than the quality of population and clinic data used as inputs to them. Today, the collection of these data encounters many of the same problems faced by the early evaluators of family planning clinics.

The intention of this paper is to acquaint the reader with the methodology employed by ETSS once the reader has become familiar with the basic factors discussed in the background paper by R. Potter(2). This methodology is introduced in conjunction with the division of labour among and within the nine computer programmes comprising ETSS. It is hoped that the methodological and data issues will be illuminated by the presentation of several impressions obtained during the spring and summer of 1975 through the application of ETSS to the real situation of the eight countries participating in the Target-Setting Project.

A. DIVISION OF LABOUR AMONG COMPUTER PROGRAMMES

Nine computer programmes comprise the ESCAP Target-Setting System. Three aid parameter assignments for contraceptive continuation. Two, TABRAP and CONVERSE, are independent target-setting models which provide input to four additional programmes which can extend the analysis done by TABRAP and CONVERSE.

Input auxiliaries

Most often, data depicting the continuation of various contraceptive methods are stated in terms of proportions of original acceptors still using a method at different durations after acceptance. It is necessary to translate these proportions

into the two parameters required for the Mauldin-Nortman-Stephan exponential continuation function used in ETSS to express contraceptive continuation. Thus, three "mini-programmes" were written to regress the data to the required function. These three programmes are discussed as follows.

CONTINUE. This programme estimates continuation parameters from a pair of observation times and corresponding proportions of couples still using. The disadvantage of this programme is that unrealistic values of the "a" parameter (see section C of this paper) may result. However, it is an efficient auxiliary programme to use when only two observations are available.

CONTINU2. This programme is able to incorporate the additional information obtained when three or more observations of contraceptive continuation have been made. CONTINU2 can regress as many as 12 observations to the exponential function by the least squares technique.

MORT. Due to the irreversible nature of sterilization, its recipients will not discontinue its use in the manner of discontinuation of other methods. However, provision must be made to enable those women who are no longer at risk to be subtracted, in calculation, from the group of "effective users". The loss of the "at risk" status is due to marital dissolution, principally by widowhood. MORT computes the annual age-specific risks of death of a sterilization acceptor and of a spouse, which risks are assumed to remain constant over the target period. Inputs to this programme are both male and female 5Lx values which determine the joint probability of survival of the couple. The parameter "a" in the continuation function used is assumed to be equal to 1.0 for sterilization acceptors. If

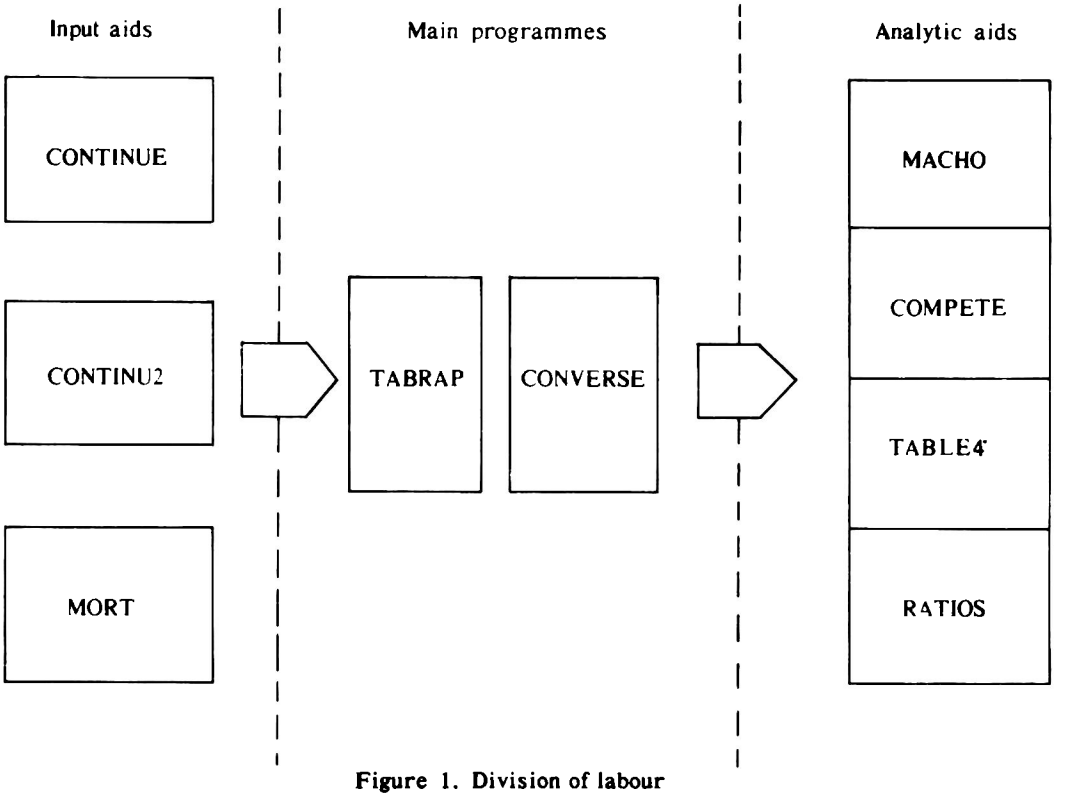


Figure 1. Division of labour

*/ Prepared by Sharon Kirmeyer, Brown University, for the Study Directors' meeting.

multiple decrement marriage life-tables were available, divorce could also be included as a cause for discontinuation.

Main programmes

TABRAP and CONVERSE are the core programmes of ETSS. Each may stand alone and yet provide sufficient output for elaborate analysis. A fuller discussion of the mechanics of the pair follows in this paper. Suffice it for now to distinguish between the two with provision of the following basic schematic:

Model	Input	Output
TABRAP	Crude birth rate path	⟶ Acceptance pattern
CONVERSE	Acceptance pattern	⟶ Crude vital rates

Auxiliary programmes for further analysis

Four auxiliary programmes require input from tables printed by TABRAP or CONVERSE. These programmes allow an administrator to extend an analysis further in a particular direction. While any or all could have been appended to TABRAP or to CONVERSE, it was felt that their occasional use would not justify the enormous increases in the complexity of compilation in the two main programmes had this been done. Thus, these four programmes exist as separate entities. Comment on each of the four follows.

MACHO. TABRAP and CONVERSE are single-sex (female) component projection models so the vital rates computed by either pertain to females only. These rates can be significantly different from those of a total population in instances of anomalies in age structure or large male-female differences in expectation of life at birth. MACHO produces a male-only projection based on total births from either TABRAP or CONVERSE and male mortality (via life-tables), both with and without contraceptive protection. The end products are vital rates for females, males, and a total population.

COMPETE. TABRAP and CONVERSE present tables of contraceptive use, acceptance, and births averted, undistinguished by individual methods. One may think of these methods as being in competition with each other in the multiple method situation to attract and retain users. Thus, COMPETE traces the results of this "competition" as reflected in the users and the births averted attributed to each method. Trends over time in the relative abilities of the various methods to avert births, attract acceptors, and maintain users are depicted. Also computed are actual numbers of acceptors and users, which numbers are necessary for detailed planning.

TABLE4. This auxiliary programme permits further analysis of the powers of each method to provide contraceptive protection. It gives couple-years of protection and births averted per acceptor of a particular method as a function of age at acceptance, of continuation characteristics of the method, and of the time elapsed since the method was accepted.

RATIOS takes the analysis of contraceptive methods one step further. After replicating the schedules generated by TABLE4, RATIOS investigates the consequences of changing the method mix of acceptor targets at sometime in the projection period. This is done for a re-weighted mix of methods and by comparing

ratios of births averted per acceptor by each method to those of a "standard method".

B. AN OVERVIEW OF THE TABRAP AND CONVERSE METHODOLOGIES

Figures 2 and 3 outline a simplified scheme of computational steps found in the TABRAP and CONVERSE models. The general flow of these models is summarized in the following paragraphs. More detailed accounts and technical appendices are available (3) (4).

To calculate the impact of acceptors on a population's vital rates, the computational labour of CONVERSE was divided into five sections. The first section reads data and constructs preliminary arrays; the second generates a first-year female population and projects that population under the assumption of no programme contraception. The middle section establishes schedules of contraceptive use, of attrition of users, and of births averted per acceptor. The fourth section calculates the demographic impact delivered by acceptors of a contraceptive programme. Finally, tables summarizing the experience of acceptors, users and their diminished fertility are generated.

To move in the opposite direction, that is, determining numbers of acceptors required to bring about a specified impact on the crude birth rate, TABRAP is also divided into a pentad. The first section again reads data and generates essential arrays. In the second, the population is projected in one-year steps for the target period, first under the assumption that contraception is not introduced to the population, and second assuming that the projection meets crude birth rate targets through the mechanism of contraceptive adoption. A third section identical with that of CONVERSE derives schedules of contraceptive use, continuation, and births averted per acceptor. The critical work of the fourth section is to calculate the number of births which need to be averted in order to meet a birth rates goal, and to translate these births to be averted into annual quotas of contraceptive acceptance and usage during the target period are generated.

C. SELECTED COMPUTATIONS

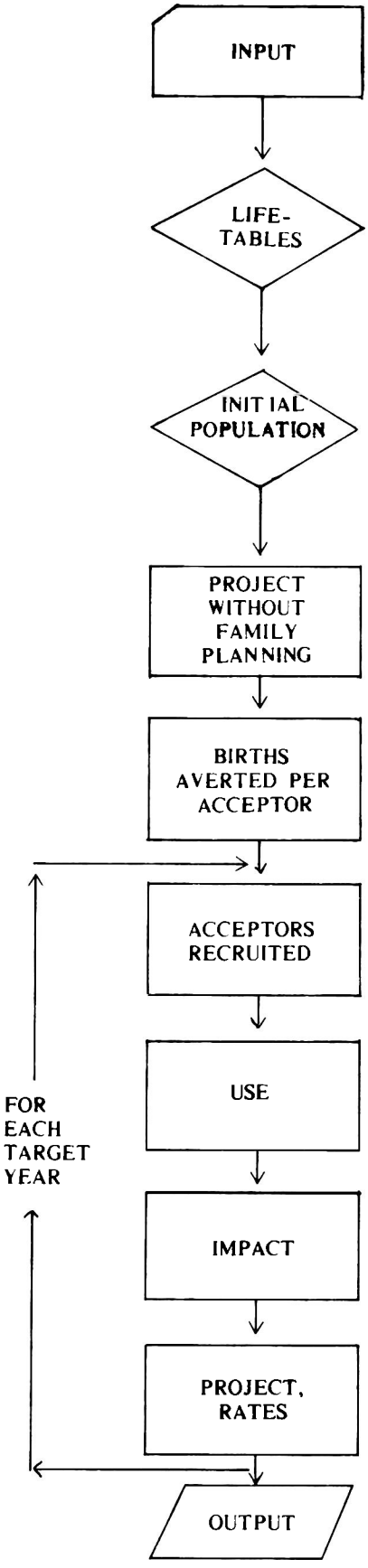
Several critical equations are presented below with the hope that their inclusion will reinforce understanding of the interactions among basic factors.

Contraceptive practice can be represented by a number of functions. The Mauldin-Nortman-Stephan negative exponential function (5) is one general enough to represent the continuation of users of a variety of contraceptive methods:

$$\text{Proportions using as a function of time} \equiv C(t) = ae^{-rt}$$

where a = those not immediately discontinuing,
r = the annual measure of attrition, and
t = number of years since accepting.

This is a flexible equation. The term (1.0 - a) can include wasted supplies (such as condoms or pills accepted but never put to use), or those who immediately discontinue use, exemplified by the immediate removals of IUDs for pain. The measure of attrition, r, indicates discontinuation not only for stopping or switching of methods, but for cases of marriage dissolution by divorce or widowhood (those circumstances responsible for "discontinuation" by sterilized couples).



Data are entered allowing the computation of several initial arrays: proportions fecund, annual proportions married, age-specific fertility and age-specific marital fertility rates. Checks of input data are made.

Calculation of life-tables, either empirical (from age-specific death rates), or model (Coale/Demeny(6)). Only model life-tables change over time.

The initial population is established as either "real", from female age distributions, or "stable", calculated from life-table values and an intrinsic growth rate.

Annual projections of female population for the duration of analysis are made. "Current" life-table values are applied to the preceding year's population to project a five-year age group. Annual births calculated by applying age-specific fertility rates to females. Calculations of vital rates without a family planning programme are made.

Births averted per acceptor from calculations of proportions still using, women-years of use and potential fertility are determined.

For each target year, this part of the programme applies one of four acceptance options to eligible women:
(1) acceptors as a percentage of married women,
(2) annual total numbers of acceptors,
(3) acceptors as percentage of eligible women, or
(4) age-specific acceptance rates of eligible women.

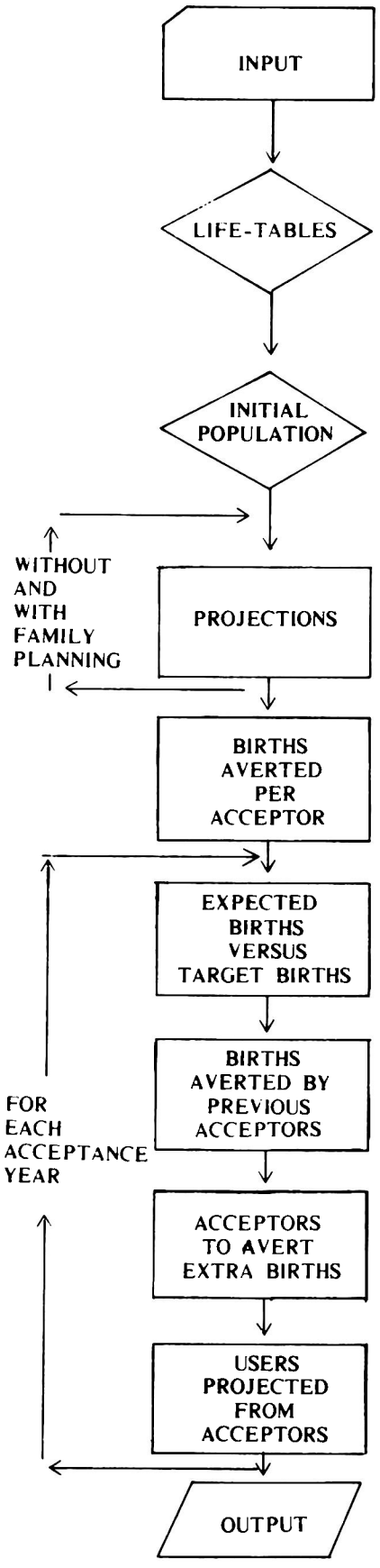
Number of users = current and continuing acceptors.

Calculated are numbers of expected and prevented births to yield allowed births, i.e. fertility under a family planning programme. Prevented births equals the sum of births averted by old and new acceptors.

The population is projected with family planning, once corresponding births are known, and vital rates with family planning are determined.

Generation of output to summarize annual trends in users and acceptors is made.

Figure 2. CONVERSE flow diagram



Data are entered, followed by the computation of proportions fecund and projected proportions married, and age-specific fertility and age-specific marital fertility rates. Checks of input data are made.

Calculations of life-tables as in CONVERSE are performed.

An initial population as established in CONVERSE is calculated.

Two projections, without and with family planning, are made.

Five-year age cohorts are projected annually through applying life-table values.

Births averted per acceptor following calculation of proportions using, women-years of use, and potential fertility for each year following acceptance are calculated.

For each target year, acceptors in the preceding year are found.

Expected births minus target births yields births to be prevented.

Some births have been averted by past users; these are found by summing the births averted in the current year from each past acceptor cohort.

The number of residual births to be averted is calculated by subtracting births already prevented from the total to be averted. Sufficient acceptors to prevent these births are drawn from the pool of eligible women.

Attrition schedules are applied to these acceptors to determine how many will remain using in future years.

Summary tables of use and acceptance schedules are generated.

Figure 3. TABRAP flow diagram

Contraceptive use

Couple-years of use are found by integrating the aforesaid function over a specified time interval. In order properly to relate the protection afforded to the time when births would have occurred, the limits of the integral are made to lag nine months (or .75 of a year) after acceptance.

$$\text{Use as a function of time} \equiv U(t) = a \int_{t_1}^{t_2} e^{-rt} dt$$

where $t_1 = t - 0.25$,

$t_2 = t - 1.25$, and

both are measured in years.

For example, contraceptive protection appropriate to preventing births in the second year of an analysis stems from practice during the interval extending from t — 0.75 to 1.75 years.

Births averted

Two components are responsible for the annual preventing of births: the potential fertility of a woman in the absence of contraceptive practice, and the contraceptive use (protection) attributed to that woman as affecting that year. Potential fertility strikes a balance between the higher proved fertility of acceptors (who quite often enter a programme immediately after birth or abortion) and the likelihood that a woman would use a form of fertility control other than those offered by organized family planning efforts. The potential fertility of an acceptor is waned linearly to zero by the time of her menopause. The timing of contraceptive use to prevent births was discussed in the preceding paragraph. Thus, births averted per acceptor of contraception, M years after accepting at age N is calculated as the product of use and of potential fertility, or, using the symbology of the ETSS programmes:

$$^{N}(BAV)_{M} = {}^{N}(U)_{M} \times {}^{N}(F)_{M}$$

Births expected, prevented, etc.

Basic to these models are several categories of births which occur (or do not occur) in a year. These are defined as follows.

Expected births (or potential births): births which would have occurred in a population had there been no programme-initiated contraception.

Target births (or allowed births): births which result when a contraceptive programme designed to achieve a certain reduction in the birth rate is applied to a population. These births provide the numerators for crude birth rate goals.

Prevented births (or averted births): the difference between expected and target births, i.e. the fertility suppressed by a contraceptive programme.

Births already averted: a subset of prevented births, representing those births averted in a given year by women who accepted prior to that year and who continue to practise contraception at least into the previous year.

Births to be averted by acceptors: the residual number of births to be averted in a given year, which number must be prevented by acceptors recruited in previous years.

Conversion of a crude birth rate goal to a specific number of births

TABRAP assumes an annual crude birth rate goal. The problem is to determine the appropriate number of births to meet the goal. At first glance, the solution looks easy: to solve the simple crude birth rate equation in terms of the rate's numerator.

$$CBR_T = (B_T/P_T) \times 1{,}000$$

However, the denominator, population, is unknown until the number of births occurring that year is known. To work toward this, the population at any time may be represented as those individuals older than one year plus the survivors of the average number of infants born in two adjacent programme years. The simple equation above is then rewritten as:

$$CBRT_{\cdot} = \frac{B_T}{> {}^1P_T + {}^1L_T \times (B_T + B_{T-1})/2} \times 1{,}000, \text{ and}$$

the solution for "target" births follows as:

$$BT = \frac{CBR_T \times (2 \times {}^{>1}P_T + {}^1L_T \times B_{T-1})}{2 - CBR_T \times {}^1L_T} \times 1{,}000$$

Women eligible for contraceptive acceptance

Generally speaking, to be eligible as an acceptor of programme-offered contraception, the ETSS programmes assume that a woman is married*, is between 15 and 44 years of age and is not currently using contraception. Married women are projected by multiplying age-specific proportions married to the corresponding projected five-year cohorts. Current users in a given year, T, are those acceptors who remain in the programme, or:

$$USERS = \sum_{M=0}^{T} (ACCEPTORS)_{T-M.} \times (PROPORTION\ STILL\ USING)_M$$

So the number of eligible women is calculated as:

$$(ELIGIBLES)_T^{-N} (MARRIED\ WOMEN)_T^{-N} (USERS)_T,$$

Where M = years since accepting, and
N = age of users

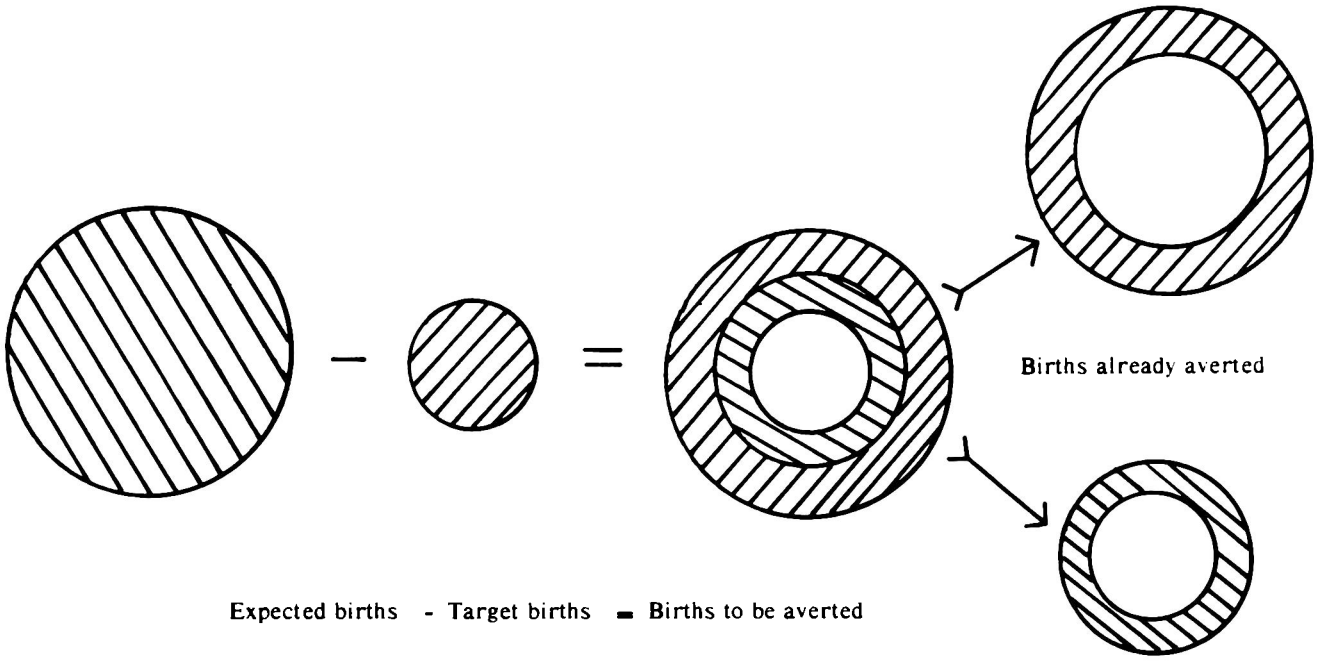


Figure 4. Birth typology

Acceptors

In CONVERSE, the calculation of acceptors is straightforward but this is more complex in TABRAP. The particular combination of acceptors brought into a programme must meet the demands of averting a calculated number of births. Thus, both the number of "extra births to be averted" and the strength of the age and method mix of acceptors in terms of births averted per acceptor must be dealt with simultaneously. The complexities of the acceptance methodologies will not be dealt with here. Instead, a modifying factor, "S", will represent the acceptance definition called for in CONVERSE or the extra-births-to-be-averted/ability-to-avert quotient of TABRAP. (Relative disposition to accept (RDA) refers to the ratio of the number of acceptors in an age class and the size of that cohort's pool of eligible women.)

$$N_{(ACCEPTORS)} = S_T \times N_{(RDA)_T} \times N_{(ELIGIBLES)_T}.$$

* However, the programmes do have the capacity to account for the significant non-marital fertility found in some populations.

D. INPUT DATA REQUIREMENTS FOR TABRAP AND CONVERSE

Through the vigilance of certain members of the Population Division and the respective country Study Directors, data gathered for the Target-Setting Project came to the computer analysis stage of the Project generally complete and internally consistent. Using the division of programme factors outlined in R. Potter's background paper (7), input requirements are now discussed with reference to general observations about the country data.

Demographic setting

1. **Female population.** This is presented in five-year cohorts so that both total female population size and its age distribution are known. If no reliable population estimates are available, a stable population is used requiring the assumption of a constant intrinsic rate of natural increase. Most countries have provided this base population from their 1970 censuses. In several instances, the youngest or oldest age groups (such as 0-14 or 65+) were grouped together in their original presentations. This condition required the application of a stable population distribution (calculated exogenously through the subroutines RVALUS and SPP) to the aggregated age groups.

2. **Sex ratio at birth (SRAB).** In some countries, the sex ratio at birth departs significantly from a "standard" ratio of 1.04 or 1.05. This sex ratio is therefore made a required input rather than a built-in constant, so that departures from a constant ratio will not result in erroneous mortality rates which, subtracted from the crude birth rate, would then distort the crude rate of natural increase for the total population. Correct values of SRAB also ensure better calculations of CRR, NRR, T, and the intrinsic growth rate.

3. **Proportions currently married.** It is necessary to know the proportions currently married in each age class from age 15 through age 44. Often, individual countries anticipate changes in proportions married, such as fewer younger women being married due to an increased legal age of marriage, or more older women spared from widowhood as mortality conditions improve. When such changes are anticipated, or if an administrator wishes to manipulate this variable to judge its impact, projected proportions married for the terminal programme year can be used as inputs. To provide proportions married for the intervening years, the computer programmes linearly interpolate between initial and terminal proportions.

4. **Mortality.** Crude death rates are not useful mortality data for this pair of component projection models, primarily because they are crude. Not only are age-specific death rates necessary, but they must be female-specific (which reported crude-rates often are not). These data are stored in life-tables, giving the administrator the choice of using a model life-table or an empirical one. The advantage of choosing model (Coale/Demeny) (8) life-tables is that forecast changes in life expectancies for females are important for the model's accuracy. On the other hand, the pattern of age-specific death rates of a particular country may significantly deviate from each of the four regional patterns available from the Coale/Demeny models. This condition precipitates the use of a static empirical life-table (requiring age-specific mortality rates). The choice assigned to the majority of ESCAP countries has been the model life-tables (generally the "West" region) in order to allow for changing mortality.

5. **Age-specific marital fertility rates.** Both age-specific fertility rates and

age-specific marital fertility rates have usually been reported by each study country. Congruence between the two rates is tested by the following method (where N is the age of women):

$$^{N}(\text{ASFR}) = (\text{Marital births} + \text{Non-marital births}) / {}^{N}(\text{Females}).$$

Ignoring the marital/non-marital distinction,

$$^{N}(\text{ASFR}) = {}^{N}(\text{Births}) / {}^{N}(\text{Women})$$

$$= {}^{N}(\text{Births}) / {}^{N}(\text{Married Women}) \times {}^{N}(\text{Married Women}) / {}^{N}(\text{Women})$$

$$= {}^{N}(\text{Marital Fertility Rate}) \times {}^{N}(\text{Proportions Married}).$$

This, then, is an easy tool with which to translate or evaluate one type of fertility in terms of the other. Where a lack of congruence is revealed (due to errors in vital registries, "illegitimacy", or misreporting of marital status), the marital fertility is made congruent with age-specific fertility rather than vice versa.

Input data are in terms of marital fertility so that projected fertility changes would not be due to changes in age structure or proportions married as would be the case for age-specific fertility. Change may be expected in the fertility of non-users of programme contraception for a host of reasons: changes in lactation practices, internal migration, adoption of private sector contraception, changes in abortion practices, etc. These projected changes are treated in the manner of changes in proportions married, i.e. through interpolation between initial and terminal year rates.

6. **Proportions sterile.** This datum is exceedingly hard to acquire, especially in developing countries. Thus, Louis Henry's schedules based on historical European experience have been employed repeatedly (9). The main utility for a sterility schedule is in the estimation of potential fertility.

Demographic goals

1. **Length of target period.** The choice in the ETSS programmes is limited to either five or ten years for this variable. The projection length is determined by data availability, "real" years of interest to a planner (such as a span of time encompassing a five-year plan), etc.

2. **Desired birth rate or growth rate.** TABRAP provides a direct solution to a crude birth rate goal in terms of acceptors needed to reach the goal, whereas a desired growth rate is reached after iteration between the TABRAP and MACHO programmes.

Demographic goals are usually couched in terms such as "...X percentage reduction in the crude birth rate over Y years..." thus leaving a choice of paths between initial and terminal years of the projection. The advantages and disadvantages of the several conventional shapes of crude birth rate paths are becoming clear through repeated applications. For example, an accelerating CBR path provides the more regular increases in the annual requirement of acceptors as well as fewer acceptors needed over the total projection period, but a linear path results in a smaller terminal population size.

Programme factors

1. **Method continuation.** Optimal utilization of the ETSS capabilities requires age-specific parameters of continuation for each method, as continuation generally improves with age, but there is more variation among methods than within them. However, the majority of continuation data are only age-specific or only method-specific, thus sacrificing results on important interactions which the models are able to yield.

2. **Age of acceptors.** The age distribution of past acceptors influences the pattern of future contraceptive adoption. The exact distribution does not remain constant owing to the constraints of eligibility (as a general rule, users become older and acceptors younger over time), but the general shape of the age-specific acceptance schedules for each method do not show much change over time.

3. **Distributions of acceptance by method for each age group.** The mix of contraceptive methods chosen by women changes in composition as the women age. Younger women often choose methods which are easily reversible, involve fewer personal costs, and are less effective. Older women are more prone to choose the more effective methods in spite of their characteristic inconveniences (the pain and bleeding of IUDs, the finality of sterilization). To take these preferences into account, this input variable indicates the proportions of acceptors within each age class which choose a particular method. Again, the capability to deal with age-specific method composition is often absent as data frequently report method distribution only for all acceptors.

4. **Timing of contraceptive acceptance in conjunction with latest birth.** In most family planning programmes, women are recruited from the population at random, while, in others, there is a concerned effort to introduce women to family planning services in the post-partum period. In the latter case, there is an overlap between the protection afforded by contraception and that afforded by post-partum anovulation. In order not to double-count the protection credit of the contraceptive with Mother Nature's prophylactic, contraceptive practice is discounted in the model by the number of months of overlap. Thus, educated guesses have been used, based on the extent to which post-partum programmes are responsible for recruiting new acceptors; knowledge of the average length of post-partum amenorrhea (the observable correlate to anovulation) of women in a specific country; and the characteristics of each contraceptive method.

5. **Acceptance patterns (CONVERSE only).** A choice of four acceptance strategies in recruiting new acceptors exists. Unfortunately, these strategies do not provide for changes in method composition over time owing to algebraic constraints of the model. Hence, new methods cannot be introduced at mid-period nor can others be phased out. The only shifts occurring are those in the age distributions of acceptors. The administrator may choose from one of four acceptance patterns:

(a) Total annual number of acceptors — the kind of target expressed most often in official plans;

(b) Annual acceptors as a percentage of all married women — an option with a great deal of intuitive appeal as well as being an option which overcomes problems of accounting for past users and private-sector users;

(c) Annual acceptors as a percentage of all eligible women — a useful strategy when one is assured that most contraceptors are clients of the national family

planning system and have become so associated during the projection period; or

(d) Age-specific acceptance rates (among eligible women) — a rather abstract option for administrators, but one which allows for elaborate age-specific trends to be observed.

Targeted acceptors are generally expressed as option (a); the total number of acceptors. However, a great deal of variability has entered into the interpretation of this option. It is intended to refer to new acceptors only. New acceptors are those who are not currently using programme-issued contraception or who are changing methods. Acceptors should not include follow-up visits for resupplies or examinations. Very often, clinic records have confused acceptors with users or even with visits per year, leaving the investigator with few clues as how to disaggregate reported figures.

E. INTERPRETATION OF THE OUTPUT OF TABRAP AND CONVERSE

Approximately thirty tables each are generated by TABRAP and CONVERSE. Some are more effective than others in terms of answering central questions. The following outlines the content of the tables, moving for the most part consecutively through the output tables. (One feature of the models is that one may suppress the printing of any desired subset of tables.)

"Echo checks"

These tables provide an immediate reiteration of input data for ease of identifying the runs and for double-checking correctness of data. Included in the echo checks are population characteristics, family planning programme characteristics, and projection goals (either crude birth rate targets (TABRAP) or acceptor patterns (CONVERSE)).

Intermediate processes

Before the main question of each model can be answered, transitional calculations provide output of interest to some.

Annual life-tables: of use generally for determining errors or explaining unexpected projection results.

Initial reproductive values: intrinsic growth rate (r), NRR, GRR, TFR and the mean length of a generation (T). These provide benchmarks with which to compare the final year's reproductive values as well as giving a check against published values.

Age-specific schedules of proportions using, couple-years of use, potential fertility, and births averted per acceptor for each year following acceptance. These exhibit the relative strength of performance of the prevailing combinations of contraceptive methods.

Annual accounts of expected, targeted, and prevented births, as well as age-specific fertility and marital fertility rates under the contraceptive programme and numbers of births averted by age-class.

Summary tables

Projection of numbers of married women; the growth of which provides useful

es for comparisons with total population growth.

ired population projections: with and without a contraceptive programme, ng comparison to be made of age structures, total size, dependency ratios,

Paired projections of crude vital rates, both with and without a contraceptive gramme. This is the key table to indicate the demographic impact of a con-aceptive programme.

Terminal year reproductive values that show the impact under a programme without the distortions inherent in crude rates.

Actual numbers of eligible women, acceptors, users, and births averted by age. The acceptor figures are the derived targets.

Acceptors as a percentage of eligible women, and acceptors and users as percentages of married women.

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9. Henry, Louis. Some data on natural fertility. Eugenics Quarterly, Vol. VIII, No. 2, 1961.

Annex I

SOME COMMENTS ON LOCAL IMPLEMENTATION OF ETSS

Potter has argued for wide implementation of ETSS.[a/] If a country does not have the computer facilities for use of ETSS, at the very least, the System should be accessible on a regional basis (at a locale such as Bangkok). Should local installation come to pass, a few general comments are in order.

To the user:

Utilization of any model of ETSS requires minimal background experience with computers. A user's manual has been prepare for each of ETSS' nine computer programmes, indicating the exact layout of each data card. There are relatively few data requirements (e.g. less than twenty cards for the largest models (TABRAP CONVERSE)). To make the data requirements flexible for the user, the following options have been provided:

(i) Length of projection period (five or ten years)

(ii) Choice of life-table types (empirical or model)

(iii) Choice of initial population type (real or stable)

(iv) Changing or static proportions married

(v) Changing or static marital fertility

(vi) Choice of acceptance patterns (CONVERSE)

To the computer programmer:

These models have been written in ANS FORTRAN IV and used on an IBM 360/70, a large machine. Thus, in the development of the programmes, emphasis was not on saving space as much as it was on making options available and providing well documented output. As a consequence, the largest jobs consume about two minutes of central processing unit (CPU) time.

The programmes share many subroutines. When these subprogrammes were placed on magnetic disk for direct access, the CPU requirements were greatly reduced. In preparing these programmes for international use (admittedly, after the fact of programme development), the process of "subdividing for subroutines" was carried out to the extreme. This was done in order that overlaying of subroutines can be accomplished at installations which have only limited core capacity. Following the convention for writing "generalized" programmes, all arrays of the larger programmes are stored in common. Also, variable names are assigned for device numbers (e.g., a card reader or line printer) which vary from one facility to the next.

The tables and figures of annex II depict the relationships among models and subroutines. (MORT, CONTINUE and CONTINU2 are too small to require subprogrammes.)

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a/ See reference No. 2.

Annex II

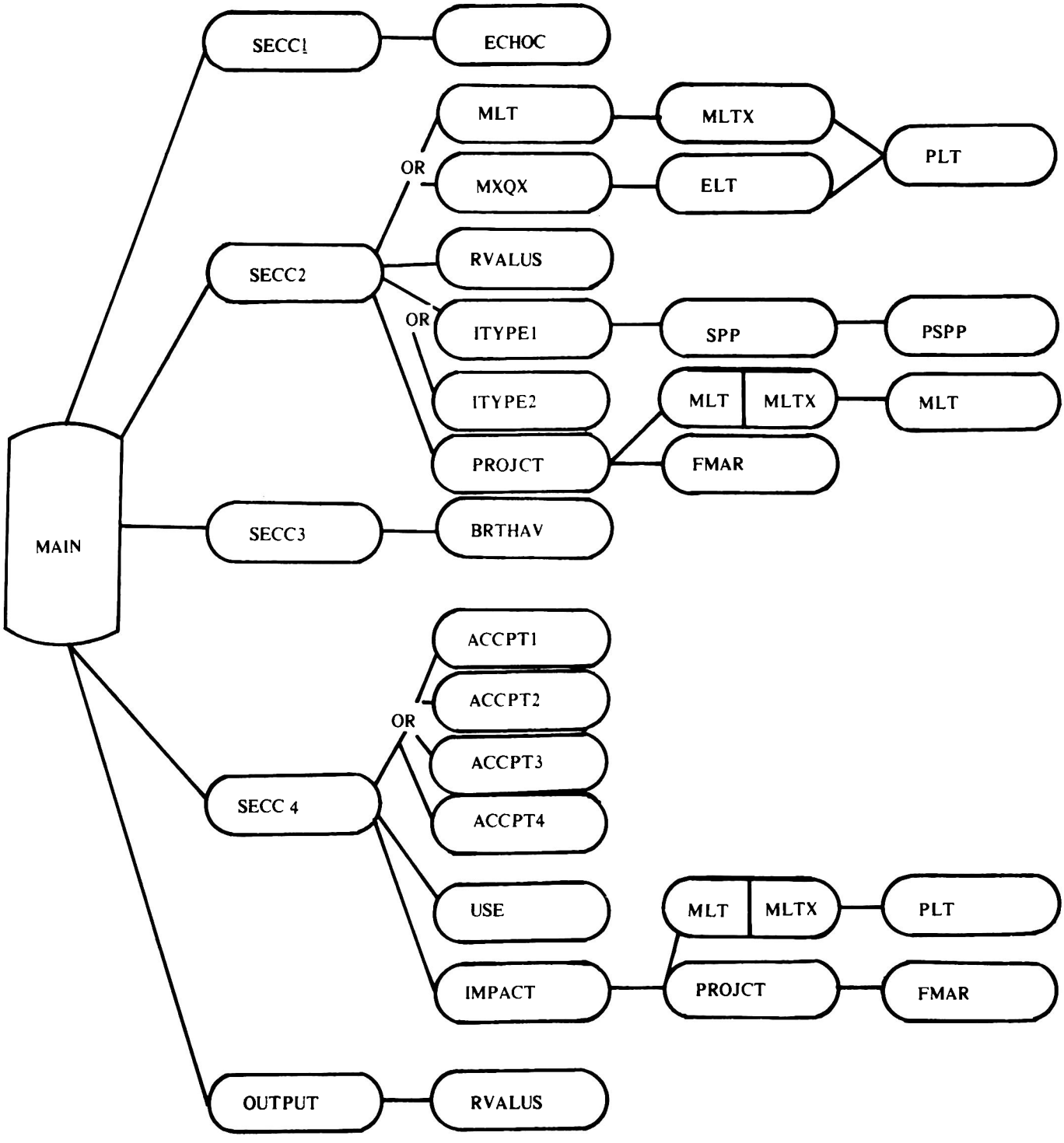
RELATIONSHIPS AMONG SUBROUTINES AND MAIN PROGRAMMES OF ETSS

Subroutine	Purpose
ACALC	(RATIOS) Prints auxiliary calculations
ACCEPT	(TABRAP) Calculates needed acceptors
ACCPT1	(CONVERSE) Calculates numbers of acceptors specified as a percentage of married women
ACCPT2	(CONVERSE) Calculates numbers of acceptors, given an annual total
ACCPT3	(CONVERSE) Calculates numbers of acceptors as a specified percentage of all eligible women
ACCPT4	(CONVERSE) Calculates numbers of acceptors from age-specific acceptance rates of eligible women
ALLYRS	(RATIOS) Computes annual births averted for all methods for each age class
BAVERT	(RATIOS) Computes annual births averted for each method
BAVUS	(RATIOS) Computes use and births averted for acceptors of each method
BIRTHAV	(CONVERSE, TABRAP, COMPETE) Determines schedules of use, potential fertility, and births averted per acceptor
COMPUT	(COMPETE) Calculates numbers of method-specific acceptors, births averted, and users
CUPLYR	(RATIOS) Computes couple-years of use for each method and year since accepting
ECHCHK	(RATIOS) Echo check of input
ECHOC	(CONVERSE) Echo check of input
ECHOM	(MACHO) Echo check of input
ECHOT	(TABRAP) Echo check of input
EKCHK4	(TABLE4) Echo check of input
ELT	(CONVERSE, TABRAP, MACHO) Calculates empirical life tables from q_x values
FMAR	(CONVERSE, TABRAP) Performs projections of numbers of married women

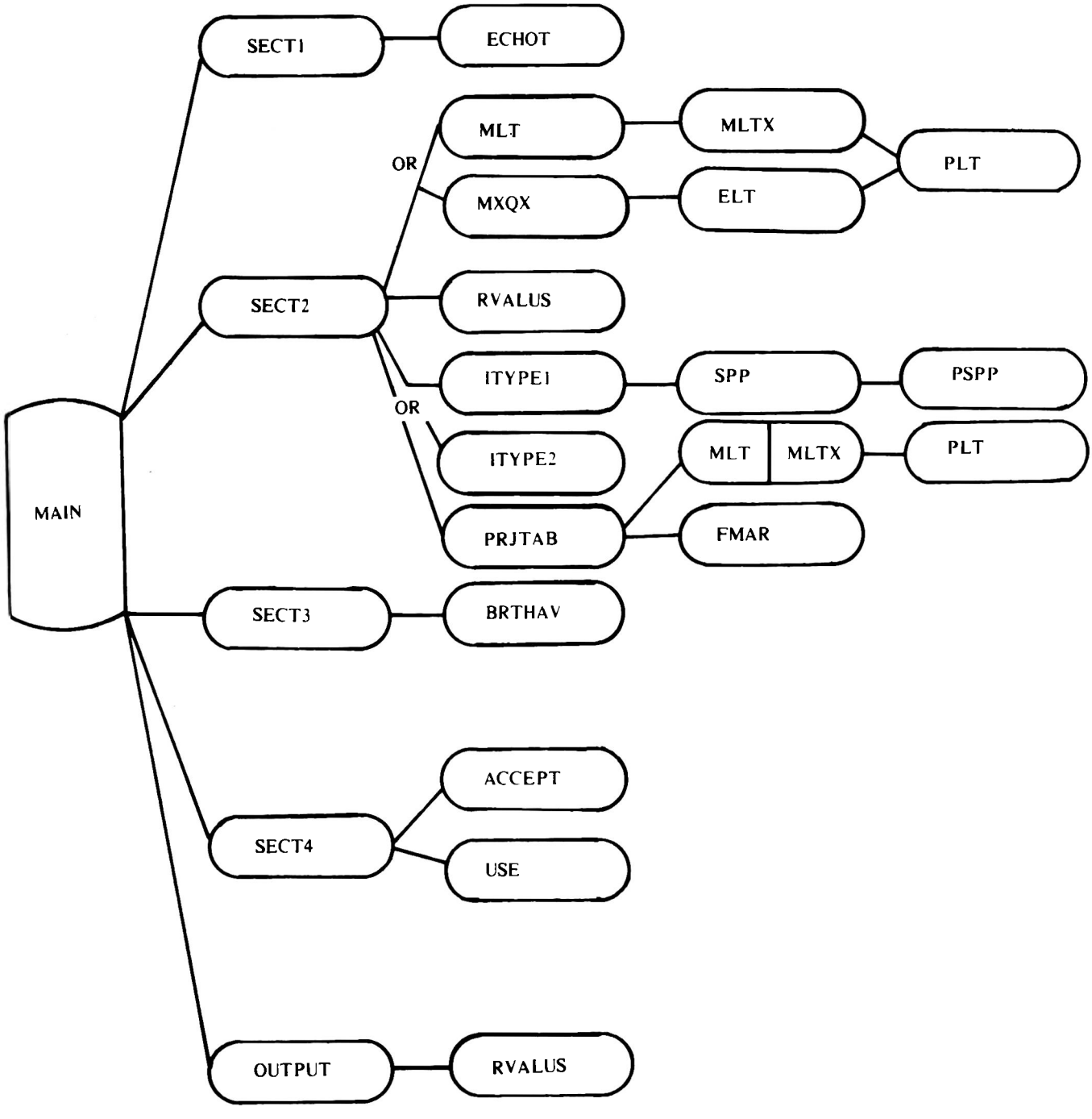
Subroutine	Purpose
IMPACT	(CONVERSE) Details the demographic impact of a family planning programme
ITYPE1	(CONVERSE, TRABRAP) Prints stable initial population age distribution
ITYPE2	(CONVERSE, TABRAP) Prints real initial population age distribution
MACALC	(RATIOS) Prints main calculations
MLT	(CONVERSE, TABRAP, MACHO) Calling routine from MLTX until specified e_0 is matched
MLTX	(CONVERSE, TABRAP, MACHO) Calculates Coale/Demeny life-tables for e_0, sex, and region
MPROJ	(MACHO) Annual population projections of males
MTYPE1	(MACHO) Stable initial population age distribution
MTYPE2	(MACHO) Real initial population age distribution
MXQX	(CONVERSE, TABRAP, MACHO) Conversion of m_x values to q_x values for an empirical life-table
OUTPT2	(TABLE4) Prints output
OUTPUT	(CONVERSE, TABRAP) Summary output tables
PFERT	(TABLE4) Calculates potential fertility
PLT	(CONVERSE, TABRAP, MACHO) Prints life-tables
POTFER	(RATIOS) Computes potential fertility
PRJTAB	(TABRAP) Five-year projection of a female population
PROJCT	(CONVERSE) Annual projection of a female population
PROP	(RATIOS) Computes proportions of acceptors of a method which belong to an age class
PSPP	(CONVERSE, TABRAP, MACHO) Prints stable populations
RATIO	(RATIOS) Calculates ratios of births averted per acceptor between a test method and a standard method
RVALUS	(CONVERSE, TABRAP) Calculates certain fertility indices, namely r, NRR, GRR, TFR, T, etc.
READ1	(COMPETE) Input of "transferred" arrays
SECC1	(CONVERSE) Section 1 for input and echo checks

Subroutine	Purpose
SECC2	(CONVERSE) Section 2 for projection without family planning
SECC3	(CONVERSE) Section 3 for use and births averted schedules
SECC4	(CONVERSE) Section 4 for acceptance and impact of acceptors
SECM	(MACHO) Section 1 for input and echo checks
SECT1	(TABRAP) Section 1 for input and echo checks
SECT2	(TABRAP) Section 2 for two population projections, (with and without family planning)
SECT3	(TABRAP) Section 3 for use and births averted schedules
SECT4	(TABRAP) Section 4 to calculate numbers of eligible women
SPP	(CONVERSE, TABRAP, MACHO) Creates a stable population from r and a life-table
USBAV	(TABLE4) Calculates use and births averted per acceptor for a particular method
USE	(CONVERSE) Projections of contraceptive users
VITAL	(MACHO) Calculation and printing of vital rates
WRITE	(COMPETE) Output of all calculated results.

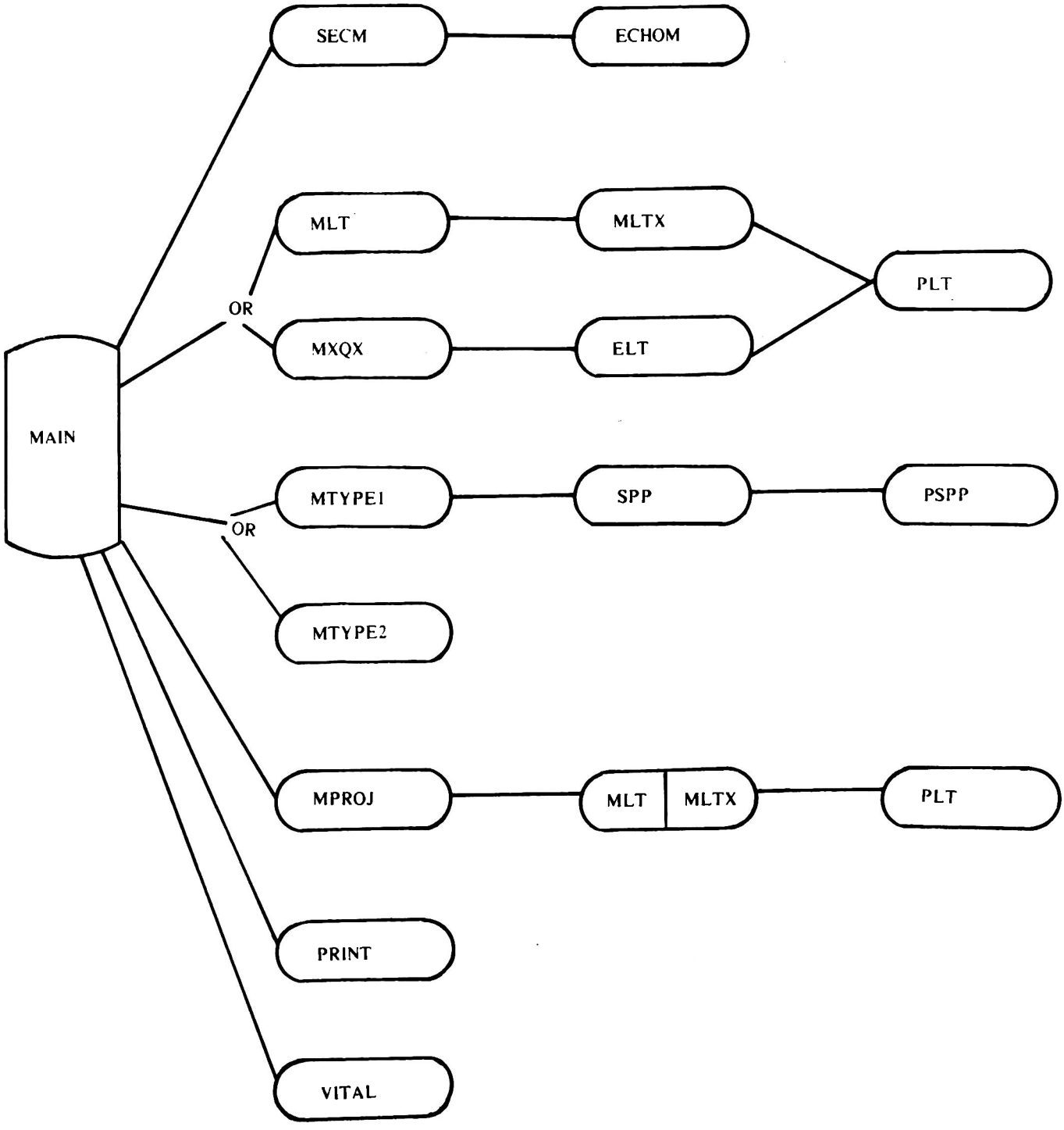
CONVERSE


MAIN
SECC1
ECHOC
SECC2
OR
MLT
MLTX
PLT
MXQX
ELT
RVALUS
ITYPE1
SPP
PSPP
ITYPE2
MLT
MLTX
MLT
PROJCT
FMAR
SECC3
BRTHAV
SECC 4
OR
ACCPT1
ACCPT2
ACCPT3
ACCPT4
USE
MLT
MLTX
PLT
IMPACT
PROJCT
FMAR
OUTPUT
RVALUS

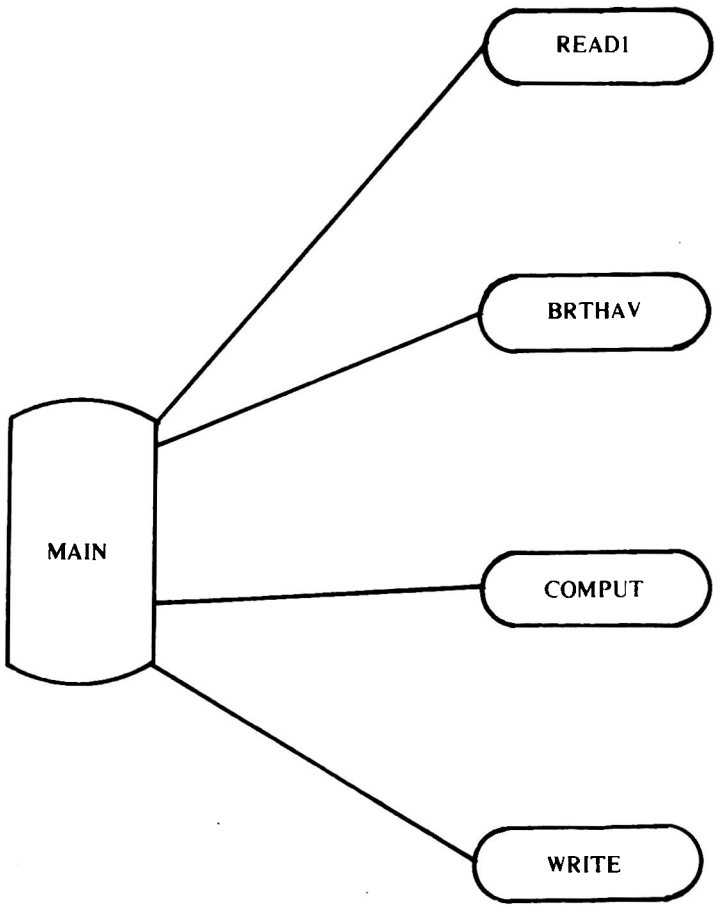
TABRAP


MAIN
SECT1
ECHOT
SECT2
OR
MLT
MXQX
MLTX
ELT
PLT
RVALUS
ITYPE1
OR
ITYPE2
PRJTAB
SPP
PSPP
MLT
MLTX
PLT
FMAR
SECT3
BRTHAV
SECT4
ACCEPT
USE
OUTPUT
RVALUS

MACHO


SECM
ECHOM
MLT
MLTX
PLT
OR
MXQX
ELT
MAIN
MTYPE1
SPP
PSPP
OR
MTYPE2
MPROJ
MLT
MLTX
PLT
PRINT
VITAL

COMPETE



RATIOS

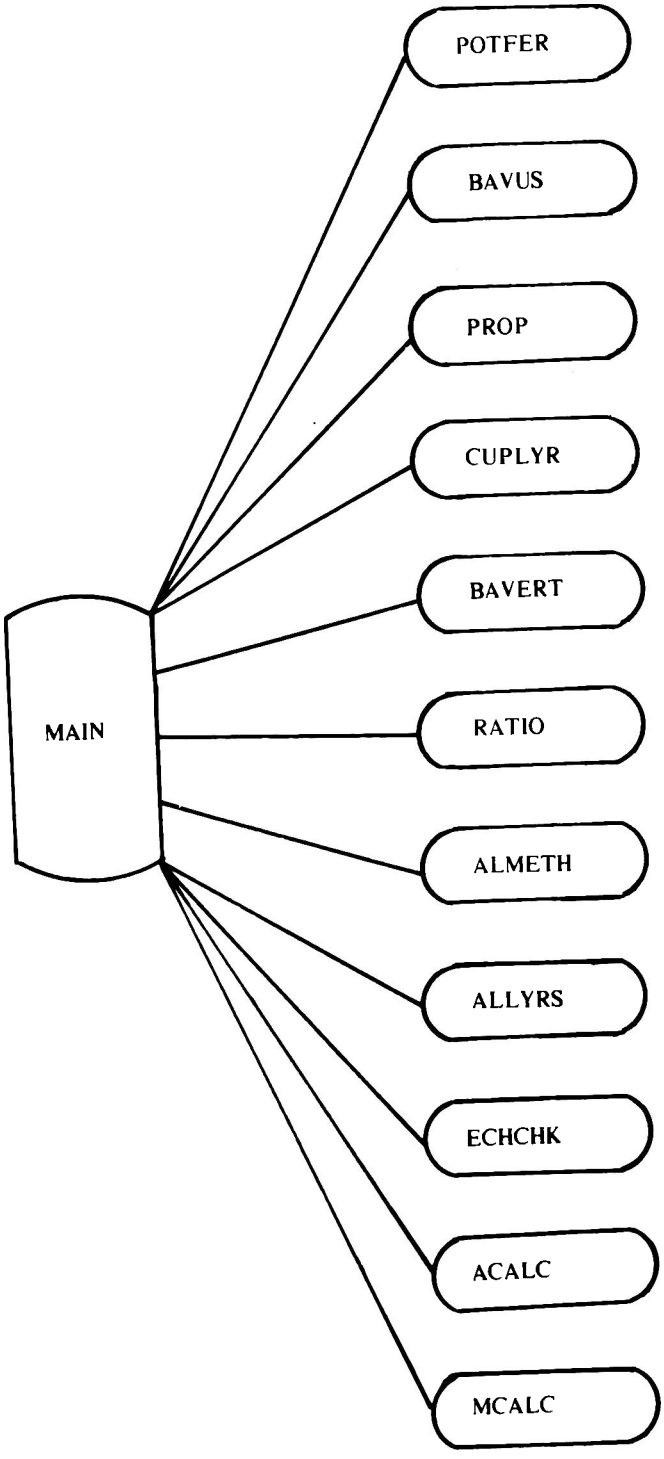
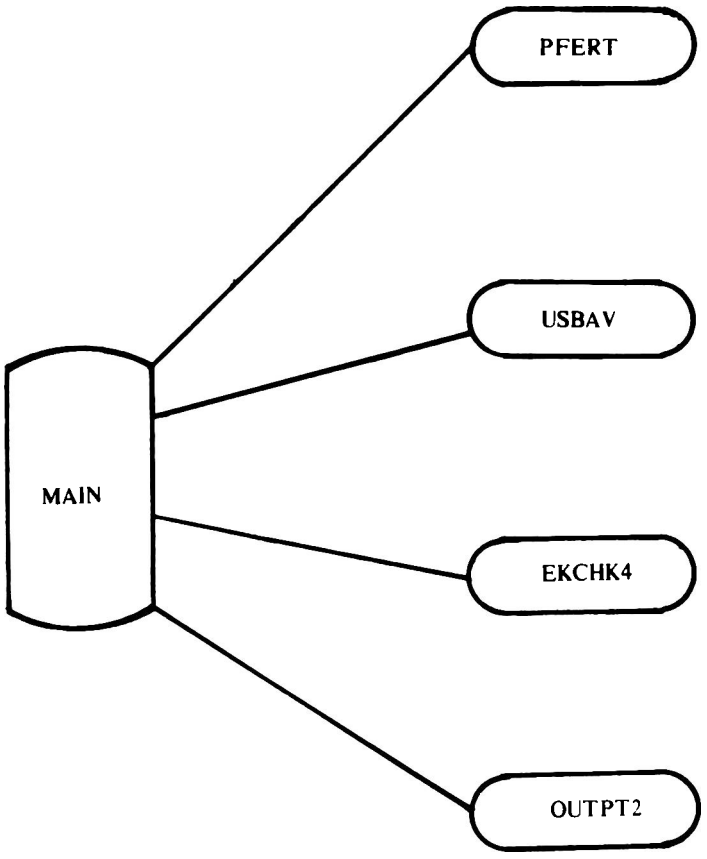

MAIN
POTFER
BAVUS
PROP
CUPLYR
BAVERT
RATIO
ALMETH
ALLYRS
ECHCHK
ACALC
MCALC

TABLE 4



III. A COMPARISON OF THE THREE VERSIONS OF TABRAP/CONVERSE (PRINCIPAL MODELS OF THE ESCAP TARGET-SETTING SYSTEM) *

Introduction

Three versions of the CONVERSE/TABRAP package exist at present. The first is the "standard version", which existed at the time of the September meeting of the Study Directors and which is the object of attention of other sections of this final report. The second is the "revised version", which includes four extensions strongly advocated by the Study Directors, namely: (i) providing for users of contraception at the start of the target period; (ii) permitting the mix of contraceptive methods to be changed annually; (iii) expanding the maximum number of methods from four to six; and (iv) providing additional acceptance options in CONVERSE defined in terms of annual age-specific acceptance rates among all women, among married women, or among married women currently not using a method. A third "abortion version" has been developed in an independent research project funded by the Population Council, under the direction of Mrs. Dorothy Nortman.1/

The computer programming of both the revised and abortion versions has been carried out by Sharon Kirmeyer.

It is the objective of this brief, technical paper to compare the three versions. The first section outlines the devices used to: encompass abortion; incorporate initial users; permit changes of method emphasis; expand the number of possible methods; and provide for two additional acceptance options, respectively. The sizes of programmes are next compared. The additional simplifying assumptions involved in the two newer versions are identified. The advantages and disadvantages of the three versions are discussed briefly. Several charts appear in the annexes: these include check lists of inputs for the three versions as well as simplified flow diagrams of the two more recent models. The flow diagrams pertaining to the standard models were included in the second technical paper in the present volume.2/ Finally, some suggestions are offered to anyone who wishes to programme an alternative users' option in such a way that the number of users of the final target year can be converted into the initial year's users of a new target period.

Methodologies to expand options (including abortion)

Because any component projection deals with births rather than pregnancies, it is inherently awkward to incorporate induced abortion into TABRAP and CONVERSE. An induced abortion is not equivalent to averting a birth, for two main reasons. First, the pregnancy deliberately interrupted might have ended in a spontaneous foetal death. Secondly, even if the pregnancy might have ended in a live birth, the abortion is shortening gestation by several months, and abbreviating the period of post-partum anovulation, with the result that the abortion is putting the woman at the risk of another pregnancy sooner than would have otherwise been the case.

Thus the fractional number of births averted per induced abortion is problematic. One estimation approach has been to utilize a macrosimulation model to compare under fixed conditions of contraception and fecundity the mean number of live births per woman in a cohort, not resorting to induced abortion, with the mean number of induced abortions per woman in a cohort deliberately interrupting every pregnancy that is not terminated by an early miscarriage. The results of this theoretical work suggest that in the absence of contraception, an induced abortion averts approximately .4 births whereas an abortion followed by one year of successful contraception is worth about .9 births averted.

Instead of these two extreme cases, what is more likely to occur is a mixed picture (figure 1) with some women adopting contraception immediately after the abortion, and others not; the former do not always continue their practice of contraception for a minimum of a year. If continuation of contraception is represented by a modified negative exponential function, then births averted per induced abortion, plus the ensuing fractional year of contraceptive practice, are given by:

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* Prepared by Sharon Kirmeyer, Brown University.

1/ A more complete description of the treatment of abortion in this component projection approach is found in Nortman and others, *Model Relationships Between Birth Rates and Control Practices* (Population Council, forthcoming).

2/ Sharon Kirmeyer, "The ESCAP Target-Setting System: A computerized component projection approach", background paper prepared for the Population Division, ESCAP, August 1975.

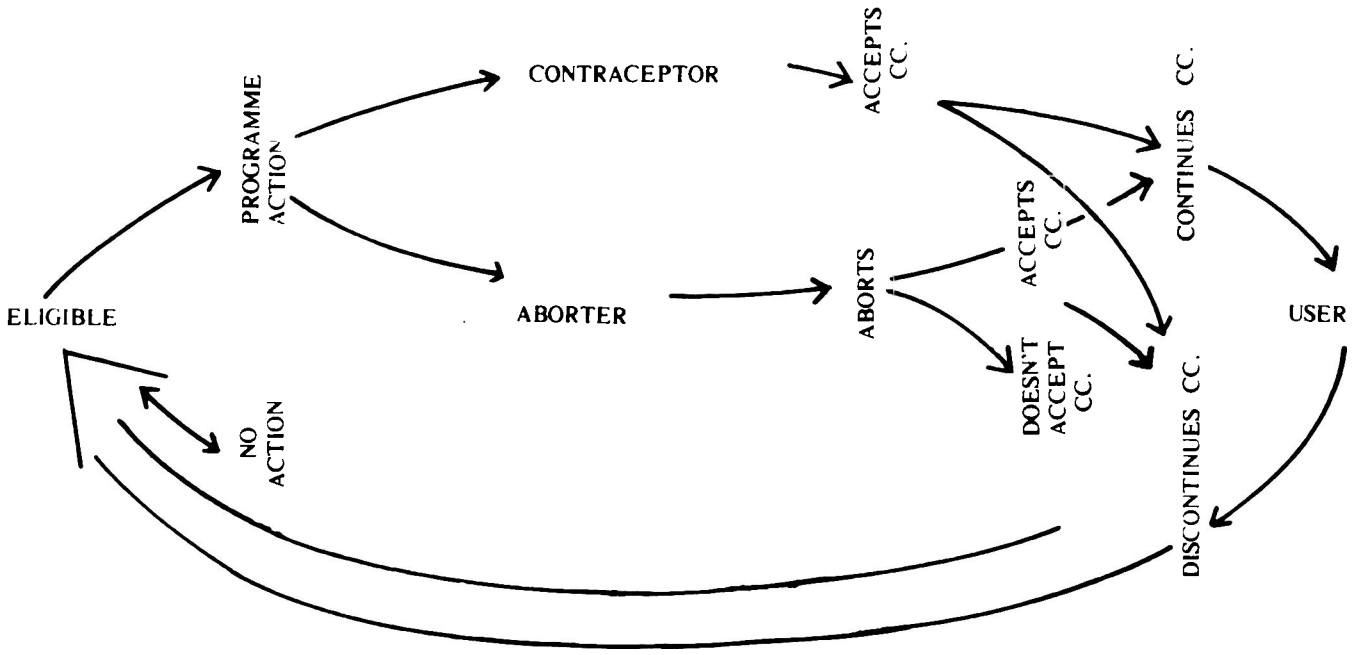


Figure 1. Dynamic classification of "married" women, 15-44 by family planning status

$$B = 0.9\mu + 0.4(1 - \mu)$$
$$u = Pk$$

where P is the proportion of women who follow their abortion with contraception and k is mean per capita duration among such women of contraceptive practice during the first post-abortum year, averaged over the different contraceptive methods.

Following this 12-month period immediately after abortion, the treatment of contraceptive practice — notably its conversions into proportions using couple-years of use and births averted per aborter — is the same as with non-aborters, with one qualification. A different mix of post-abortion contraceptives may be assigned to aborters, this mix typically placing a heavier weight on the "better methods" than in the case of the contracepting population as a whole; or again, aborters may follow their abortions with the same mix of methods as non-aborters, but may be more or less faithful in practising these methods.

The alternative acceptor options are straightforward in the case of CONVERSE. Respecting "contraception only" women, annual acceptance frequencies are defined in terms of:

1. A total absolute number of acceptors;
2. A percentage of all married women;
3. A percentage of all eligibles (married women not currently practising a method);
4. Age-specific acceptance rates among eligible women. Among potential aborters, abortion frequencies are assigned annually as:

(a) A total absolute number of abortions;
(b) Age-specific abortion rates.

The approach taken in TABRAP is not so straightforward. For each target year t, it is calculated how many births have to be averted. This birth total is further classified into births whose prevention is assured by acceptance of contraception during year t-2 or earlier and residual births to be averted. These residual births to be averted are next subdivided into those to be accounted for by acceptance of contraception during year t-1 and those to be accomplished by abortions during year t-1 (see figure 2.) This last allocation is controlled by an input item.

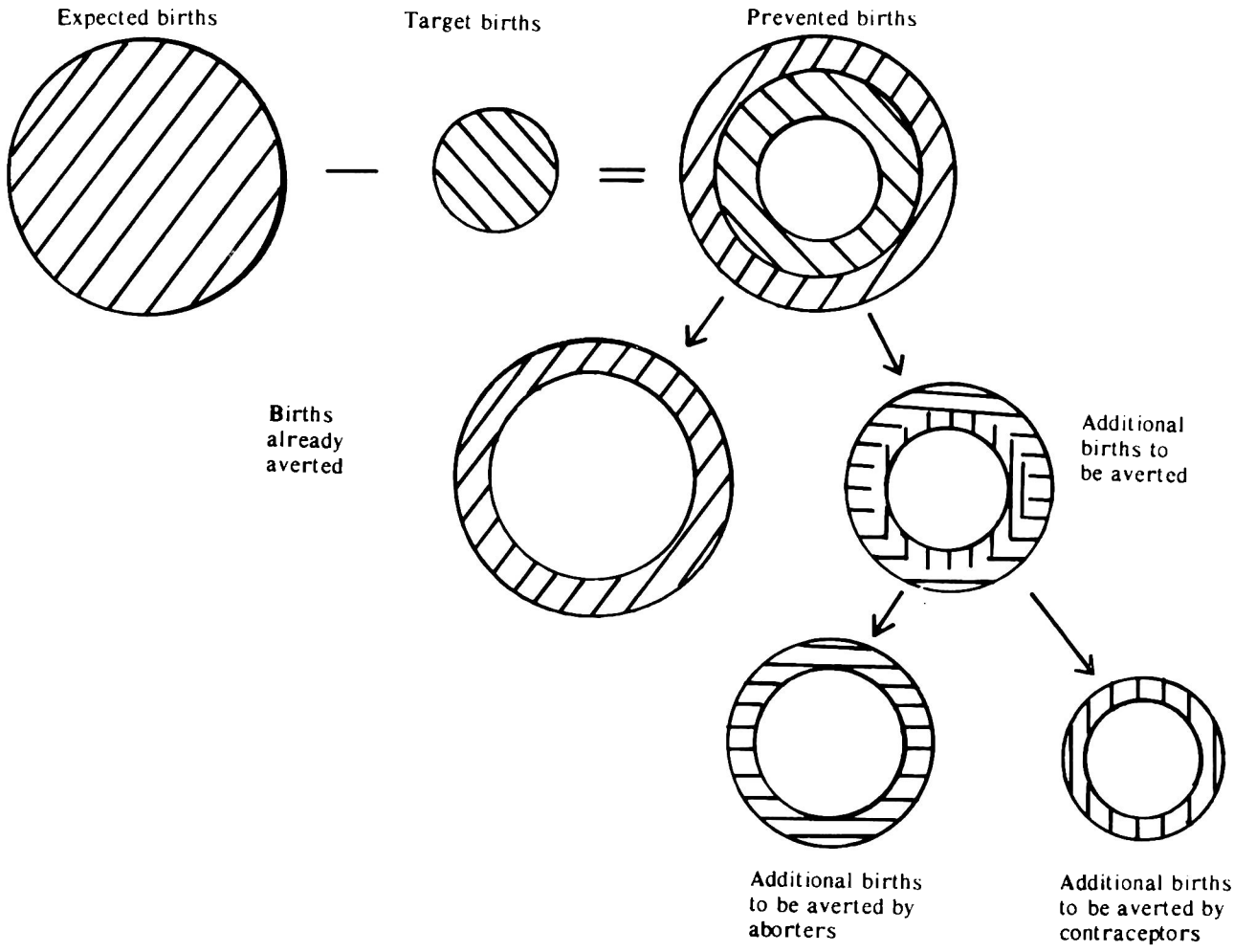


Figure 2. Functional representation of birth categories

Inclusion of initial contraceptive users

With the provision for contraceptive practice at the beginning of the target period in TABRAP and CONVERSE, a major shortcoming of ETSS has been eliminated. The device attempting to simulate this ongoing practice by means of a "build-up period" in the first ETSS version proved clumsy. Resulting acceptor targets during the first half of the projection period were often quite erratic when simulating a build-up period. Figure 3 contrasts acceptor targets to meet the same birth rate goals (from TABRAP runs, with and without initial users input).

This feature is extremely important as most countries participating in the target-setting study have a significant number of couples already practising contraception provided through the public and/or commercial sector. The procedure used is sufficiently unique to require a more detailed discussion than is provided for the other methodological extensions.

The provision for initial users may have an ambitious objective, or a much more limited intent. The ambitious objective entails using the output of one run as input to the next run. This permits adjusting each year's CBR goal in reference

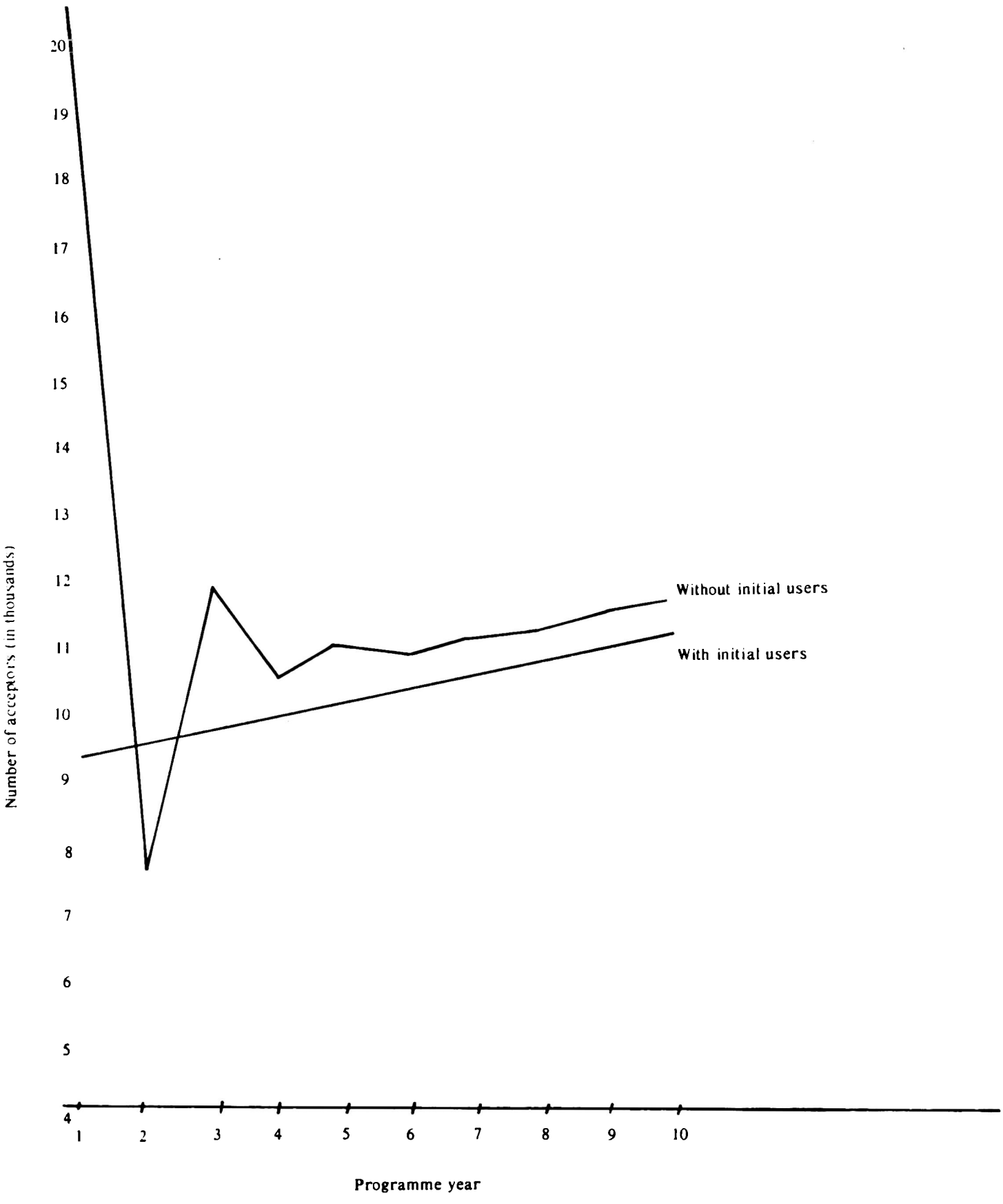


Figure 3. Number of contraceptive acceptors required to meet the same crude birth rate goals

to the actual programme performance of previous years. A more modest objective provides for initial users in the aggregate, as reported in service statistics, surveys, etc. Both approaches have the advantage over using the "build-up period" technique by neither over-estimating eligible women, nor setting an excessive acceptance target for the initial programme year and allowing an estimate of potential fertility of non-users.

These two objectives require different types of data. The latter can be an aggregate estimate of users with the computer model disaggregating these users to estimate other measures of family planning utilization which are required for the projections. The former necessitates a large number of input cards (= 90) to duplicate precisely the output of a foregoing run of TABRAP or CONVERSE. This large data requirement is necessary to fill those several arrays dealt with in the normal operations of the basic models, namely:

1. Mid-year users of the current programme year by current age;
2. Couple-years of use projected to the current programme year, by current age;
3. Births averted in the current programme year attributed to age of users;
4. Births averted in the current programme year by age and year of acceptance,
5. Initial population distribution from earlier years with and without new acceptors; and
6. Expected births in the initial year of the new projection, both with and without new acceptors.

Because of these onerous data requirements, this more ambitious initial users' option has not been implemented. For anyone wishing to implement it, some guidelines on the necessary reprogramming are outlined in annex III.

Representing initial users in an aggregate manner can take several forms. Among these are:

(a) Total initial users;
(b) Total initial users of each contraceptive method; or
(c) Total initial users, by age class.

The classification of users in any given year is more commonly reported by method than by age. While requesting more data than a simple total, method specificity greatly increases the validity of family planning user projections. Thus, initial users by method is the input requested by TABRAP/CONVERSE.

The manipulation of enumerated users in order to fill the projected arrays of mid-year users, births averted and couple-years of use relies on information also required by the other parts of the model. To specify initial contraceptive use, one needs only to input total users of each method to activate this option.

The following steps are applied to each contraceptive method under the simpler static mix of methods option.

1. A weighted average of continuation rates is determined. The weighting is by the distribution of acceptor ages.

2. A key objective is to estimate a number of acceptors of each method to be subjected to the continuation function in order to derive their contributions to various arrays. The only means to estimate these acceptors with given information is through reverse survival. Reverse survival could span any number of years, but for the purposes of this programme, acceptors are resurrected to one year immediately prior to year "1" of the computer programme:

$$\text{Total Acceptors}^{M} = ({}^{M}\text{Users}) \cdot (A.e^{(R)})$$

where M = the respective contraceptive method
A = average proportion not immediately discontinuing use
R = average annual rate of discontinuation.

Reverse survival over longer periods of time increases irregularities initiated by the averaging of continuation rates and the aging process.

It must be emphasized that the notion of "acceptors" is merely a convenience to permit forward projections of various arrays. The acceptors concept is justified as the negative exponential employed in projecting contraceptive use stipulates a constant probability of discontinuation.

3. These estimated acceptors of a particular method are an underestimate of those actually using in the "acceptance year" because some of those in the 40-44 group have passed the age 45 limit of programme users. Accordingly, "acceptors" are inflated by a factor of one-fifth of the assumed proportions of "acceptors" 40-44.

4. These inflated total "acceptors" of a contraceptive method are distributed by age according to the initial age distribution of acceptors being used as input to the main model.

5. Schedules of per acceptor births averted, couple-years of use and proportions using are established for each method type.

6. Couple-years of use, births averted and mid-year users are extrapolated through the length of the target period on the basis of these per capita schedules and the age distribution of "acceptors."

Once the necessary arrays have been derived for each method, they are combined, since the routine mechanics of ETSS do not distinguish methods, once acceptance has taken place. The mid-year users in the initial year are compared with those originally input. As the weighting and aging process necessarily introduces slight variations when one attempts to infer age-specific quantities from the aggregate, all arrays are then adjusted for this deviation.

The reader may well wonder why the aforementioned "more ambitious" option would require six sets of inputs while the present procedure entails only four arrays. The aggregate initial users option may start at any one point in history, it does not need to look back at earlier experience or computer runs. But the year by year option, by its nature, needs consistency with earlier runs. An essential part of that consistency is including the diverging population projections: one with and one without family planning.

Changing method mix

The annual allocation of contraceptive methods is usually a dynamic phenomenon. The distribution of methods is affected by the state of contraceptive technology as well as by programme intentions. In this light, a static mix of methods could produce very unrealistic results in either estimating acceptors required (TABRAP) or demographic impact (CONVERSE).

An option designed to allow for a changing emphasis among methods calls for two types of input:

1. The distribution of methods in each target year.

Example:

Year	IUD	Pill	Condom	Sterilization
1	33%	40%	20%	7%
2	33%	50%	17%	0%
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

2. A fixed age distribution of acceptors of each type of method.

If the changing mix option is exercised, these two data types are utilized by subroutine "DISTRB" to produce two basic arrays, namely:

1. The relative popularity of methods within age classes (CODIS), and
2. The initial age pattern for all acceptors (ACPDS).

From these arrays, "per acceptor" schedules of births averted, proportions still using at each mid-year interval and couple-years of use are generated for each annual mix of methods, thereby setting the stage for later steps of estimating demographic impact or number of acceptors.

If the option is specified as "static", CODIS and ACPDS are calculated as in the basic version and only one set of "per acceptor" schedules need be computed.

Expansion of number of methods from four to six

Having an upper limit of four possible methods in the models was a shortcoming for family planning programmes which provided more than four methods — when those methods exhibited distinct acceptance age and continuation characteristics. In many cases (exemplified by the inclusion of oral contraceptives, injectables, IUDs, condoms, and sterilization) combining two methods into one category such as "anovulants" for injectables and pills) would be unwarranted when data is available for each method and when the data indicates unique parameters for each method.

A second purpose is served by expanding the number of methods to six. The additional number of methods provides sufficient room in which to treat abortion as a "method". The impact of an abortion in terms of births averted may be equated to couple-years of use times the potential fertility of the aborter. The users' manuals for the revised ETSS

provide a technique for assigning continuation rates which will generate the appropriate couple-years of use for either an abortion alone, or an abortion followed by one year of contraceptive practice.

This abbreviated technique of including abortion as a method permits a wider range of options for the revised ETSS. However, a more refined analysis of abortion as a family planning strategy requires the "abortion" version of the models.

Additional acceptance options

Whenever the data are available, users of the models will wish to utilize age-specific rates of acceptance rather than aggregate rates of acceptance for all women 15-44 years of age. The standard version provided only one age-specific option, formulated as age-specific acceptance rates among eligible women (eligibility being restricted to married women not currently using a method). Acceptance options have been expanded to include age-specific acceptance rates among married women, as well as age-specific acceptance rates among all women regardless of marital status.

Size comparison

Often the limiting factor in the adoption of a computer package is the size of that package compared with the size of the available computer. A way to overcome space ceilings is to utilize the "overlay" capacity of a machine. In overlaying, necessary workspace is the sum of total bytes of the main programme its largest subroutine and its COMMON area. This space is used as each subroutine is called and placed in the available area. Table 1 defines each model in terms of its size, with and without the overlay procedure.

As seen from table 1, the standard and revised versions of TABRAP and CONVERSE were designed to achieve an efficient use of space — both through reliance on putting all array arguments in the COMMON area and by dividing the main programme into sectional subroutines. One finds that the standard version of ETSS is smallest when run either in a single pass, or when overlaid. The abortion model is the largest of the three when run either way.

Figures 4-9 indicate the calling order of subroutines for the three variations of the two models. (figures 4 and 5 are updated from their analogues in S. Kirmeyer's earlier paper.[3/]) The calling order is essential for correct alignment when attempting to overlay.

3/ *Ibid.*

Table 1.
Size comparisons of the three versions of TABRAP and CONVERSE
(in bytes)

	Main	Largest subroutine	Common space	Total: With overlay	Total: Without overlay
TABRAP					
ETSS—standard	676	"OUTPUT" — 11,128	13,788	25,592	76,124
ETSS—revised	2,304	"OUTPUT" — 9,176	15,276	26,756	87,138
Abortion model	49,628	"OUTPUT" — 10,676	1,668	61,972	102,468
CONVERSE					
ETSS—standard	696	"OUTPUT" — 11,128	13,788	25,612	82,214
ETSS—revised	2,376	"OUTPUT" — 9,176	15,276	26,828	101,998
Abortion model	51,558	"TAB2" — 10,696	1,668	63,902	118,282

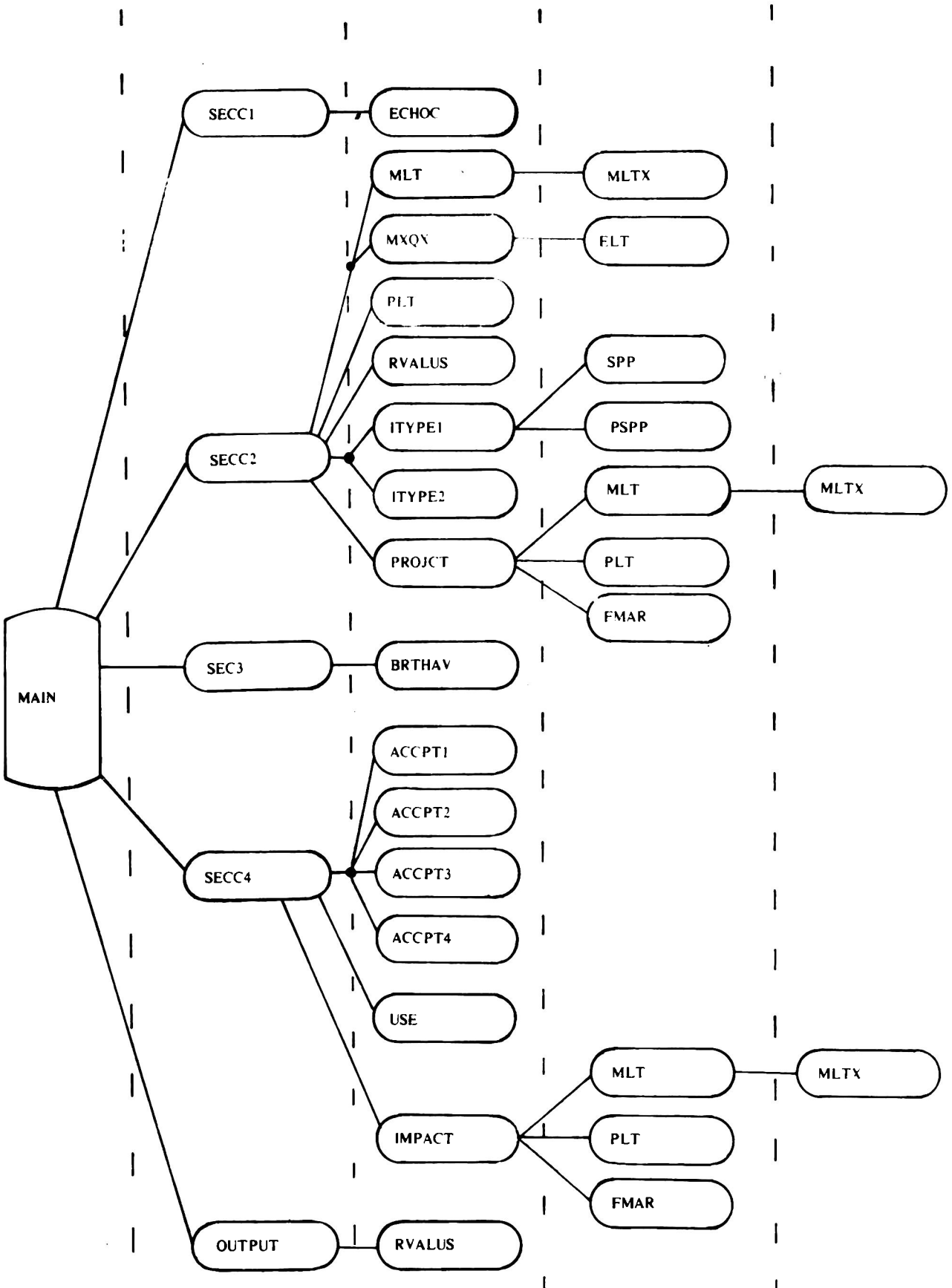


Figure 4. CONVERSE — Standard

Note: Denotes decision.

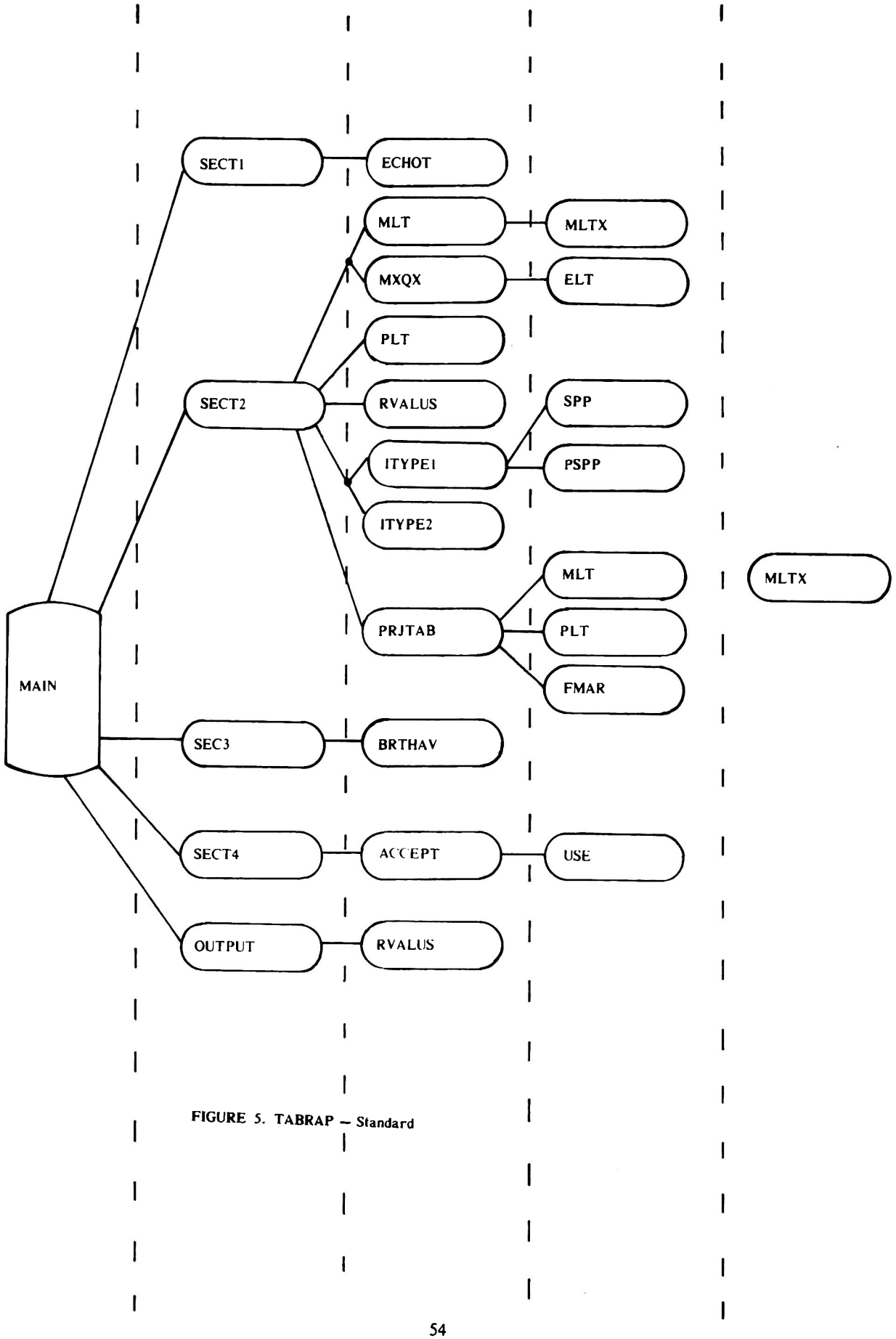


FIGURE 5. TABRAP – Standard

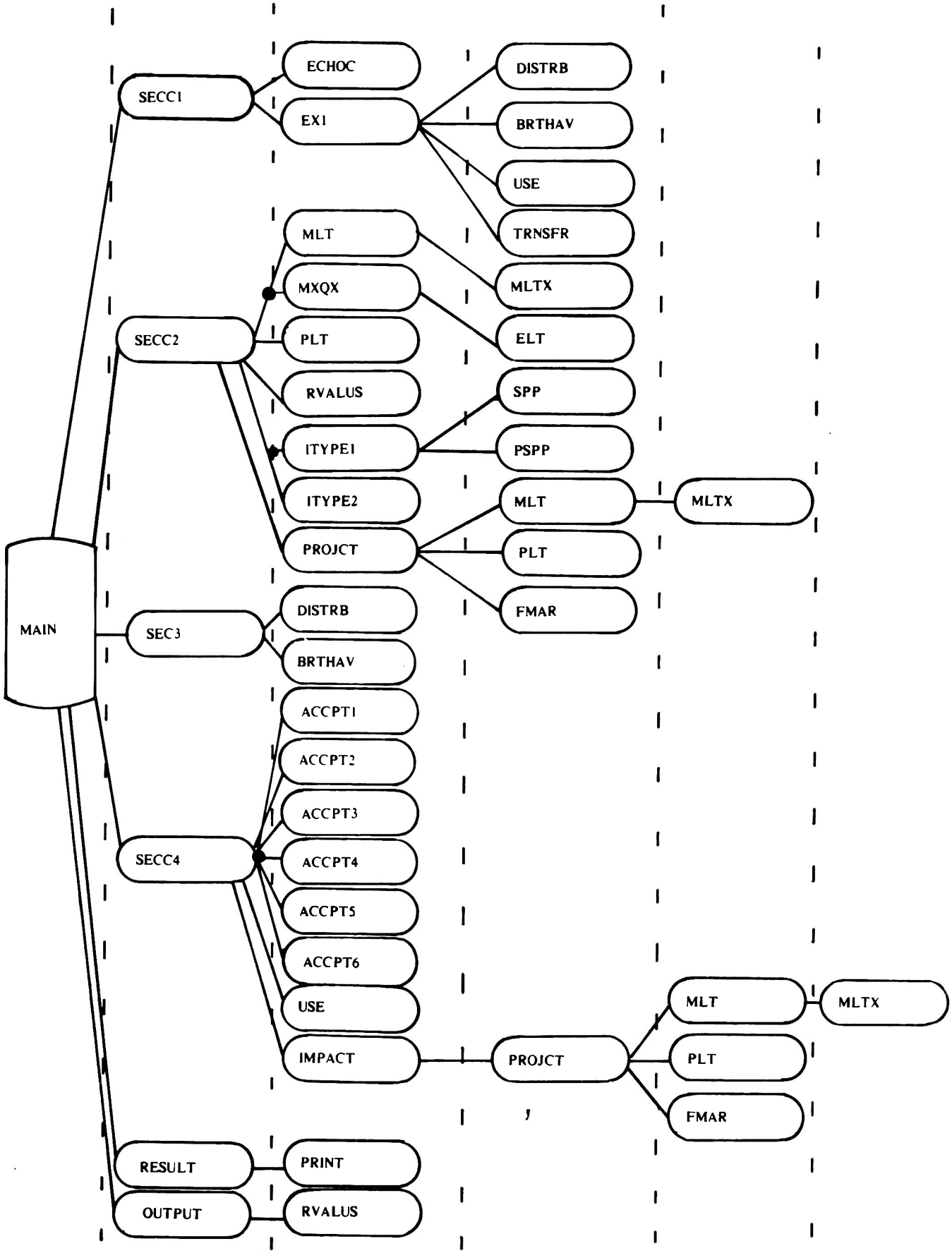


Figure 6. CONVERSE — Revised

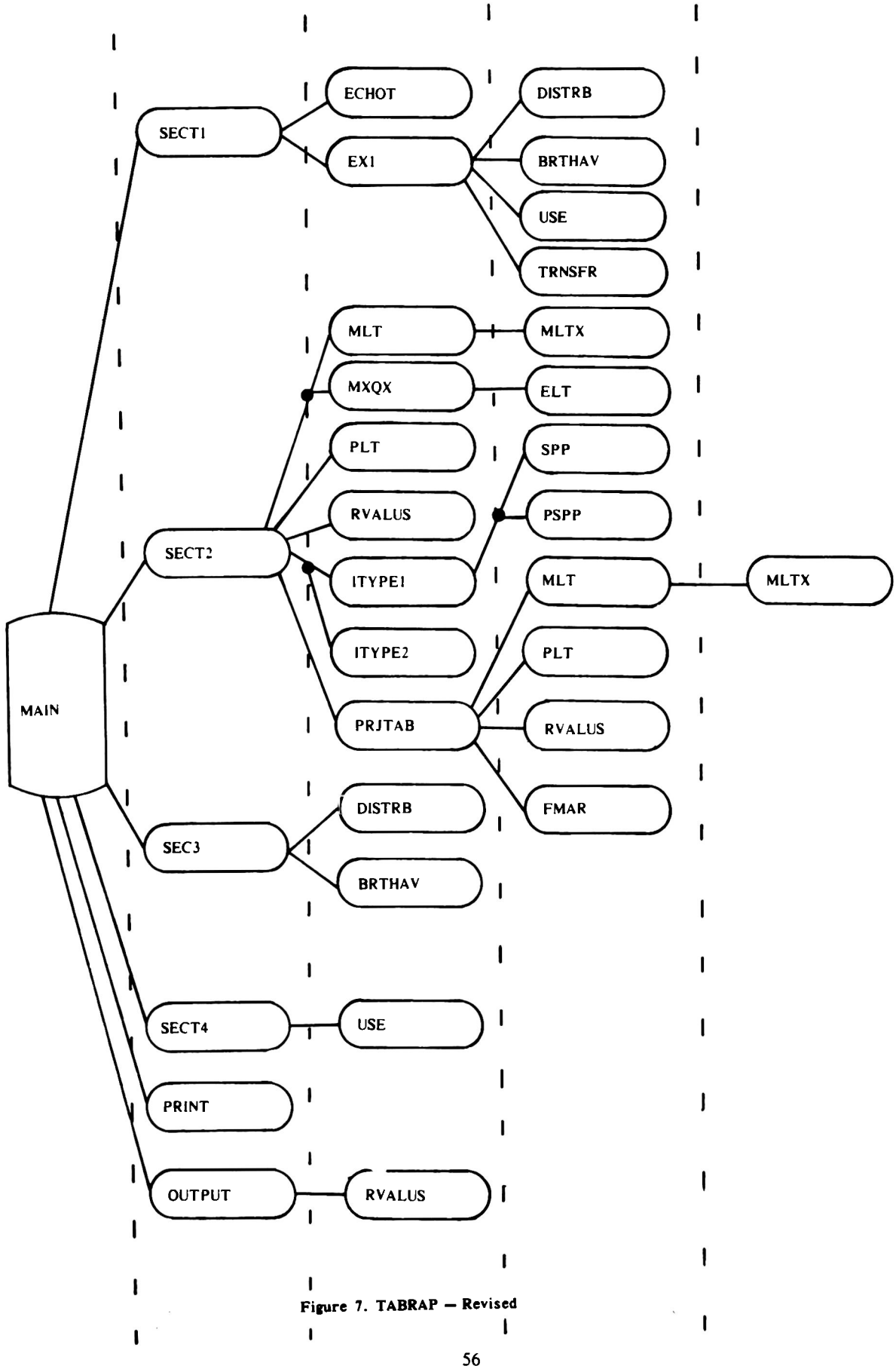


Figure 7. TABRAP — Revised

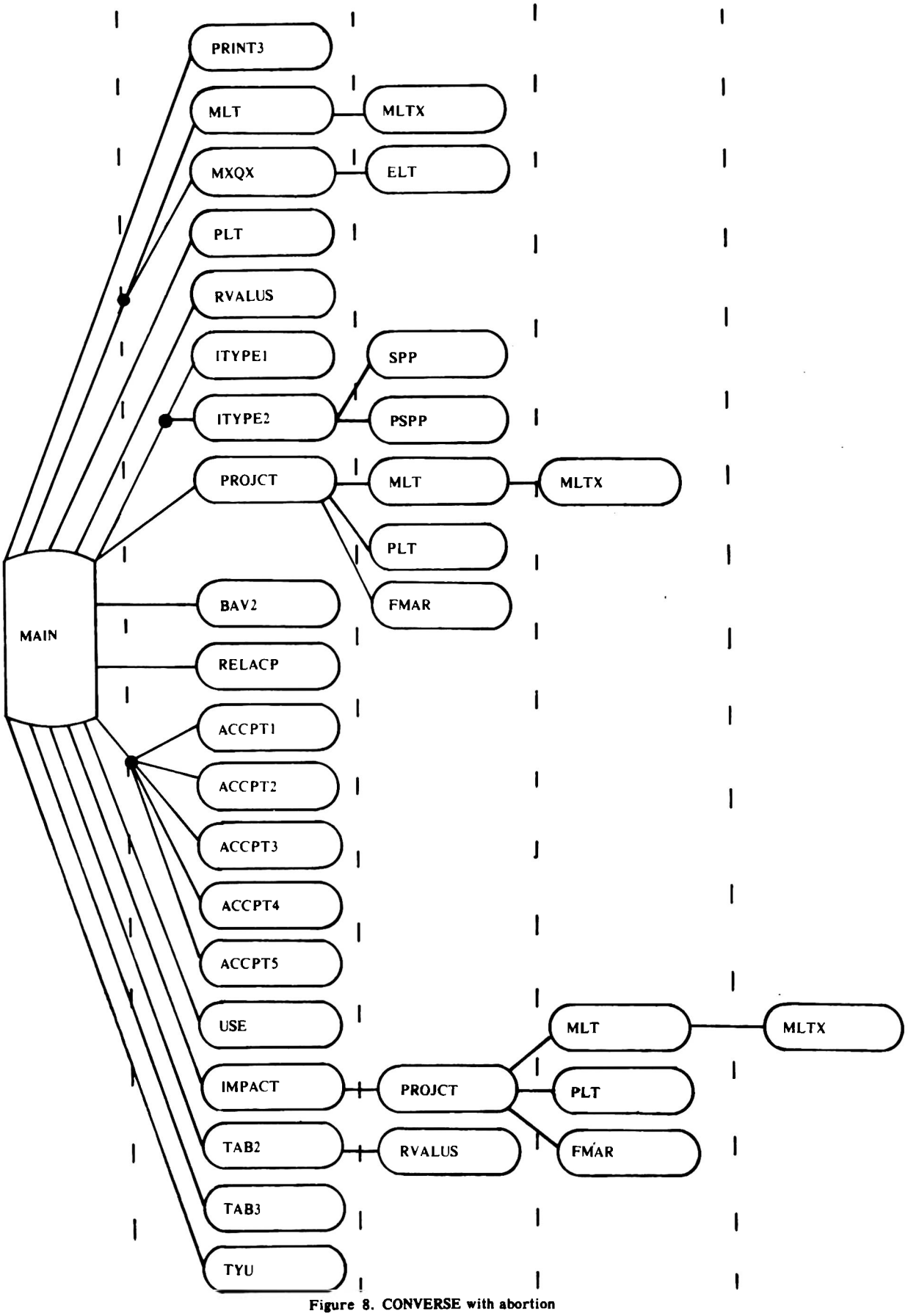


Figure 8. CONVERSE with abortion

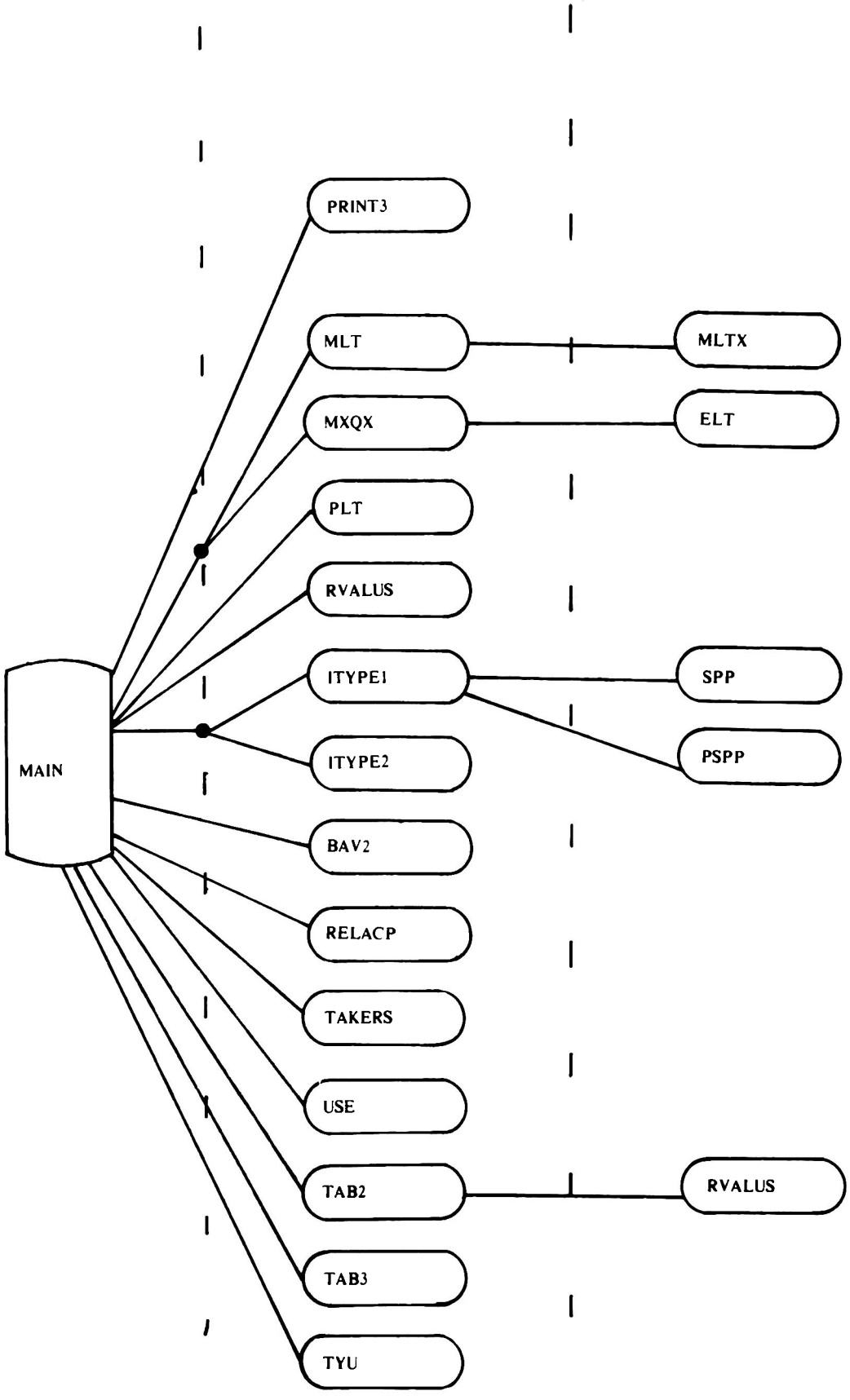


Figure 9. TABRAP with abortion

Assumptions peculiar to changes in methodologies

Abortion

1. Lifetime births averted are allocated to the year following an abortion. The estimates of 0.9 and 0.4 births averted by an abortion are actually those prevented in the remaining years of a woman's reproductive span. However, TABRAP/CONVERSE attribute them to the year following the abortion. This treatment is made necessary by the lack of appropriate function to map their net impact over a succession of years. Since the "0.9." and "0.4" figures are merely input, other values may be postulated. Also, this input is age-specific, allowing the user to account for age-related influences.

2. Abortion eligibility has no unique definition. Eligibility for abortion is defined in the same way as eligibility for contraception, namely, that the woman be married and not currently using contraception. It is logically possible that the demand for aborters may be set so high that it exceeds the supply of pregnant women in a particular age group. To bar this contradiction, women eligible for abortions would have to be redefined as married and pregnant, calculated by lagging age-specific fertility rates by nine months predicated on no abortion.

3. The relative number of abortion acceptors to contraceptive acceptors is determined by an input value which allocates births to be averted between these two groups. In this model, two modes exist by which a woman initiates contact with a family planning programme by seeking an abortion or by requesting contraception. TABRAP estimates the residual number of births which need to be prevented in year t by acceptors in the preceding year t-1. (These residual births are those above and beyond those which will be prevented by acceptors in year t-2 and earlier.) TABRAP divides these residual births to be averted between abortion and contraception acceptors by a single input constant.

An alternative treatment would have been to input a value representing a percentage of pregnancies to terminate by abortion and have the contraceptive acceptors make up the difference of residual births to be averted.

4. No provision for initial users. It is recognized that countries which include abortion as a family planning strategy are also countries whose programmes have been in existence for a number of years. Nevertheless, this version does not make provision for initial users as the abortion and revised versions were developed semi-independently of each other. The combination of the two features, e.g., initial users and abortion, would require a very substantial reprogramming job.

Initial users option

1. Initial users input is method-specific. The input for the initial users option is the total number of users at the start of the projection period for each method. This type of data, which determined the procedure for projecting these users into future programme years, was chosen over age-specific data, because the latter are generally unavailable. A third alternative, namely, total users, can give very unreliable results as it would not provide empirically based values to weight the several methods.

2. Continuation rates are the same for past acceptors as for acceptors in the main programme. It is assumed that the contraceptive continuation of earlier users will equal that of women in the projection period. Continuation rates for existing users are empirically grounded, whereas the choice of continuation rates for the projection years is speculative. Hence, it is arbitrary whether one assumes that future rates will equal past rates or will acquire distinct characteristics.

3. Users in year "0" are treated as acceptors. In order to mesh with the prevailing mechanics of TABRAP and CONVERSE, acceptors in the projection year "0" are derived by means of reverse survival from the input of existing users in year "1." Alternatively these prior acceptors could have been "reverse-survived" over a duration equal to the mean number of years of use respective to each method. This alternative has the advantage of distributing "acceptors" among several pre-projection years, thus presenting a more realistic pattern of user discontinuation. However, two biases would be introduced which increase over time. One bias stems from the necessity of using age-weighted continuation rates for reverse survival and the other from attrition of users due to the aging process.

Relative advantages and disadvantages

Each version may be criticized for its characteristic set of assumptions, large size or somewhat complicated set of data requirements. It will have to be the job of another reviewer to contrast the ETSS approach against other projection and evaluation models. The following paragraphs stress major advantages and disadvantages of each model relative to the other.

ETSS standard version

The leading advantage of the standard version is that it has undergone extensive debugging and testing from repeated application. This advantage cannot be minimized when a potential user seeks to implement a large computer model. Another advantage is that thanks to the seven auxiliary programmes developed contemporaneously with it, a balanced system for processing and interpreting data relevant to national family planning programme target setting and evaluation results. A third advantage is that this version requires the least amount of memory space for total storage and use.

The main disadvantages are, of course, certain simplifying assumptions. The desire to eliminate these assumptions has inspired the two variants of this version.

ETSS revised version

This version goes the farthest toward overcoming shortcomings of the standard version by including initial users, allowing annual changes of method mix, further diversifying acceptor options and raising the maximum number of family planning methods to six from the ceiling of four existing in the other versions. This expansion of methods permits the possibility of treating abortion as a method, yielding a complete package of options for the user of ETSS.

These extensions are designed not to burden the ETSS user with great new data demands. For the initial users option, one needs only total users of each method. Changing the annual mix of methods requires data which are normally found in target-setting reports – annual distribution of methods and age distributions of acceptors of each method recorded at one point in time.

Revisions, however, exact a cost. The auxiliary programme COMPETE loses utility because it cannot account for initial users. Also, the revised models have been tested in only a limited number of applications, which raises the possibility that internal inconsistencies have not yet surfaced.

Abortion version

The abortion model includes abortion as a family planning strategy for the first time in a component projection scheme. The advantage of this extra capability for CONVERSE is clear enough. However, in the case of TABRAP, it is an open question whether it is appropriate or even ethical to stretch the concept of target setting to the point where annual quotas of abortions are being set. The present methodology begs the question of whether there are sufficient pregnant women in each age group to abort in order to meet crude birth rate goals. Furthermore, a certain amount of clairvoyance is required to input the value which allocates "residual births to be averted" between abortion and contraceptive acceptors. A potential user of the abortion version might be advised to use TABRAP for strictly analytic rather than pragmatic purposes.

Its other drawbacks – excessive programme size, lack of an initial users option, no changing method mix, a ceiling of four methods, and incompatibility with the programme "COMPETE" are remediable with sufficient person-hours of computer programming.

ANNEX I

Data requirements for each version of ETSS

	TABRAP			CONVERSE		
	S	AB	R	S	AB	R
I. DEMOGRAPHIC SETTING FOR A FEMALE POPULATION						
A. Size of population	X	X	X	X	X	X
B. Initial age distribution						
1. Stable (no distinguishing input)	X	X	X	X	X	X
or						
2. Empirical (percentage age distribution)	X	X	X	X	X	X
C. Proportions married 15-44						
1. Constant over time						
or						
2. Changing (inputting initial and terminal proportions)	X	X	X	X	X	X
D. Sex ratio at birth	X	X	X	X	X	X
E. Age-specific marital fertility of "Non-users"						
1. Constant over projection	X	X	X	X	X	X
or						
2. Changing (inputting initial and terminal rates)	X	X	X	X	X	X
F. Proportions sterile in each age group, 15-44	X	X	X	X	X	X
G. Mortality						
1. Model (region and annual e_0°)	X	X	X	X	X	X
or						
2. Empirical (age-specific death rates)	X	X	X	X	X	X
II. DEMOGRAPHIC GOAL						
A. Length of target period						
1. Five years	X	X	X	X	X	X
or						
2. Ten years	X	X	X	X	X	X
B. Annual crude birth rate goals	X	X	X			

	TABRAP			CONVERSE		
	S	AB	R	S	AB	R
III. PROGRAMME FACTORS						
Specification of contraceptive methods						
A. Annual rate of discontinuing method	X	X	X	X	X	X
B. Proportion not immediately discontinuing method	X	X	X	X	X	X
C. Overlap with post-partum amenorrhea	X	X	X	X	X	X
D. Over-all mix of methods						
1. Static (initial age distribution of all acceptors plus relative popularity of methods within an age class of acceptors)	X	X	X	X	X	X
or						
2. Changing (annual distribution of all methods accepted, plus initial age distribution of acceptors of each method)			X			X
E. Number of methods						
1. Four maximum	X	X		X	X	
or						
2. Six maximum			X			X
Abortion availability						
F. Post abortion contraceptive methods		X			X	
G. Annual rate of discontinuing those methods		X			X	
H. Proportion not immediately discontinuing those methods		X			X	
I. Initial age distribution of aborters		X			X	
J. Relative popularity of contraceptives within age classes of aborters		X			X	
K. Births averted by a single abortion		X			X	
L. Births averted by an abortion plus one year contraceptive period		X			X	
M. Share of births averted by acceptors attributed to aborters		X				

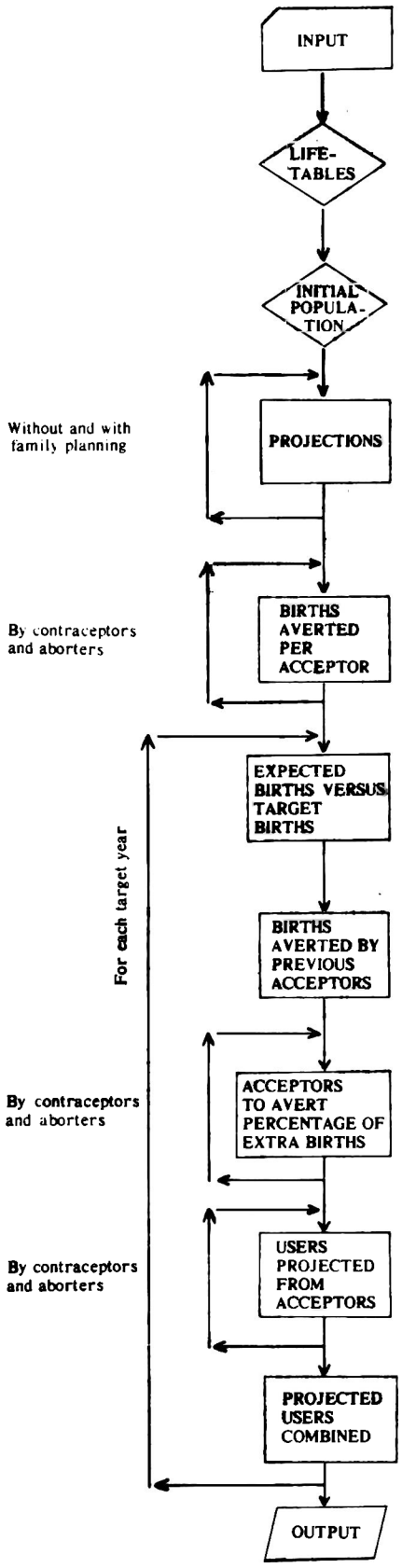
	TABRAP			CONVERSE		
	S	AB	R	S	AB	R
Acceptor targets						
N. Contraceptive acceptors						
1. Total annual target				X	X	X
or						
2. As an annual percentage of all married women				X	X	X
or						
3. As an annual percentage of all eligible women				X	X	X
or						
4. Annual age-specific acceptance rates of married women						X
or						
5. Annual age-specific acceptance rates of eligible women						X
or						
6. Annual age-specific acceptance rates of eligible (i.e. married and not currently using) women				X	X	X
O. Abortion acceptors						
1. Total annual abortions					X	
or						
2. Annual age-specific abortion rates					X	
Initial users						
P. (If any) Number of initial users of each method			X			X

Note:

S – Standard ETSS version
AB – Abortion version
R – Revised ETSS version

ANNEX II

Flowchart of TABRAP procedures — abortion version



Data are read in, followed by the computation of proportions fecund and projected proportions married, age-specific fertility and age-specific marital fertility rates. Echo checks of input data.

Calculation of life-tables, as either:
Empirical: from age-specific death rates, or Model: Coale/Demeny, requiring e_0^* and region. Only model life-tables may change over time.

Establish initial population as:
Real: female age distribution, or
Stable: from the intrinsic R and life-table values.

Five-year age cohorts are survived annually through applying life-table values. Annual births:

1. Without family planning: age-specific fertility rates to females of reproductive age

2. With family planning: application of CBR to total population

Calculations for two types of acceptors: aborters and contraceptors: Births averted per acceptor following calculation of proportions using, women-years of use and potential fertility for each year following acceptance.

For each target year, acceptors in preceding year are found:

Expected births minus target births yield births to prevent.

Some births have been averted by past users, found by summing the births averted in the current year from each past acceptor cohort.
Calculations for two types of acceptors: aborters and contraceptors:

Residual births to be averted by subtracting births already prevented from total to be averted. Of these, a predesignated percentage will be averted by aborters and the rest by contraceptors. Sufficient acceptors to prevent these births are summoned from pools of eligibles (non-users).

Calculations for two types of acceptors: aborters and contraceptors:

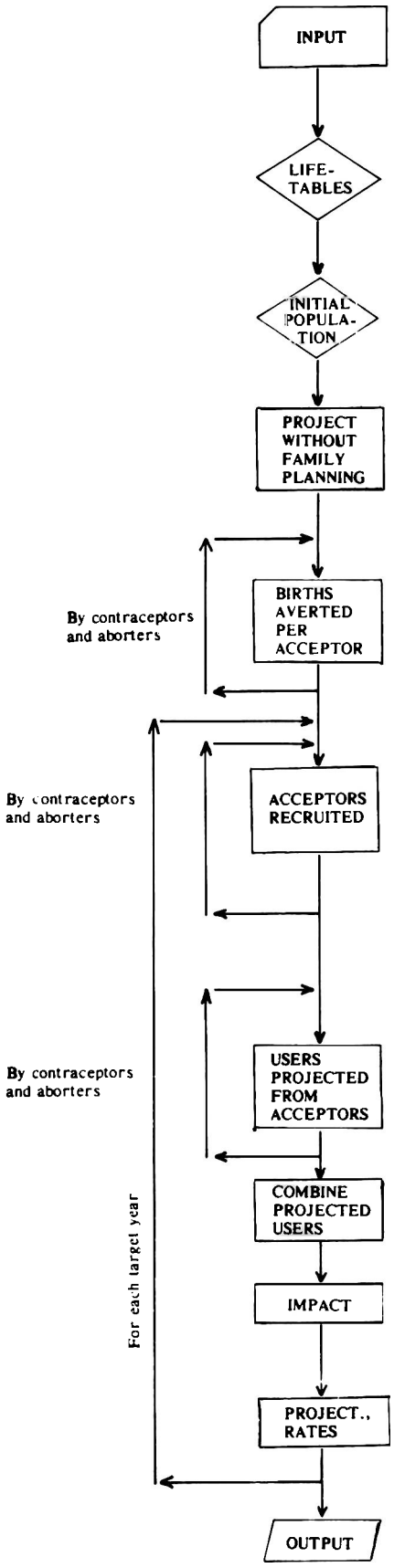
Attrition schedules are applied to these acceptors to determine how many will remain using in future years.

Projected users who accepted as aborters or contraceptors are combined to give total users.

End of loop calculating annual acceptors.

Summary tables of use and acceptance schedules.

Flowchart of CONVERSE procedures — abortion version



Data are read in, allowing the computation of several initial arrays: proportions fecund, annual proportions married, age-specific fertility and age-specific marital fertility rates. Echo check of input data.

Calculation of life-tables:
Empirical: from age-specific death rates, or
Model: Coale/Demeny, needing region and e_0^*.
Only model life-tables change over time.

The initial population is established as either:
Real: from female age distribution, or
Stable: calculated from life-table values and the intrinsic R.

Annual projection of female population for duration of programme length. "Current" life-table values are applied to preceding year's population to survive a five-year age group. Annual births from applying age-specific fertility rates to respective females. Calculation of vital rates without family planning introduction.

For two types of acceptors: contraceptors and aborters:

Births averted per acceptor from calculation of proportions still using, women-years of use and potential fertility.

For each target year:

For contraceptors, applies one of four acceptance options:
1. Total annual number of contraceptive acceptors
2. Contraceptive acceptors as an annual percentage of all married women
3. Contraceptive acceptors as annual percentage of all eligible women
4. Annual age-specific contraceptive acceptance rates of eligibles

For aborters, application of one of two acceptance options:
1. Total annual number of abortions
2. Annual age-specific abortion rates

For each type of acceptor: contraceptors and aborters:
Number of contraceptive or abortion users = current and continuing acceptors (from application of attrition schedules).

Projected total users = "continuing aborters" plus "continuing contraceptors."

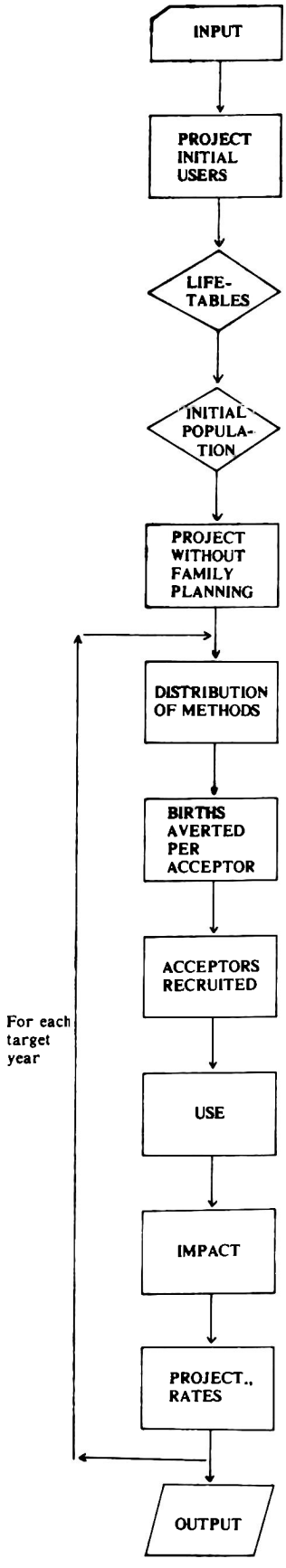
Calculation of expected and prevented births to yield allowed births, i.e. fertility under a family planning programme. Prevented births: sum of births averted by old and new acceptors.

Population projection under family planning, once corresponding births are known. Also, vital rates under family planning.

End of loop which estimates the annual impact of family planning acceptors on demographic indicators.

Output to summarize annual trends in users and acceptors.

CONVERSE flow diagram, revised version



Data are entered allowing the computation of several initial arrays: proportions fecund, annual proportions married, age-specific fertility and age-specific marital fertility rates. Input data are printed out.

Births averted and the attenuation of initial users are projected through the target period.

Calculation of life-tables, either empirical (from age-specific death rates) or model (Coale/Demeny). Only model life-tables change over time.

The initial population is established as either "real," from female age distributions, or "stable," calculated from life-table values and an intrinsic growth rate. Annual projections of female population for the duration of analysis are made. "Current" life-table values are applied to the preceding year's population to project a five-year age group. Annual births are calculated by applying age-specific fertility rates to females. Calculations of vital rates without new acceptors are made.

New acceptors lower fertility in each target year:

Methods are distributed among age classes of acceptors to satisfy the annual mix specified.

Births averted per acceptor from calculations of proportions still using, women-years of use and potential fertility are determined.

For each target year, this part of the programme applies one of six acceptance options to eligible women:

1. Acceptors as a percentage of married women,
2. Annual total numbers of acceptors,
3. Acceptors as percentage of eligible women,
4. Age-specific acceptance rates of eligible women,
5. Age-specific acceptance rates of all women, or
6. Age-specific acceptance rates of married women.

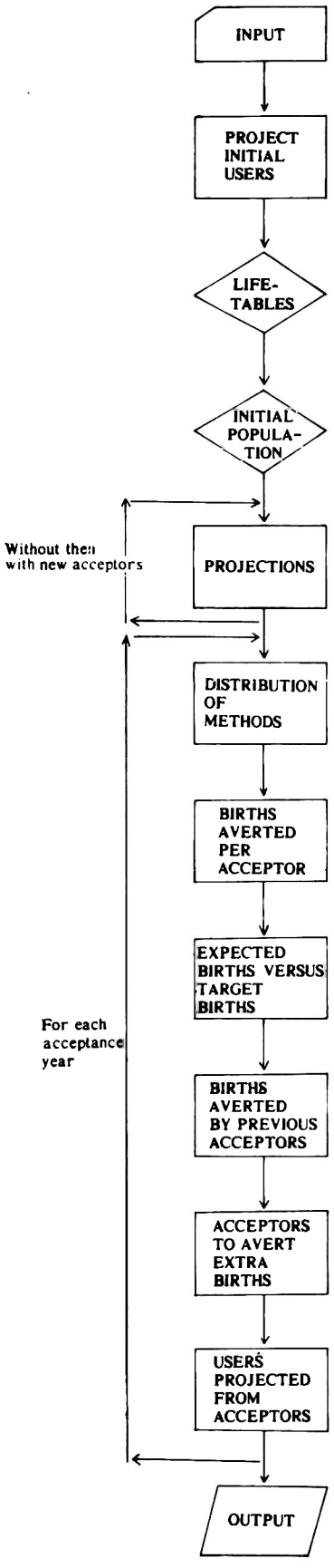
Number of users = current and continuing acceptors.

Calculated are numbers of expected and prevented births to yield allowed births, i.e. fertility under a family planning programme. Prevented births equal the sum of births averted by old and new acceptors.

The population is projected with additional acceptors, once corresponding births are known, and vital rates with additional acceptance are determined.

Generation of output to summarize annual trends in users and acceptors is made.

TABRAP flow diagram, revised version



Data are entered, followed by the computation of proportions fecund and projected proportions married, and age-specific marital fertility rates. Input data are printed.

Projected use and births averted from initial users.

Calculations of life-tables, as in CONVERSE, are performed.

An initial population, as established in CONVERSE, is calculated.

Two projections, without then with additional acceptors, are made.

Five-year age cohorts are projected annually through applying life-table values.
For each target year, acceptors in the preceding year are found.

Distribution of methods corresponding to specified annual method mix.

Births averted per acceptor following calculation of proportions using, women-years of use and potential fertility for each year following acceptance are calculated.

Expected births minus target births yields births to be prevented.

Some births have been averted by past users; these are found by summing the births averted in the current year from each past acceptor cohort.

The number of residual births to be averted is calculated by subtracting births already prevented from the total to be averted. Sufficient acceptors to prevent these births are drawn from the pool of the eligible women.

Attrition schedules are applied to these acceptors to determine how many will remain using in future years.

Summary tables of use and acceptance schedules are generated.

ANNEX III

Suggestions for the would-be reviser (who wishes to programme another initial users option which utilizes results of earlier runs)

A. Source of input data

1. The current output of TABRAP and CONVERSE needs to be expanded to obtain BAS, TUS, TUM, BTA for years projected beyond the projection period printed in existing tables. This can be done by adding the following statement directly before the STOP card in both MAIN programmes:
   CALL TRNSFR (IO, IPROJ, MM, IPROJ)
   (where the first IPROJ dictates the length of the arrays; the second positions them).

2. The other required data have been printed in tables midway through the output:

   (a) The female population distribution (absolute numbers, not percentages) from the last year of the projection, both without and with "new acceptors." Call these POP1 and POP2 respectively.
   (b) Births expected and births resulting in the last year of the projection period; label these B1 and B2, respectively.

B. To programme the new initial users option, one has three concerns: (a) to input data from earlier runs; (b) to print it as a check; (c) to initialize the female population distribution.

1. Add a new initials option, XUSE = 2. The choice among initial users options should be reflected in ECHOC and ECHOT.
2. Write a new subroutine, EX2 which:
   (a) Reads BAS, TUS, TUM, BTA, POP1, POP2, B1 and B2;
   (b) Prints as an echo check the preceding arrays. Utilize TRNSFR to print arrays BAS, TUS, TUM, BTA:
   CALL TRNSFR (IO, IPROJ, MM, O)
3. Set up initial female populations and their respective year 1 births.

(a) For CONVERSE, subroutine SECC2:

1. Insert the following statements following "MM=6":

```
IF (XUSE.NE.2) GO TO 20
DO 10 N = 1, 18
10 POPD (1,N) = POP1 (N)
TBCL = B1 / DENOM
BC (1) = TBCL
GO TO 30
20 CONTINUE
```

2. Follow the "IF (ITYPE)" stateinents with:

```
30 CONTINUE
```

3. Insert the following statements directly prior to the FORMAT statements:

```
IF (XUSE.NE.2) GO TO 220
DO 210 N = 1, 18
210 POPD (N, 1) = POP2 (N)
TBCL = B2 / DENOM
BC (1) = TBCL
220 CONTINUE
```

(b) For TABRAP, subroutine SECT2

1. Following MM=5, insert:

```
IF (XUSE.NE.2) GO TO 20
DO 10 N = 1, 18
IF (M.EQ.1) POPD (N,1) =
POP1 (N)
IF (M.EQ.2) POPD (N,1) =
POP2 (N)
10 CONTINUE
IF (M.EQ.1) TBCL = B1 / DENOM
IF (M.EQ.2) TBCL = B2 / DENOM
GO TO 30
20 CONTINUE
```

2. Follow the "IF (ITYPE)" statements with:

```
30 CONTINUE
```

Part Three
Annexes

ANNEX I

INPUT DATA REQUIREMENTS FOR THE ESCAP TARGET-SETTING SYSTEM (ETSS)

The amount of data required by the ESCAP Target-Setting System is to a certain degree flexible according to the availability of data for a given country. The minimum amount required, however, is rather substantial and in some cases may prohibit the use of ETSS. The specific kinds of data which ETSS requires are as follows:

Forecasts of mortality. Forecasts can be estimated from the retrospective mortality data and the age compositions supplied with the required data, but studies specifically designed to estimate future mortality rates would be expected to provide better estimates.

Age distributions in one-year or five-year groupings for each sex from age zero onward including classification by marital status for appropriate ages;

Life expectancies for as many years as possible in the past and for the present year provided for a number of years sufficient to provide a pattern of mortality trends;

Most recently calculated life tables for males and for females or, if not available, sufficient mortality data to permit the choice of a life-table from among those of the Princeton Regional Model Life-Tables; 1/

Latest estimates of crude birth rates and of age-specific fertility rates for the population, and estimates of fertility trends;

Figures or reasonable estimates for as many years as possible of the numbers of users of each contraceptive method offered by the public family planning programme;

Total acceptance rates for each contraceptive method, or preferably, age-specific acceptance rates;

Continuation rates for each method, preferably by age group;

Past, present and future acceptor targets by method, government demographic goals, and changes and reasons for changes in targets and goals. In addition it is useful to know the mathematical rationale for establishment of targets and goals.

These eight kinds of data taken as a minimum permit the determination of how far existing contraceptive acceptor targets will go toward achieving demographic goals, and conversely, what possible increases in targets are required to achieve goals. However, these determinations can be made with greater degrees of precision and assurance by the incorporation of additional data if they are available. In addition to those already mentioned, the methodology is programmed to permit the use of the following kinds of data as options:

1/ A.J. Coale and P. Demeny, *Regional Model Life-Tables and Statistic Populations* (Princeton, Princeton University Press, 1966).

Distributions of age at first marriage. Though the ETSS methodology can be applied either with age-specific fertility rates or with marital age-specific fertility rates, the latter are more useful since changes in marriage patterns which affect fertility can be accounted for in estimates of future fertility.

The distributions of duration of post-partum and post-abortem amenorrhea, and time of contraceptive acceptance after birth or abortion. These also are seldom-found data but if available can be used productively in discounting contraceptive protection for the overlap of contraceptive use with an amenorrheaic state.

Age-specific abortion rates and data on duration of pregnancy at the time of induced abortion. If abortion data are not available, the abortion practices can be accounted for implicitly but not as precisely in prevailing fertility rates.

Acceptance data by method (preferably age-specific) for commercial-sector users of contraception. To an extent, the effects of this too can be assumed in prevailing fertility rates, but data on such extra-programme contraception can be very productively used if available, especially in cases where a country has experienced a secular shift from public programme contraception to commercial-sector use.

ANNEX II

PRO FORMA FOR COLLECTION OF INFORMATION

GENERAL INSTRUCTIONS:

(1) Kindly compile and present the data or information required in this pro forma indicating for each table:
   (a) The date for which data corresponds;
   (b) Source of data;
   (c) Your own assessment of reliability of information.

(2) As far as possible, furnish figures which are used for official purposes, such as those used in five-year plans, indicating basic source. If required information is not available from censuses or official statistics, kindly compile them from reports and publications from special field studies conducted in recent years and give detailed references to such publications and reports; wherever possible copies of these may also be sent.

(3) It will be appreciated if each table is presented on a separate sheet with adequate foot-notes covering the above two points and also special instructions for each table as explanatory notes.

A. Population composition and growth

Table 1 (a,b): Age-sex-marital status distributions

Explanatory note: Complete tables 1 (a,b) (two tables) from the latest available population census figures and from the latest available national sample survey for the country as a whole. These tables form the basis for any target-setting procedure. Give the smoothened age distributions wherever available, indicating briefly the procedures used for smoothening.

Table 1 (a): From the latest census sources
1 (b): From the latest national sample survey

Age group	Males					Females				
	S	M	W	D	Total	S	M	W	D	Total
0-4 5-9 10-14 80+										
Total										

S: Single; M: Married currently; W: Widowed; D: Divorced or separated

Table 2: Population growth rates per 1,000 population per year

Explanatory note: The population growth rate used here is the net growth rate taking into account migration, expressed as rates per 1,000 population per year. These rates are needed for the 1973 or the latest available year, and the average annual rates for the previous quinquennia 1968-1972, 1963-1967, 1958-1962, till the quinquennium just before the commencement of the family planning programme. If the information is not available for the periods as specified, give the figures as available, indicating appropriate time periods.

Estimated for 1973	Average annual rates for quinquennium			
	1968-1972	1963-1967	1958-1962	

B. Mortality

Table 3. Current levels and trends in mortality

Explanatory note: The crude death rate and expectation of life figures (males and females separately) are needed for 1973, and for the previous quinquennia 1968-1972, 1963-1967, 1958-1962, till the quinquennium just before the commencement of the family planning programme. The figures could be compiled from vital registration data if they were considered reliable. Otherwise rates computed from sample surveys or sample registration could be given. If the information is not available for the periods as specified, give the figures as available indicating appropriate time periods and source.

	1973	1968-1972	1963-1967	1958-1962	1953-1957	
Crude death rate						
e_0^0(male)						
e_0^0(female)						

Table 4. Latest available life-table values by single year of age (Males and females separately)

Tables 4 (a, b) (two tables): Single year life-table values for males and females separately are computed usually from censuses or national sample surveys from the age-distributions of the population. Please give the life-table values as available for the latest year or time period. If single year life-table values are not available, give the data in age groups, as available, indicating briefly the method of computation.

X	q_x	l_x	L_x	T_x	e_x
0					
1					
2					
80+					

Table 5. Forecasts of mortality in the future

Explanatory note: Every country, for the purposes of population projection, health planning and for other reasons assumes certain trends in mortality in the future. These assumptions are made either in terms of specified reductions in crude death rate or increments in expectation of life in specified time span or both. Give these figures in annual changes assumed in specified time periods as used in official records.

	1973 (Latest available)	1973-1977	1978-1982	1983-1987	1988-1992
Crude death e_0^0(male) e_0^0(female)					
other indices (specify)					

C. Marriage

Table 6. Latest available figures on distribution of age at marriage

Explanatory note: Data on age at marriage of women can be compiled from marriage registration records or from selected sample surveys where questions on age at marriage are included. The data on age at marriage obtained from survey inquiries may relate to marriages occurring in different time periods in the past. If the marriage registration records are complete and reliable, give data from such records of the latest available year. In case they are not complete or reliable, give data as obtained from surveys, giving details of the survey and the period for which the data correspond. If the single year distributions of age at marriage are not available, give them in age-groups as available in the published records.

Age at marriage	⩽ 10	11	12	13	14	. . . . .
Proportion of married women surveyed who were married in the particular age						

Table 7. Estimates of median age at marriage from census

Explanatory note: In most of the countries, estimates of median age at marriage are computed from the census data on the basis of the proportion of women, single, in each age group using what is known as Hajnal's method or an adaptation of the same. Such estimates of median age at marriage obviously refer to marriages in different time periods. These estimates based on past three censuses may be given indicating briefly the method used for estimating them.

	1973	Latest census (1970 or 1971)	1960 or 1961	1950 or 1951
Median age at marriage				

D. Fertility

Table 8. Latest estimates of crude birth rate and age-specific fertility rates for the country as a whole

Explanatory note: Data on current levels of crude birth rate, age-specific fertility rates (married and all women), and Gross Reproduction Rate are required in this table. If the birth registration data are of good coverage and quality they may be used to obtain the estimates for 1973. Otherwise the rates could be obtained from the results of a survey of national coverage completed most recently. If a survey of national coverage does not provide such data, separate fertility estimates of rural and urban areas could be given from available sample survey.

Crude birth rate: . . . . . GRR: . . . . . .

Age group	Age-specific fertility rates	Age-specific marital fertility rate
10-14 15-19 ----- 45-49		
General		

Table 9. Trends in fertility

Explanatory note: The purpose of this table is to obtain time trends in various fertility measures for the latest available year (1973, if possible) and 1970, 1965, 1960 till the year just preceding the commencement of national family planning programme. If data are not available for these years, give data as available to the closest dates around these years. If the rates are available only separately for rural and urban areas on the basis of independent surveys, give these in separate tables giving detailed references. The mean open birth interval is defined as the mean of the interval between the date of last live birth and survey date computed from a survey of a sample of married women in the reproductive age group. Such data may be available from fertility surveys and may be given with detailed references.

Rates	1973 (Latest available year)	1970	1965	1960
Crude birth rate				
Age-specific fertility rate				
15-19 20-24 25-29 30-34 35-39 40-44 45-49				
G R R				
Mean open birth interval of married women in reproductive age group				

E. Biological factors

Table 10. Distribution of post-partum and post-abortum amenorrhea

Explanatory note: The duration of the interval between the date of termination of pregnancy and resumption of menstruation has been found to vary among women from country to country and is an important factor to be reckoned with in any fertility analysis or target-setting. This amenorrhea period varies with the nature of termination of pregnancy. Data on these intervals have to be obtained only from fertility and related surveys and studies and the latest available information may be given with details on their coverage, sample size used, reliability and references to publications.

Nature of pregnancy termination	Amenorrhea period (Interval between pregnancy termination and resumption of menstruation)			
	2 or less months	2-3	4-5	6-7
Live birth				
Still birth				
Spontaneous abortion				
Induced abortion				

F. Contraception

Table 11: Trends in number of programme acceptors by method

Explanatory note: For the purposes of the present study a "programme acceptor" is defined as a married women in the reproductive age group (or her husband) undergoing a sterilization operation, IUD insertion or accepting any other family planning methods offered by the programme initiating a new segment of use of the method for the purposes of limitation or spacing of children. Change of method or commencing the same method again after a significant spell of non-use of the method constitutes a new acceptance by this definition. However the definition of the term varies among different programmes, and in some programmes has been revised over time. State clearly the definition of "acceptor", new and old, as used in your programme and complete the following table of number of "new" and "old" acceptors recruited by the programme year by year since the inception of the programme up to 1973.

Method	1973		1972		1971		
	New	Old	New	Old	New	Old	
IUD							
Orals							
Vasectomy							
Salpingectomy							
Condoms							
Other methods (specify)							

Table 12. Characteristics of acceptors for the latest available year

Explanatory note: The age of the "acceptor" (or his wife in case acceptor is Male) is an important characteristic determining the fertility impact of the programme. Analysis of acceptors by age is usually done on the basis of a sample of acceptors at periodical intervals of time. For the following table, kindly give details on the nature of sample, periodicity of analysis and reliability of data.

Age of wife	Method					
	IUD	Orals	Vasectomy	Salpin-gectomy	Condoms	Other methods (specify)
15-19						
20-24						
25-29						
30-34						
35-39						
40-44						
45-49						

Table 13. Continuation rates of methods

Explanatory note: The duration of use of a family planning method is an important factor determining its impact on fertility. Prepare the following table (on the continuation rates) for each method on the basis of follow-up studies of acceptors carried out in the country. If different studies give different results, furnish results of all large-scale studies explaining sampling details and your views on the reasons for the differences in continuation rates.

Age group of acceptors	Continuation rates (proportion of a cohort of acceptors continuing) at the end of				
	6 months	12 months	18 months	24 months	36 .....
15-19					
20-24					
25-29					

45-49					

Table 14. Acceptance and use of methods from non-programme sources

Explanatory note: In many of the countries of the ESCAP region, a significant proportion of the couples use family planning methods obtained from sources outside the governmental programmes, such as private physicians, commercial channels, voluntary agencies etc. Data on the number of such acceptors and proportion of couples using contraception from non-programme sources are usually obtained from periodical reports submitted by these agencies to Governments and or from responses of population samples to specific questions on sources of contraceptive supplies in fertility-related surveys. Please compile available information on this topic and complete the following table. Give references to sources of data, coverage and size of samples used in case of surveys and send copies of publications or reports wherever possible. If data are not available for the years specified, give data for any available years.

Method	Acceptance and use from non-programme sources									
	Number of acceptors					Proportion of eligible couples using contraception				
	1973	1970	1965	1960		1973	1970	1965	1960	
IUD										
Orals										
Vasectomy										
Salpingectomy										
Condoms										
Others (specify)										
Induced abortions										

Table 15. Overlap of contraceptive use and post-partum amenorrhea

Explanatory note: The data needed for this table pertain to the average duration in months during which contraceptive usage overlaps with post-partum amenorrhea and is obtained only from some special studies. Especially in post-partum programmes there is a considerable overlap of contraceptive use with periods of post-partum amenorrhea. In the following table give the proportion of acceptors whose overlap period is zero (i.e. where the woman has already commenced menstration or menstruating within a month after acceptance), 1 to 2 months, 2-3 months . . . . . and so on. If the data are not available in this form, give as available and give details of the study from which the data are extracted.

Method	Overlap period			
	0 (women menstruating within one month of acceptance)	Within 2 months	2-3 months	4-5 months
IUD				
Orals				
Vasectomy				
Salpingectomy				
Condoms				
Others (specify)				

G. Demographic goals

(1) Please describe the demographic goals of the country, as officially stated, in terms of population growth rates and/or crude birth rates. Explain also the reasons underlying these goals.
(2) Have the demographic goals undergone revisions in the past ? If so state when, what type of revisions were made and why?
(3) Are there annual birth rate or growth rate goals assumed explicitly or implicitly for the purposes of computing family planning targets? If so please state the assumptions.

H. Family planning targets

(a) Table 16. Annual acceptor targets by methods

Explanatory note: The annual acceptor targets for different methods from 1970 onwards as far as specified by the Government may be given. The targets might have been specified in terms of absolute number of acceptors, or rates per thousand population or eligible women. Give details.

Method	Targets	
	1970	1971
IUD		
Vasectomy		
Orals		
Salpingectomy		
Condoms		
Others (specify)		

(b) **Table 17. Revision in family planning targets in the past**

Explanatory note: This table is intended to compile information on the series of revisions made on family planning targets, the nature of revisions and the reasons underlying them. Reasons for revisions may be explained on separate sheets if necessary.

Method	Initial set of targets when target setting was first made		First revision			Second revision		
	Year	Targets	Year	Revised targets	Reasons for revision	Year	Revised targets	Reasons for revision
IUD								
Orals								
Vasectomy								
Salpin-gectomy								
Condoms								
Others (specify)								

(c) Describe in detail the method used in the calculation of the latest set of family planning targets, indicating the formulae adopted, data used and the general assumptions underlying the procedure.

(d) Describe the changes in target-setting procedures during every revision of targets in the past.

I. Induced abortions

Table 18. Induced abortions: numbers and distributions by age

Explanatory note: Induced abortions have played a significant role in the reduction of fertility rates in many countries of Asia and Europe. The number and rate of such abortions every year classified in different age groups are important factors to be considered. Data on these aspects of induced abortions are obtained usually from special community surveys of a sample of women in the reproductive age group. The following table may be completed from data collected through such surveys. If the data are not available in the form or year specified, give as available furnishing details of the study (ies). For years 1973, 1970, 1965, 1960 ..... give the following particulars.

Age group of married women	Number of women inquired	Number of induced abortions	Rate per 1000 women in age groups	Average gestation month at which abortion is done
15-19				
20-24				
25-29				
30-34				
35-39				
40-44				
45-49				
Total				

ANNEX III
USERS' MANUAL

1. Glossary of terms used in computer model and formulae

1.	A	Accumulated births under programme
2.	AAC (N,T)	Number of acceptors in age group N and year T.
3.	AACPM (T)	Total acceptors as a percentage of all married women in programme year.
4.	AACT (T)	Total number of acceptors in a programme year.
5.	AAP (T)	Total acceptors as a percentage of all eligibles in programme year.
6.	ABA	Births averted in year T by all acceptors before year T-1.
7.	AC (N,T)	Proportion of eligibles that accepts in age group N and year T.
8.	ACM (T)	Acceptors as a percentage of all married women.
9.	ACP (N)	Relative proportion of eligibles accepting in age group N and year T.
10.	ACPDS (N)	Percentage distribution of acceptors by age, year 1.
11.	AGDIS	Age distribution for real population.
12.	AMNU (T)	All married non-users.
13.	AMW (T)	All married women in the programme year.
14.	ANRR	Net reproduction rate.
15.	ATMU (T)	All users as a percentage of all married women in a programme year, not including new acceptors.
16.	ATUS (T)	Average couple years of use for programme year.
17.	BAAS (N,T)	Births averted, age at acceptance N, and programme year T.
18.	BAS (N,J,KK)	Births averted in year KK by acceptors age N in year J.
19.	BAST (M,T)	Births averted, for year of acceptance M, and programme year T.
20.	BASTT (T)	Births averted — for programme year T.
21.	BAV (N,Y)	Births averted per acceptor aged N, in year Y after acceptance.
22.	BC (T)	Total female births in a year.

23.	BE	Births expected in year T without contraceptive use.
24.	BL	Proportion of persons surviving X years from time I, age group N.
25.	BLO	Survivors, ages 1-4.
26.	BTA (N,J)	Births averted in J by current users, age N.
27.	BTBA	Births to be averted in year T by all acceptors: BE-BTAR.
28.	C (N,KK)	Matrix to adjust births averted by the programme in year KK, age group N, to take into account changing marital fertility.
29.	CBR1	Crude birth rate without contraception.
30.	CBR2	Crude birth rate under contraceptive regime.
31.	CCB	Crude birth rate.
32.	CCD	Crude death rate.
33.	CODIS (N,M)	Proportion of acceptors of age class N accepting method M.
34.	CRNI	Crude rate of natural increase.
35.	D (21,9)	Life-table array.
36.	D (N,5)	L column of life-table; number of person years lived by age group N, by time T for original cohort of 100,000.
37.	D (N+1,6)	Proportion of persons in age group N, alive five years later.
38.	DC (T)	Total female deaths in a year.
39.	DPOPB (N)	Survivors to year I+X from population in age group N, in year I.
40.	DUMMY (T)	Variable created for various table printouts.
41.	E (51)	Stable population array.
42.	EL (N,T)	Population in age group N which is eligible for acceptance.
43.	EMX	Central death rates for each age group.
44.	ETBAV	Births to be averted in year T by acceptors in year T-1.
45.	ETBAV/X	Scaling factor for proportion of acceptors.
46.	EX (T)	Life expectancy in year T.
47.	F (N,Y)	Potential fertility of a couple that accepted Y years ago, when age N

48.	FDIF	Annual difference in age-specific marital fertility, used for linear interpolation.
49.	FECU (N)	Proportion of women in age group N who are non-sterile
50.	FER (T,N)	Age-specific fertility rate for women in age group N, at time T.
51.	FERM (T,N)	Age-specific marital fertility rate for women in age group N, at time T.
52.	GRR	Gross reproduction rate.
53.	IPICK	Type of acceptance pattern.
54.	IPROJ	Number of programme years acceptors enter family planning programme.
55.	IPROJ1	Number of programme years of impact attributed to acceptors (i.e. IPROJ + 1).
56.	IREG	Region for Coale/Demeny life-tables.
57.	ITYPE	Population type: real or stable age distribution and size.
58.	J	Year of projection.
59.	L	Type of contraceptive method, distinguished by continuation rates.
60.	LFTAB	Life-table type: model or empirical.
61.	M	Years since acceptance.
62.	METHOD (M,K)	Name of each of M methods.
63.	N	Age index with values from 1 - 17, Corresponding to age groups 0-1, 1-4, 5-9, ... 75+.
64.	NUM	Number of contraceptive methods.
65.	OPTS (K)	Allows user to print or delete table K.
66.	PDIF	Annual difference in proportions married in age group, used for linear interpolation.
67.	PERM (T,N)	Proportion married among women in age group N at time T.
68.	PM (N,T)	Married population in age group N at time T.
69.	POPD (N,T)	Mid-interval population, except for 0-4.
70.	RETA (N,L)	Proportion not immediately discontinuing among acceptors of method L.

71. RETR (N,L) Annual rate of discontinuing contraceptive use among acceptors of method L not immediately discontinuing.

72. RFERM Current age-specific marital fertility stored for input into "RVALUS".

73. RINTR Intrinsic rate of natural increase.

74. RPERM Current proportion married, stored for use in "RVALUS".

75. S (T) Scaling factor.

76. STER (N) Proportion of women in age group N who are sterile.

77. TBC Total female birth cohort in year T+1.

78. TBCL Total female birth cohort of last year.

79. TG Length of generation.

80. TGEN Mean of fertility schedule.

81. TOTACA (T) Acceptors as a percentage of all eligible women.

82. TOTMAR (T) Total married women in population at time T.

83. TUM (N,T) Mid-year users in age group N and year T, not including users who accept in year T.

84. TUS (N,T) Couple years of effective use among women aged N, year T.

85. TUSM (T) Total mid-year users in T, not including acceptors in programme year.

86. TUST (T) Total couple years of use in programme year T.

87. U (N,Y) Couple years of use that affect births in the Yth programme year after year of acceptance among women aged N at time of acceptance.

88. US (N,Y) Couple years of use during (Y-1) th programme year after of acceptance, among acceptors aged N at time of acceptance.

89. USM (N,Y) Proportion of acceptors in age group N who are still using exactly (Y-1) years after acceptance.

90. XAMSF Marital age-specific fertility rate under programme.

91. XASF Age-specific fertility rate under programme.

92. XF Births averted by users.

93. XFM Births expected without programme.

94. XT — Total fertility rate.

95. XV — Age variance of fertility schedule.

96. YEAR — Population age 0-1.

97. ZO (L) — Method-specific overlap with post-partum amenorrhea.

2. Manuals for the nine ETSS programmes

A. TABRAP

TABRAP is a female-only component projection model which calculates the number and composition of contraceptive acceptors required to meet annual crude birth rate goals.

TABRAP was written to exercise many options so that the data availability and desires of the user may be accommodated. Among these options are:

(a) Length of projection period: 5 or 10 years;
(b) Type of initial population age distribution: empirical or stable;
(c) Type of life-tables used for projections: Coale/Demeny model life-tables or empirical life-tables using the country's age-specific death rates;
(d) Changing or constant marital fertility;
(e) Changing or constant proportions married;
(f) Output: any or all table printed.

One important modification is necessary for each facility using TABRAP: in section 1, following the specification statements, there is a section referring to device numbers. On the IBM 360, a "5" refers to the card reader and a "6" to the line printer, and these are the numbers inserted in the original programme. If the user's installation has different device numbers, they may be changed by replacing the following cards:

For card reader: II =——
For line printer: IO =——

INPUT REQUIRED

Input Number	Variable (s) on Card
1.	NUM, IPROJ, INYR, NAME

NUM — Number of different contraceptive methods acceptors utilize. NUM will be referred to as "N", a multiplier in several of the following formats.

IPROJ — Length of projection period, 5 or 10 years.
INYR — Initial year of programme run.
NAME — Name of country or population projection is applied to, up to 20 characters.

Format: (2I2, I4, 4X, 20A1)

Example for three methods in a 10-year projection applied to a hypothetical Asian population. Initial year of programme run is 1970.

Column

1	10	20	30	40	50	60	70
03101970	HYPOTHET. ASIAN POP						

2. METHOD

METHOD — Name of contraceptive method, limited to 30 characters. There are "NUM" METHOD cards, one name per card.

Format: (30A1)

Example for three methods — IUD, pill and sterilization:

Column

1	10	20	30	40	50	60	70
MEDIUM DISCONTINUATION--IUD							
HIGH DISCONTINUATION--PILL							
LOW DISCONTINUATION--STER.							

3. ZO

ZO — Method specific overlap of use, in years, with post-pregnancy amenorrhea. Largely depends on programme mode of delivery (i.e., post-abortum, post-partum, random recruitment, etc.)

FORMAT: (NF4.3)

Example for three methods, assuming all to have 2 month overlap:

Column

1	10	20	30	40	50	60	70
.167.167.167							

4. ACPDS

ACPDS — Based on past experience of a programme the percentage distribution of acceptors into a family planning programme, by age in 5 year cohorts: 15-44.

Format: (6F6.2)

Example:

Age	Percentage of acceptors
15-19	4.00
20-24	20.26
25-29	24.81
30-34	24.97
35-39	19.10
40-44	6.16
	100.00

Column

1	10	20	30	40	50	60	70
4.00 20.96 24.81 24.97 19.10 6.16							

5. RETA

RETA—For each contraceptive method, proportion of acceptors not immediately discontinuing use, by age cohort (1).

Format: (N (6F3.2))

Example for three methods:

Age	Method 1 (IUD)	Method 2 (Pill)	Method 3 (Ster.)
15-19	.90	.90	.98
20-24	.90	.90	.97
25-29	.90	.90	.96
30-34	.90	.90	.95
35-39	.90	.90	.94
40-44	.90	.90	.93

Column

1 10 20 30 40 50 60 70

.90.90.90.90.90.90.90.90.90.90.90.90.98.97.96.95.94.93

method 1 method 2 method 3

6. RETR

RETR—For each contraceptive method, annual rate of discontinuation for women in each five-year cohort (1).

Format: (N(6F3.2))

Example for three methods:

Ages	Method 1 (IUD)	Method 2 (Pill)	Method 3 (Ster.)
15-19	.55	.02	1.32
20-24	.50	.02	1.20
25-29	.45	.03	1.08
30-34	.40	.03	.96
35-39	.35	.04	.84
40-44	.30	.05	.72

Column

1 10 20 30 40 50 60 70

55 50 45 40 35 30 02 02 03 03 04 05132120108 96 84 72

method 1 method 2 method 3

7. CODIS

CODIS-For each method, percentage of acceptors' age group adopting that method (i.e. for each age group, the sum over all methods = 1.00)

Format: (N (6F3.2))

Example for three methods:

Ages	Method 1 (IUD)	Method 2 (Pill)	Method 3 (Ster.)	
15-19	.25	.75	.00	= 1.00
20-24	.25	.75	.00	= 1.00
25-29	.25	.50	.25	= 1.00
30-34	.25	.25	.50	= 1.00
35-39	.25	.00	.75	= 1.00
40-44	.25	.00	.75	= 1.00

Column

1 10 20 30 40 50 60 70

.25.25.25.25.25.25.75.75.50.25.00.00.00.00.25.50.75.75

method 1 method 2 method 3

8. FERM

FERM—Age-specific marital fertility rates for year 1 and year 11. If these rates are expected to change, the hypothetical rates for year 11 are input. These rates will be linearly interpolated within the programme to give annual rates for years 2-10. If marital fertility is expected to remain constant, the same rates will be input for year 11 as are for year 1.

Format: (12F4.3)

Example for changing marital fertility; ages 15-24; constant for ages 25-44.

Ages	Year 1	Year 11
15-19	.498	.450
20-24	.530	.500
25-29	.439	.439
30-34	.341	.341
35-39	.268	.268
40-44	.168	.168

Column

1 10 20 30 40 50 60 70

.498.530.439.341.268.168.450.500.439.341.268.168

year 1 year 11

9. PERM

PERM—Proportion married in each five-year cohort of women for years 1 and 11. If these rates are expected to change, the hypothetical rates for year 11 are input. Similar to marital fertility rates, annual proportion married, years 2-10 will be derived by linear interpolation. If proportion married is expected to remain constant, the same rates are input in years 1 and 11.

Format: (12F4.3)

Example for changing proportion married, ages 15-19 and 40-44; constant for ages 20-39.

	Proportion married	
Age	Year 1	Year 11
15-19	.147	.120
20-24	.538	.538
25-29	.759	.759
30-34	.880	.880
35-39	.914	.914
40-44	.890	.900

Column

1 10 20 30 40 50 60 70

.147.538.759.880.914.890.120.538.759.880.914.900

year 1 year 11

10. STER

STER—Proportion of women sterile in each age group (2).

Format: (6F4.3)

Example:

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

Column

1 10 20 30 40 50 60 70

.020.045.080.130.235.455

11. CBRT

CBRT—Target crude birth rates for each programme year. Any curve or straight line may be used for the path which links initial and final target; but the path chosen should conform to practical expectations. The crude birth rate for year 1 must be drawn from data of the same years in which marital fertility rates for year 1 are drawn.

Format: (11F6.2)

Example in which crude birth rate drops by one third in the 11 programme years. Curve has CBRTS falling slowly at first, then accelerating as the programme gains "momentum."

Year	CBRT
1	45.00
2	44.85
3	44.40
4	43.65
5	42.60
6	41.25
7	39.60
8	37.65
9	35.40
10	32.85
11	30.00

Column

1 10 20 30 40 50 60 70

45.00 44.85 44.40 43.65 42.60 41.25 39.60 37.65 35.40 32.85 30.00

12. LFTAB, ITYPE

LFTAB—Life-table type. Choice depends on data available for an area.

1 Model life-table: requires annual life expectancy for women at age 0, and choice of Coale/Demeny region for life-table (3).

2 Empirical life-table: requires age-specific death rates for the female population.

ITYPE—Population size and distribution; choice again depends on data availability.

1 Stable population: given the intrinsic rate of growth (which is calculated in the programme), a stable population distribution, with total size = 10,000 can be generated.

2 "Real" population; which requires the age distribution of females for year 1, the total size of the female population and the crude death rate for females in that year.

Format: (2I2)

Example, specifying model life-table and a real population:

Column

1 10 20 30 40 50 60 70

1 2

13. EX and IREG, or EMX

Variables depend on whether model or empirical life-table is chosen.

A. For model life-table:

EX—Life expectancy at birth for women. The EX's may be a continuation of historical trends in life expectations, or a theoretical curvilinear or straight path, as the situation demands.

IREG—Coale/Demeny life-table region (3).

1 - West
2 - North
3 - East
4 - South

Format: (I5, 11F5.1)

Example for 11 years, with a linear increase in EX, and IREG = West.

Year	Life expectancy
1	57.5
2	58.0
3	58.5
4	59.0
5	59.5
6	60.0
7	60.5
8	61.0
9	61.5
10	62.0
11	62.5; Region = 1.

Column

```
1         10        20        30        40        50        60        70
-----------------------------------------------------------------------
    1 57.5 58.0 58.5 59.0 59.5 60.0 60.5 61.0 61.5 62.0 62.5
-----------------------------------------------------------------------
```

B. For empirical life-tables:

EMX—Age specific female death rates; i.e. total female deaths in year, age n
mid-year female population, age n
Age range: 0-1, 1-4, 5-9, 10-14, ..., to as high as data is available.

Format: (16F5.4 / 3F5.4)

Example of ages 0-85+ :

Age	CDR	Age	CDR
0-1	.0177	45-49	.0052
1-4	.0007	50-54	.0052
5-9	.0003	55-59	.0088
10-14	.0003	60-64	.0132
15-19	.0007	65-69	.0212
20-24	.0007	70-74	.0338
25-29	.0010	75-79	.0531
30-34	.0010	80-84	.0841
35-39	.0023	85+	.1741
40-44	.0023		

Column

1 10 20 30 40 50 60 70

.0177.0007.0003.0003.0007.0007.0010.0010.0023.0023.0052.0052.0088.0132.0212.0338
.0531.0841.1747

14. AGDIS, POPD (18, 1), CDR and SR or POPD (18, 1) and SR

Variables depend on whether a real or stable population is used for year 1.

A. If a real population is to be utilized:

SR—Sex ratio at birth (male births/female live births).

AGDIS—Age distribution of females, in five year age cohorts.

POPD (18, 1) — Total size of female population in initial year.

CDR—Crude death rate for females in initial year.

Format: (17F4.1 / F10.0 2F5.2)

Example:

Age	Percentage distribution of females
0-4	8.1
5-9	9.4
10-14	9.8
15-19	9.0
20-24	8.1
25-29	6.6
30-34	5.6
35-39	5.5
40-44	5.9
45-49	6.0
50-54	5.5
55-59	5.0
60-64	4.4
65-69	3.7
70-74	3.3
75-79	2.2
80 +	2.3

Total female population = 104,299,728.
Crude death rate in initial year = 9.40.
Sex ratio at birth = 1.04.

Column

1 10 20 30 40 50 60 70

Card (i)

8.1 9.4 9.8 9.0 8.1 6.6 5.6 5.5 5.9 6.0 5.5 5.0 4.4 3.7 3.3 2.2 2.3

Card (ii)

104299728 9.40 1.04

B. If a stable population is used:

POPD (18, 1)—Total size of female population in initial year. If the actual size is known, use it for input data so that output will give the proper magnitude of births averted, number of acceptors, etc. If the size is unknown, insert a hypothetical population size of 10,000.

SR—Sex ratio at birth.

Format: (F10.0, F5.2)

Example: Total female population = 104,299,728.
Sex ratio at birth = 1.04.

Column							
1	10	20	30	40	50	60	70
104299728 1.04							

15. OPTS

OPTS— Output options. Corresponding to each table number, a "1" in the respective column means that the table will be printed. An "0" means that the table will not be printed. Each table is independent of another, and a new page is started for each table. Card columns and corresponding tables:

Card column	Table
1.	Input to programme, echo check (1): FER, FERM, PERM, ACPDS, STER, EX, OR EMX, SR, LFTAB, ITYPE, IREG, INYR.
2.	Input to programme, echo check (2): METHOD, RETA, RETR, CODIS— by contraceptive method — and NUM.
3.	Life-table — year 1.
4.	Reproduction rates, for year 1.
5.	Initial population distribution (stable or real).
6.	6 or 11 years: population projection, without crude birth rate targets.
7.	6 or 11 years: married population, CBR, CDR, CRNI — without targets.
8.	Life-table—years 2-6 or 11.
9.	6 or 11 years: population projection, with crude birth rate targets.
10.	6 or 11 years: married population, CBR, CDR, CRNI— with targets.
11.	Worksheet of the multiplicative approach to derive births averted per acceptor and other measures: T1-T2, U, F, BA, US, USM.
12.	Programme results—years 2-10: XASF, XAMSF, TUS, XF, XFM, S.
13.	Programme results — last year only: XASF, XAMSF, TUS, XF, XFM, S.
14.	Number (and percentage of acceptors in programme year by age and method accepted.
15.	Births averted in programme year by those accepting M years ago, by age of acceptors.
16.	Acceptors as a percentage of married non-users (eligibles).
17.	Acceptors as a percentage of married women.
18.	Percentage age distribution of users.
19.	Programme users as a percentage of married women.
20.	Mid-year users as a percentage of married women.
21.	Percentage distribution of mid-year users by age.
22.	Percentage distribution of averted births by programme year cohort.
23.	Percentage distribution of averted births by acceptance age cohort.

24. Number of acceptors.
25. Women eligible for acceptance.
26. Reproduction rates, for terminal year of programme.
27. Number of mid-year users.

Format: (2711)

Example for: Yes on tables 1-5, 9-14 and 20-27
No on tables 6-8 and 15-19.

Column

```
        10        20        30        40        50        60        70
--------|---------|---------|---------|---------|---------|---------|
1111100111111000001111111
```

References to aid understanding of methodology to obtain necessary input:

1. For RETA and RETR, see discussion of "a" and "r" in: Mauldin, W. P., Nortman, D. and Stephan, F. F, Retention of IUDs: An international comparison. *Studies in Family Planning. No. 18, April 1967, pp. 7-8.*

2. Sterility data taken from: Henry, Louis. Some data on natural fertility. Eugenics Quarterly, Vol. VIII, (No. 2), June 1961.

3. To make the decision as to which regional life-table to specify, see: Coale, A.J. and Demeny, P. *Regional Model Life-Tables and Stable Populations.* Princeton University Press, Princeton, N. J., 1966.

B. CONVERSE

CONVERSE is a one-sex (female) component projection model which assesses the impact of contraceptive acceptors on a country's female population and its vital rates. It was written to allow the user flexibility through the excercise of several options:

(a) Length of projection period: 5 or 10 years;
(b) Type of initial population: real or empirical distribution;
(c) Type of life-tables used for projections: Coale/Demeny model life-tables or empirical life-tables using the country's age-specific death rates;
(d) Changing or constant marital fertility;
(e) Changing or constant proportions married;
(f) Choice of acceptance patterns;
(g) Output: any or all tables printed.

One important modification is necessary for each facility using CONVERSE: in section 1, following the specification statements, there is a section referring to device numbers. On the IBM 360, a "5" refers to the card reader and a "6" to the line printer, and these are the numbers inserted in the original programme. If the user's installation has different device numbers, they may be changed by replacing the following cards:

for card reader: II =
for line printer: IO =

INPUT REQUIRED

Input Number	Variable (s) on Card
1.	NUM, IPROJ, INYR, NAME

NUM —Number of different contraceptive methods acceptors utilize. NUM will be referred to as "N", a multiplier in several of the following formats.

IPROJ—Length of projection, either 5 or 10 years.
INYR —Initial year of programme run.
NAME—Name of country or population projection is applied to, up to 20 characters.

Format: (2I2, I4, 4X, 20A1)

Example for three methods in a 10-year projection for a hypothetical Asian population; initial programme year is 1970:

```
Column
1        10        20        30        40        50        60        70
-------------------------------------------------------------------------
03101970    HYPOTHET. ASIAN POP
-------------------------------------------------------------------------
```

2. METHOD

METHOD—Name of contraceptive method, limited to 30 characters. There are "NUM"" METHOD cards, one name per card.

Format: (30A1)

Example for three methods — IUD, pill and sterilization:

```
Column
1        10        20        30        40        50        60        70
-------------------------------------------------------------------------
MEDIUM DISCONTINUATION--IUD
HIGH DISCONTINUATION--PILL
LOW DISCONTINUATION--STER.
-------------------------------------------------------------------------
```

3. ZO

ZO—Method specific overlap of use, in years, with post-pregnancy amenorrhea. Largely depends on programme mode of delivery (i.e., post-abortum, post-partum, random recruitment, etc.)

FORMAT: (NF4.3)

Example for three methods, assuming all to have 2 month overlap:

```
Column
1        10        20        30        40        50        60        70
-------------------------------------------------------------------------
.167.167.167
-------------------------------------------------------------------------
```

4. RETA

RETA—For each contraceptive method, proportion of acceptors not immediately discontinuing use, by age cohort (1).

Format: (N (6F3. 2))

Example for three methods:

Age	Method 1 (IUD)	Method 2 (Pill)	Method 3 (Ster.)
15-19	.90	.90	.98
20-24	.90	.90	.97
25-29	.90	.90	.96
30-34	.90	.90	.95
35-39	.90	.90	.94
40-44	.90	.90	.93

Column

1 10 20 30 40 50 60 70

.90.90.90.90.90.90.90.90.90.90.90.90.98.97.96.95.94.93

method 1 method 2 method 3

5. RETR

RETR—For each contraceptive method, annual rate of discontinuation for women in each 5-year cohort 1.

Format: (N (6F3.2))

Example for three methods:

Ages	Method 1 (IUD)	Method 2 (Pill)	Method 3 (Ster.)
15-19	.55	.02	1.32
20-24	.50	.02	1.20
25-29	.45	.03	1.08
30-34	.40	.03	.96
35-39	.35	.04	.84
40-44	.30	.05	.72

Column

1 10 20 30 40 50 60 70

55 50 45 40 35 30 02 02 03 03 04 05132120108 96 84 72

method 1 method 2 method 3

6. CODIS

CODIS—For each method, percentage of acceptors' age group adopting that method (i.e. for each age group, the sum over all methods = 1.00)

Format:(N (6F3.2))

Example for three methods:

Ages	Method 1 (IUD)	Method 2 (Pill)	Method 3 (Ster.)	
15-19	.25	.75	.00	= 1.00
20-24	.25	.75	.00	= 1.00
25-29	.25	.50	.25	= 1.00
30-34	.25	.25	.50	= 1.00
35-39	.25	.00	.75	= 1.00
40-44	.25	.00	.75	= 1.00

Column

1 10 20 30 40 50 60 70

.25.25.25.25.25.25.75.75.50.25.00.00.00.00.25.50.75.75

method 1 method 2 method 3

7. FERM

FERM—Age-specific marital fertility rates for year 1 and year 11. If these rates are expected to change, the hypothetical rates for year 11 are input. These rates will be linearly interpolated within the programme to give annual rates for years 2-10. If marital fertility is expected to remain constant, the same rates will be input for year 11 as are for year 1.

Format: (12F4.3)

Example for changing marital fertility; ages 15-24; constant for ages 25-44.

Ages	Year 1	Year 11
15-19	.498	.450
20-24	.530	.500
25-29	.439	.439
30-34	.341	.341
35-39	.268	.268
40-44	.168	.168

Column

1 10 20 30 40 50 60 70

.498.530.439.341.268.168.450.500.439.341.268.168

year 1 year 11

8. PERM

PERM—Proportion married in each 5-year cohort of women for years 1 and 11. If these rates are expected to change, the hypothetical rates for year 11 are input. Similar to marital fertility rates, annual proportion married, years 2-10 will be derived by linear interpolation. If proportion married is expected to remain constant, the same rates are input in years 1 and 11.

Format: (12F4.3)

Example for changing proportion married, ages 15-19 and 40-44; constant for ages 20-39.

	Proportion married	
Age	Year 1	Year 11
15-19	.147	.120
20-24	.538	.538
25-29	.759	.759
30-34	.880	.880
35-39	.914	.914
40-44	.890	.900

Column

1 10 20 30 40 50 60 70

.147.538.759.880.914.890.120.538.759.880.914.900

year 1 year 11

9. STER

STER—Proportion of women sterile in each age group 2.

Format: (6F4. 3)

Example:

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

Column

1 10 20 30 40 50 60 70

.020.045.080.130.235.455

10. LFTAB, ITYPE

LFTAB—Life-table type. Choice depends on data available for an area.

1 - Model life-table: requires annual life expectancy for women at age 0, and choice of Coale/Demeny region for life-table (3).
2 - Empirical life-table: requires age-specific death rates for the female population.

ITYPE—Population size and distribution; choice again depends on data availability.

1 - Stable population: given the intrinsic rate of growth (which is calculated in the programme), a stable population distribution, with total size = 10,000 can be generated.
2 - "Real" population; which requires the age distribution of females for year 1, the total size of the female population and the crude death rate for females in that year.

Format: (212)

Example, specifying model life-table and a real population:

Column 1	10	20	30	40	50	60	70
1 2							

11. EX and IREG, or EMX

Variables depend on whether model or empirical life-table is chosen.

A. For model life-table:

EX—Life expectancy at birth for women. The EX's may be a continuation of historical trends in life expectations, or a theoretical curvilinear or straight path, as the situation demands.

IREG—Coale /Demeny life-table region (3).

1 - West
2 - North
3 - East
4 - South

Format: (I5, 11F5.1)

Example for 11 years, with a linear increase in EX, and IREG = West.

Year	Life expectancy
1	57.5
2	58.0
3	58.5
4	59.0
5	59.5
6	60.0
7	60.5
8	61.0
9	61.5
10	62.0
11	62.5; Region = 1.

Column 1	10	20	30	40	50	60	70
1 57.5	58.0	58.5	59.0	59.5	60.0	60.5	61.0	61.5	62.0	62.5

B. For empirical life-tables:

EMX—Age-specific female death rates; i.e.,total female deaths in year, age n
mid-year female population, age n

Age range: 0-1, 1-4, 5-9, 10-14, ... to as high as data is available.

Format: (16F5.4 / 3F5. 4)

Example of ages 0-85+ :

Age	CDR	Age	CDR
0- 1	.0177	45-49	.0052
1- 4	.0007	50-54	.0052
5- 9	.0003	55-59	.0088
10-14	.0003	60-64	.0132
15-19	.0007	65-69	.0212
20-24	.0007	70-74	.0338
25-29	.0010	75-79	.0531
30-34	.0010	80-84	.0841
35-39	.0023	85+	.1747
40-44	.0023		

```
Column
1         10        20        30        40        50        60        70
-------------------------------------------------------------------------
.0177.0007.0003.0003.0007.0007.0010.0010.0023.0023.0052.0052.0088.0132.0212.0338
.0531.0841.1747
-------------------------------------------------------------------------
```

12. AGDIS, POPD (18,1) CDR and SR
or POPD (18,1), SR

Variables depend on whether a real or stable population is used for year 1.

A. If a real population is to be utilized:

AGDIS—Age distribution of females, in 5-year age cohorts.

POPD (18,1) — Total size of female population in initial year.

CDR—Crude death rate for females in initial year.

SR—Sex ratio at birth (male live births/female live births)

Format: (17F4.1 / F10.0 ,2F5. 2)

Example:

Age	Percentage distribution of females	Age	Percentage distribution of females
0- 4	8.1	45-49	6.0
5- 9	9.4	50-54	5.5
10-14	9.8	55-59	5.0
15-19	9.0	60-64	4.4
20-24	8.1	65-69	3.7
25-29	6.6	70-74	3.3
30-34	5.6	75-79	2.2
35-39	5.5	80+	2.3
40-44	5.9		

Total female population = 104,299,728.

Crude death rate in initial year = 9.40.

Sex ratio at birth = 1.04.

Column

1 10 20 30 40 50 60 70

Card (i)

8.1 9.4 9.8 9.0 8.1 6.6 5.6 5.5 5.9 6.0 5.5 5.0 4.4 3.7 3.3 2.2 2.3

Card (ii)

104299728 9.40 1.04

B. If a stable population is used:

POPD (18,1) —Total size of female population in initial year. If the actual size is known, use it for input data so that output will give the proper magnitude of births averted, number of acceptors, etc. If the size is unknown, insert a hypothetical population size of 10,000.

SR—Sex ratio at birth.

Format: (F10.0, F5.2)

Example: Total population = 104,299,728.
Sex ratio at birth= 1.04.

Column

1 10 20 30 40 50 60 70

104299728 1.04

13. OPTS

OPTS—Output options. Corresponding to each table number, a "1" in the respective column means that the table will be printed. An "0" means that the table will not be printed. Each table is independent of another, and a new page is started for, each table. Card columns and corresponding tables:

Card column	Table
1.	Input to programme, echo check (1): IPROJ, LFTAB, EX and IREG or EMX, ITYPE, POP (18,1), IPICK, and INYR.
2.	Input to programme, echo check (2) : FERM, PERM, ACPDS, STER, ACM or AACT or TOTACA, and computed FER.
3.	Input to programme, echo check (3) : METHOD, RETA, RETR, CODIS—by contraceptive method—and NUM.
4.	Life-table—year 1.
5.	Reproduction rates, for year 1.
6.	Initial population distribution (stable or real).
7.	Life-table—years 2-IPROJ1.

8. IPROJ1 (IPROJ1 = IRPOJ+1) years: female population projection; no new acceptors.
9. IPROJ1 years: married population, CBR, CDR, CRNI—no new acceptors.
10. Worksheet of the multiplicative approach to derive births averted per acceptor and other measures: Y, T1-T2, U, F, BA, US, USM, ZO.
11. Programme results—years 2-IPROJ: XASF, XAMSF, TUS, XF, XFM, A.
12. Programme results—last year (IPROJ1) only: XASF, XAMSF, TUS, XF, XFM, A.
13. IPROJ1 years: female population projection, taking impact of new acceptors into account.
14. IPROJ1 years: married population, CBR, CDR, CRNI — under new acceptors.
15. Number (and percentage) of acceptors in programme year by age and method accepted.
16. Births averted in programme year by those accepting M years ago, by age of acceptors.
17. Acceptors as a percentage of married non-users (eligibles).
18. Acceptors as a percentage of married women.
19. Percentage age distribution of acceptors.
20. Programme users as a percentage of married women.
21. Mid-year users as a percentage of married women.
22. Percentage distribution of mid-year users by age.
23. Percentage distribution of averted births by programme year cohort.
24. Percentage distribution of averted births by acceptance age cohort.
25. Number of acceptors.
26. Women eligible for acceptance.
27. Reproduction rates, for terminal year of programme.
28. Number of mid-year users.

Format: (28I1)

Example for: "Yes" on tables 1-5, 9-14, and 20-28,
"No" on tables 6-8 and 15-19.

Column

1 10 20 30 40 50 60 70

```
1111100111111000001111111
```

14. IPICK

IPICK—Acceptance model type.

1 — Requires the over-all annual acceptance rate ACM per married woman plus CODIS, EL, and ACP, which dictate the distribution of acceptors amongst age-method classes.
2 — Requires the total annual acceptances AACT, these acceptances being annually distributed among age and method classes according to the constraints EL, ACP, and CODIS.
3 — Requires the over-all annual acceptance rate TOTACA per eligible woman. CODIS, EL, and ACP dictate the distribution of acceptors amongst age-method classes.

4 — Requires an annual age schedule of rates of acceptance AC among eligibles. This schedule, together with the numbers of women eligible to accept EL, determines the numbers of acceptors in age class N. CODIS distributes these acceptors among methods within each age class.

Format: (I2)

Example, specifying acceptance model type 1:

Column

1	10	20	30	40	50	60	70
1							

15. ACPDS and ACM or
ACPDS and AACT or
ACPDS and TOTACA or
AC

Variables depend on which model type is chosen.

A. For IPICK = 1:

ACPDS—Based on past experience of a programme, the percentage distribution of acceptors into a family planning programme, by age in 5-year cohorts: 15-44.

ACM—Over-all annual acceptance rate per married woman.

Format: (6F6.2 / 10F4.3)

Example:

Age	ACPDS	Year	ACM
15-19	4.00	1	.005
20-24	20.96	2	.017
25-29	24.81	3	.029
30-34	24.97	4	.048
35-39	19.10	5	.072
40-44	6.16	6	.102
		7	.140
		8	.182
		9	.235
		10	.290

Column

1	10	20	30	40	50	60	70
Card (i)							
4.00 20.96 24.81 24.97 19.10 6.16							
Card (ii)							
.00¬.017.029.048.072.102.140.182.235.290							

B. For IPICK = 2:

ACPDS—(See IPICK = 1.)

AACT—Total annual acceptances.

Format: (6F6.2 / 10F7.0)

Example:

Age	ACPDS	Year	AACT
15-19	4.00	1	49
20-24	20.96	2	55
25-29	24.81	3	91
30-34	24.97	4	139
35-39	19.10	5	184
40-44	6.16	6	268
		7	324
		8	449
		9	540
		10	667

Column

1 10 20 30 40 50 60 70

Card (i)

4.00 20.96 24.81 24.97 19.10 6.16

Card (ii)

49.0 55.0 91.0 139.0 184.0 268.0 324.0 449.0 540.0 667.0

C. For IPICK = 3:

ACPDS—(See IPICK = 1.)

TOTACA—Over-all annual acceptance rate per eligible woman.

Format: (6F6.2 /10F4.3)

Example:

Age	ACPDS	Year	TOTACA
15-19	4.00	1	.020
20-24	20.96	2	.021
25-29	24.81	3	.034
30-34	24.97	4	.052
35-39	19.10	5	.067
40-44	6.16	6	.098
		7	.118
		8	.164
		9	.202
		10	.256

```
Column
1         10        20        30        40        50        60        70
```

Card (i)

```
  4.00 20.96 24.81 24.97 19.10  6.16
```

Card (ii)

```
.020.021.034.052.067.098.118.164.202.256
```

D. For IPICK = 4:

AC—Annual age schedule of rates of acceptance among eligibles.

Format: (10F5.4)

Example:

AC, by age and programme year

Age	1	2	3	4	5	6	7	8	9	10
15-19	.0125	.0137	.0221	.0332	.0434	.0628	.0758	.1053	.1290	.1631
20-24	.0216	.0237	.0383	.0574	.0750	.1086	.1310	.1819	.2229	.2819
25-29	.0220	.0241	.0389	.0583	.0763	.1104	.1331	.1849	.2266	.2866
30-34	.0232	.0254	.0410	.0616	.0805	.1164	.1405	.1951	.2391	.3024
35-39	.0208	.0229	.0369	.0553	.0723	.1046	.1262	.1753	.2148	.2717
40-44	.0085	.0093	.0150	.0224	.0293	.0425	.0512	.0711	.0872	.1103

```
Column
1         10        20        30        40        50        60        70
```

Card (i)

```
.0125.0137.0221.0332.0434.0628.0758.1053.1290.0631
```

Card (ii)

```
.0216.0237.0383.0574.0750.1086.1310.1819.2229.2819
```

Card (iii)

```
.0220.0241.0389.0583.0763.1104.1331.1849.2266.2866
```

Card (iv)

```
.0232.0254.0410.0616.0805.1164.1405.1951.2391.3024
```

Card (v)

```
.0208.0229.0369.0553.0723.1046.1262.1753.2148.2717
```

Card (vi)

```
.0085.0093.0150.0224.0293.0425.0512.0711.0872.1103
```

References to aid understanding of methodology to obtain necessary input:

1. For RETA and RETR, see discussion of "a" and "r" in: Mauldin, W. P., Nortman, D. and Stephan, F. Retention of IUD's: An International Comparison. Studies in Family Planning. No. 18, April 1967, pp. 7-8.

2. Sterility data taken from: Henry, Louis. Some data on natural fertility. Eugenics Quarterly, vol. VIII, No 2 , June 1961.

3. To make the decision as to which regional life-table to specify, see: Coale, A.J. and Demeny, P. Regional Model Life Tables and Stable Populations. Princeton University Press, Princeton, N. J., 1966.

C. COMPETE

COMPETE is an auxiliary computer programme which accompanies TABRAP. TABRAP does not furnish results of individual methods, rather it prints aggregated tables of users, acceptors and births averted. So, COMPETE was written to provide the user with a programme to indicate how individual methods fare in the competitive setting of a target-setting programme in attracting acceptors, maintaining users and contributing to yearly births averted.

One important modification is necessary for each computer installation running COMPETE: in the main programme, there are two statements referring to device numbers: "II = 5" and "IO = 6". On the IBM 360, a "5" refers to the card reader and a "6" to the line printer. If the user's facility has different device numbers, they may be changed by replacing these cards:

for card reader, II = ——
for line printer, IO = ——

INPUT REQUIRED

Input Number — Variable on Card

1. — NUM

NUM — Number of contraceptive methods. "NUM" will be referred to as "N" in several of the following format statements as a multiplier.

Format: (I2)

Example for 2 methods

Column

1 10 20 30 40 50 60 70

02

2. — METHOD

METHOD — Name of each contraceptive method. There will be one card for each method. Note that each name may contain up to 30 characters.

Format: (30A1)

Example for 2 methods:

Column

1 10 20 30 40 50 60 70

(Card 1)

ALL ANOVULANTS

(Card ii)

MALE AND FEMALE STERILIZATION

3. ZO

ZO — Duration of overlap between post-partum amenorrhea and contraceptive practice. Overlap is designed in fractions of a year and maximum value is 0.5 of a year.

Format: (N F4.3)

Example of overlap for Pills and sterilization:

```
Column
1         10        20        30        40        50        60        70
---------------------------------------------------------------------------
.167.250
 ↑    ↑
Pill  Steril.
---------------------------------------------------------------------------
```

4. ACP

ACP — Relative distribution of contraceptive acceptors between five-year age classes. (i.e., if "ACP" is greater than 100, the proportion of acceptors recruited out of that age group is greater than the proportion of married woman in that group relative to all married women, 15-44.) ACP is obtained from TABRAP output labelled: "Acceptors as a percentage of married non-users."

Format: (6F10.5)

Example:

```
Column
1         10        20        30        40        50        60        70
---------------------------------------------------------------------------
 104.85    141.72    122.89    101.71    81.66     47.17
---------------------------------------------------------------------------
```

5. RETA

RETA — For each contraceptive method, the proportion of acceptors in an age class not immediately discontinuing use of contraception. For instance, if 25 per cent of a group, age 15-19 accepts condoms at a clinic and never puts them to contraceptive use, RETA = .75.

Format: (N F3.2)

Example for two methods:

	RETA	
Age class	Anovulants	Sterilization
15-19	.75	.99
20-24	.75	.99
25-29	.80	.98
30-34	.80	.98
35-39	.85	.97
40-44	.85	.97

Column

1 10 20 30 40 50 60 70

.75.75.80.80.85.85.99.99.98.98.97.97

Anovulants Sterilization

6. RETR

RETR — For each contraceptive method, annual rate of discontinuing contraceptive practice by women in five-year age classes. This rate presupposes a negative exponential decay function to describe contraceptive discontinuation.

Format: (N F3.2)

Example for two methods:

RETR

Age class	Anovulants	Sterilization
15-19	.36	.01
20-24	.33	.01
25-29	.30	.02
30-34	.27	.02
35-39	.24	.03
40-44	.21	.03

Column

1 10 20 30 40 50 60 70

.36.33.30.27.24.21.01.01.02.02.03.03

Anovulants Sterilization

7. CODIS

CODIS — Proportion of acceptors within an age class accepting a particular contraceptive method. For example, if two thirds of contraceptive acceptors age 35-39 are sterilized and the other third accept the Pill, CODIS = .67 and .33, respectively.

Format: (N F3.2)

Example for two methods:

CODIS

Age class	Anovulants	Sterilization
15-19	.67	.33
20-24	.67	.33
25-29	.50	.50
30-34	.50	.50
35-39	.33	.67
40-44	.33	.67

Column

1 10 20 30 40 50 60 70

.67.67.50.50.33.33.33.33.50.50.67.67

Anovulants Sterilization

8. FERM

FERM — Age-specific (15-44) marital fertility rates for women in the first and eleventh programme year. Intervening years will be linearly interpolated by the computer programme.

Format: (12 F4.3)

Example:

Age class	Age-specific marital fertility rates Year 1	Year 11
15-19	.532	.441
20-24	.474	.413
25-29	.396	.355
30-34	.328	.297
35-39	.230	.199
40-44	.123	.101

Column

1 10 20 30 40 50 60 70

.532.474.396.328.230.123.441.413.355.297.199.101

Year 1 Year 11

9. STER

STER — Proportion sterile in each 5-year age class.

Format: (6 F4.3)

Example:

Age class	Proportion sterile
15-19	.027
20-24	.033
25-29	.051
30-34	.106
35-39	.258
40-44	.591

Column

1 10 20 30 40 50 60 70

.027.033.051.106.258.591

10. OPTS

OPTS — Output options. For each of seven tables, a "1" will cause the tables to be printed, an "0" will suppress the printing. The following tables are possible output for COMPETE.

Table number	Title
1.	Input table 1: NUM, METHOD(s), RETA, RETR, CODIS, ZO.
2.	Inputtable 2: FERM, EL, ETBAV, STER, ACP.
3.	Proportion of acceptors still using contraception and births averted, by age and programme year.
4.	Number of acceptors and age distribution of acceptors, by method, age and programme year accepted.
5.	Number of mid-year users, and age distribution of users, by method, age and programme year accepted.
6.	Number of births averted in a programme year, by method being used.
7.	Annual percentage distribution of total acceptors, users and births averted by method.

Example of omitting tables 1-3 and printing tables 5-7:

```
Column
1         10        20        30        40        50        60        70
-------------------------------------------------------------------------
0001111
-------------------------------------------------------------------------
```

11. EL

EL — Number of eligible women (i.e. married women who are not currently using family planning offered contraception) in each age class, every programme year. These are obtained from TABRAP output labeled: "Women eligible for acceptance."

Format: (10F7.0)

Example:

```
Column
1         10        20        30        40        50        60        70
-------------------------------------------------------------------------
(Card i      15-19)
222583.228053.234919.240187.245062.248851.250060.251179.250911.249354.
(Card ii     20-24)
789392.822789.862426.893370.921379.942694.942241.940700.931495.915300.
(Card iii    25-29)
973551.1010098105276510841361110077112578811433831153586114981811327 96
(Card iv     30-34)
911294.930869.955181.970431.981061.983289.995554.1000281992266.971788.
(Card v      35-39)
837136.834979.854579.858898.860238.855992.856909.853088.840762.820042.
(Card vi     40-44)
644190.670724.698463.722803.745038.763771.760792.755146.744896.729870.
   1         2         3         4         5         6         7         8         9         10
                                  Programme Year
-------------------------------------------------------------------------
```

12. ETBAV

ETBAV — "Extra" births to be averted in a programme year by new programme acceptors, i.e. some births to be averted to lower a crude birth rate will have been averted by past acceptors of programme procured contraception who continue to practise. The residual must be averted by new acceptors, or ETBAV—printed in TABRAP table labelled:"Programme with results."

Format: (10F8.0)

Example:

Programme year	Extra births to be averted by new acceptors
1	15,017
2	11,999
3	26,170
4	36,918
5	53,921
6	81,150
7	101,532
8	130,395
9	161,807
10	197,137

Column

1 10 20 30 40 50 60 70

```
15017. 11999. 26170. 36918. 53921. 81150. 101532 130395. 161807. 197137.
```

Example of an input deck set up for NUM = 2 methods:

Card	Variable
No. 1	NUM (= 2)
No. 2	METHOD (for first contraceptive method)
No. 3	METHOD (for second contraceptive method)
No. 4	ZO
No. 5	ACP
No. 6	RETA
No. 7	RETR
No. 8	CODIS
No. 9	FERM
No. 10	STER
No. 11	OPTS
No. 12	EL (for women 15-19)
No. 13	EL (" " 20-14)
No. 14	EL (" " 25-29)
No. 15	EL (" " 30-34)
No. 16	EL (" " 35-39)
No. 17	EL (" " 40-44)
No. 18	ETBAV

D. MORT

One important modification is necessary for each facility using MORT, CONTINUE, and CONTINU2: in the first sections of the programmes, following, "C *** READ INPUT," there are two statements referring to device numbers, "NRD = 5" and "NPR=6." On the IBM 360, a "5" refers to the card reader and a "6" to the line printer. If the user's installation has different device numbers, they may be changed by replacing these cards:

for card reader, NRD = ——— ,
for line printer, NPR = ———.

Contraceptive protection pertinent to preventing births depends on the probability of a marriage remaining intact. In TABRAP/CONVERSE it is assumed that acceptors of sterilization are subject to an annual age-specific risk of marital dissolution by death of a spouse and that this risk remains constant over the target period. MORT is a small auxiliary computer programme designed to facilitate calculating this constant annual risk "m" for each age class.

INPUT REQUIRED

Input Number — Variable(s) on card

1. — NRUNS

NRUNS — Number of "m"-values to be calculated.

Format: (I2)

Example for one case:

Column							
1	10	20	30	40	50	60	70
01							

2. — NYEAR, EL

NYEAR — Programme year of interest

EL — Populations in each of six age groups (15-19, 20-24, 25-29, 30-34, 25-39, 40-44) which are eligible for acceptance (equals married non-users).

Format: (I2, 6F8.0)

Example: NYEAR = 1;

Age Class	Married non-users
15-19	5,783
20-24	35,079
25-29	50,143
30-34	59,554
35-39	49,092
40-44	40,515

Column

1	10	20	30	40	50	60	70
01	5783.	35079.	50143.	59554.	49092.	40515.	

3. NUM, NTT

NUM — Number of methods of contraception. Maximum NUM = 6. NUM will be referred to as "N," a multiplier, in some of the following format statements.

NTT — Length of total target period (up to 10 years).

Format: (2I2)

Example for number of methods = 4 and length of total target period = 5.

Column

1	10	20	30	40	50	60	70
04 5							

4. FERM

FERM — Age-specific marital fertility rates for women in each of eight age classes (15-19, 20-24, 25-39, 30-34. 35-39, 40-44. 45-49, 50-54). (This is the only parameter that requires data for age groups 45-49 and 50-54.)

Format: (8F4.3)

Example:

Age Class	Age-specific marital fertility rates
15-19	.540
20-24	.397
25-29	.274
30-34	.157
35-39	.083
40-44	.031
45-49	.000
50-54	.000

Column

1	10	20	30	40	50	60	70
.540.397.274.157.083.031.000.000							

5. TI

TI — Duration of average use of each method of contraception that overlaps with post-partum amenorrhea, in fractions of a year.

Format: (NF4.2)

Example:

Method	Overlap with post-partum amenorrhea
Pill	.08
IUD	.17
Sterilization	.25

Column

1 10 20 30 40 50 60 70

```
.08 .17 .25
```

6. FECU

FECU — Proportion of women in each of the six age groups who are non-sterile.

Format: (6F4.3)

Age group	Proportion of women non-sterile
15-19	.980
20-24	.955
25-29	.920
30-34	.870
35-39	.765
40-44	.545

Column

1 10 20 30 40 50 60 70

```
.980.955.920.870.765.545
```

7. ACP

ACP — Relative proportion of eligibles accepting in each of six age groups in current year.

Format: (6F6.3)

Example:

Age group	Proportion of eligibles accepting
15-19	1.98
20-24	1.59
25-29	1.19
30-34	0.64
35-39	0.43
40-44	0.17

Column

1	10	20	30	40	50	60	70
1.980	1.590	1.190	0.640	0.430	0.170		

8. METHOD

METHOD— Names of methods of contraception. (Used to label tables.) 1 card for each method.

Format: (12A1)

Example for Pill.

Column

1	10	20	30	40	50	60	70
PILL							

9. RETA, RETR

RETA — Proportion of acceptors of each method in each of six age groups not immediately discontinuing.

RETR — Annual rate of discontinuing use among acceptors of each method in each of six age groups not immediately discontinuing.

There is one RETA, RETR card for each method of contraception.

Format: (12F5.3)

Age class	RETA	RETR
15-19	.59	.24
20-24	.61	.24
25-29	.61	.24
30-34	.62	.28
35-39	.62	.28
40-44	.76	.46

Column

1	10	20	30	40	50	60	70
.590	.610	.610	.620	.620	.760	.240	.240	.240	.280	.280	.460

10. CODIS

CODIS — Proportion of acceptors in each of six age groups using each method. There is one card for each method.

Format: (6F5.3)

Example:

Age class	Proportion using Pill
15-19	.71
20-24	.62
25-29	.37
30-34	.28
35-39	.19
40-44	.14

Column 1	10	20	30	40	50	60	70
.710	.620	.370	.280	.190	.140		

Repeat input #2 (NYEAR, EL) for each case to be run. All other parameters remain the same. An example of the set up of a deck of input cards when JOB = 3 and NUM = 2:

Card No. 1: JOB (= 2)

Punched once for all cases:

- No. 2: NYEAR, EL (NYEAR = 1, EL = married non-users, first year)
- No. 3: NUM, NTT
- No. 4: FERM
- No. 5: TI
- No. 6: FECU
- No. 7: ACP
- No. 8: METHOD (name of first method)
- No. 9: METHOD (name of second method)
- No.10: RETA, RETR (first method)
- No.11: RETA, RETR (second method)
- No.12: CODIS (for first method)
- No.13: CODIS (for second method)

- No.14: NYEAR (=2), EL (married non-users, second year)
- No.15: NYEAR (=3), EL (married non-users, third year)

E. MACHO

MACHO provides a male population projection and vital rates for combined males and females. It must follow a run of CONVERSE, inasmuch as female crude birth and death rates as well as total females for each year of the projection are calculated by CONVERSE and then serve as input to MACHO.

Analogous to CONVERSE, MACHO provides the following options to the user:

(a) Type of initial population: real or stable;
(b) Type of life-tables used for projections: Coale/Demeny model life-tables or empirical life-tables using the male population's age-specific death rates;
(c) Length of projection period: 5 or 10 years;
(d) Output: any or all tables printed.

In addition, the user of MACHO has two options available that are absent in CONVERSE:

(a) Type of projection: with and/or without a fertility regulation programme;
(b) Variable sex ratio at birth.

Again, the user must note that two cards following specification statements indicate the device numbers appropriate to the user's computer installation. If the machine is other than an IBM 360, the following cards may require replacement:

for card reader: II = ——
for line printer: IO = ——

1. NUM

NUM—Number of methods of contraception. Maximum NUM is four. NUM will be referred to as "N", a multiplier in one of the following formats.

Format: (I2)

Example for three methods:

Column 1	10	20	30	40	50	60	70
03							

2. FERM

FERM—Age-specific marital fertility rates for women in each of eight age classes, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, and 50-54.

Format: (8F4.3)

Example:

Age class	Age-specific marital fertility rates
15-19	.468
20-24	.378
25-29	.343
30-34	.300
35-39	.232
40-44	.118
45-49	.000
50-54	.000

Column 1	10	20	30	40	50	60	70
.468.378.343.300.232.118.000.000							

3. TI

TI—Duration of use of method that overlaps with post-partum amenorrhea (in fractions of a year, up to .50).

Format: (N(F4.2))

Example:

Method of contraception	Duration of use that overlaps with post-partum amenorrhea
Anovulation	.08
IUD	.17
Sterilization	.25

Column

1	10	20	30	40	50	60	70
.08 .17 .25							

4. FECU

FECU—Proportion of women in each age class up to age 45 who are non-sterile.

Format: (6F4.3)

Example:

Age class	Proportion of women non-sterile
15-19	.973
20-24	.967
25-29	.949
30-34	.894
35-39	.742
40-44	.409

Column

1	10	20	30	40	50	60	70
.978.967.949.894.742.409							

5. METHOD

METHOD—Name of contraceptive methods, limited to 12 characters. There are NUM method cards, one name per card.

Format: (12A1)

Example for 3 methods of contraception.

Column

1	10	20	30	40	50	60	70
(Card i): PILL							
(Card ii): IUD							
(Card iii): CONDOMS							

6. RETA, RETR

RETA—For each contraceptive method, proportion of acceptors not immediately discontinuing use, by age in five-year cohorts, 15-44.

RETR—For each contraceptive method, annual rate of discontinuation for women, by age (in five-year cohorts, 15-44)
There are "NUM" RETA, RETR cards, one for each method of contraception.

Format: (12F5.3)

Example for three methods:

Proportion of acceptors of cc method not immediately discontinuing (RETA)

Age	Method 1 (Anov.)	Method 2 (IUD)	Method 3 (Steril.)
15-19	.84	92	.99
20-24	.84	.92	.99
25-29	.84	.94	.99
30-34	.84	.94	.99
35-39	.84	.96	.99
40-44	.84	.96	.99

Annual rate of discontinuation for women (RETR)

Age	Method 1 (Anov.)	Method 2 (IUD)	Method 3 (Steril.)
15-19	.45	.43	.01
20-24	.45	.22	.01
25-29	.45	.13	.01
30-34	.45	.07	.02
35-39	.45	.08	.02
40-44	.45	.06	.03

Column

1 10 20 30 40 50 60 70

(Card i) :

.840 .840 .840 .840 .840 .840 .450 .450 .450 .450 .450 .450

(Card ii):

.920 .920 .940 .940 .960 .960 .430 .220 .130 .070 .080 .060

(Card iii):

.990 .990 .990 .990 .990 .990 .010 .010 .010 .020 .020 .030

For each case to be run, repeat all inputs consecutively following first (JOB) input "JOB" times. An example of the set up of a deck of input cards when JOB = 2 and NUM = 2 for both jobs:

Card	No. 1:	JOB (=2)
	No. 2:	NUM (= 2, first case)
	No. 3:	FERM (first case)
	No. 4:	TI (first case)
	No. 5:	FECU (first case)
	No. 6:	METHOD (first case, first method)
	No. 7:	METHOD (first case, second method)
	No. 8:	RETA, RETR (first case, first method)
	No. 9:	RETA, RETR (first case, second method)
	No. 10:	NUM (= 2, second case)
	No. 11:	FERM (second case)
	No. 12:	TI (second case)
	No. 13:	FECU (second case)
	No. 14:	METHOD (second case, first method)
	No. 15:	METHOD (second case, second method)
	No. 16:	RETA, RETR (second case, first method)
	No. 17:	RETA, RETR (second case, second method)

F. TABLE4

TABLE4 is a computer programme designed to yield estimates of births averted as a function of (1) age class at time of acceptance, (2) method of contraception, and (3) ordinal programme year following year of acceptance.

One important modification is necessary for each facility using TABLE4: in the second section of the programme, following the description of the subroutines, there are two statements referring to device numbers, "NRD = 5," and "NPR = 6." On the IBM 360, a "5" refers to the card reader and a "6" to the line printer. If the user's installation has different device numbers, they may be changed by replacing these cards:

for card reader, NRD = ——'

for line printer, NPR = ——'

INPUT REQUIRED

Input Number — Variable (s) on Card

1. JOB

JOB — Number of cases to be run.

Format: (I2)

Example for 1 case:

Column 1	10	20	30	40	50	60	70
01							

2. PROJ

PROJ—Type of projection to be performed IPROJ (1) = 1 indicates a projection without a family planning programme; IPROJ (2) = 1 indicates a projection under a family planning programme. An "0" in either column 1 or 2 indicates that the corresponding projection will not be undergone.

Format: (2I1)

Example for calculation of both projection types:

Column 1	10	20	30	40	50	60	70
11							

3. LFTAB, ITYPE

LFTAB—Life-table type. Choice depends on data availability and appropriateness for population in question.

1. Model life-table: requires annual life expectancy for men age 0, and choice of Coale/Demeny regions for life-tables.
2. Empirical life-table: requires age-specific death rates for the male population.

ITYPE-Population size and distribution; choice again depends on data availability, etc.

1. Stable population: given the intrinsic rate of growth (calculated by CONVERSE).
2. "Real" population, which requires the age distribution of males for initial year, the total size of the male population and the crude death rate for males in that year.

Format: (2I1)

Example, specifying model life-table and a real population:

1	10	20	30	40	50	60	70
12							

4. IPROJ

IPROJ—Length of projection period, either 5 or 10 years.

Format: (I2)

Example for a 10-year projection:

Column

1	10	20	30	40	50	60	70
10							

5. CBRF1

CBRF1—Crude birth rates of females without a family planning programme. Input only if PROJ(1) = 1. Data is taken from CONVERSE table 9.

Format: (11F7. 3)

Example for a 10-year projection (plus initial year):

Column

1	10	20	30	40	50	60	70
21.912	22.693	23.311	22.894	24.433	24.919	25.434	25.878	26.290	26.663	27.004

6. CBRF2

CBRF2—Crude birth rates of females under a family planning programme. Input only if PROJ (2) = 1. Data is taken from CONVERSE table 14. Format is identical to CBRF1.

7. IREG, EX, or EMX

Variables used depend on whether model or empirical life-table is chosen.

A. For model life-table:

IREG Coale/Demeny life-table region.

1. — West
2. — North
3. — East
4. — South

EX—Life expectancy at birth for males. The EX's may be a continuation of historical mortality trends, or follow a theoretical shape.

Format· (I5, 11F5. 1)

Example for 11 years, with a linear increase of .20 years per projection year and IREG = West.

Column

1	10	20	30	40	50	60	70
1	65.0	65.2	65.4	65.6	65.8	66.0	66.2	66.4	66.6	66.8	67.0

B. For empirical life-tables:

EMX — Age-specific male death rates.

Age range: 0-1, 1-4, 5-9, 10-14, ... to as high as data are available.

Format: (16F5.4/3F5.4)

Example of ages 0-85 + :

Column

1 10 20 30 40 50 60 70

Card (i)

.0177.0007.0003.0003.0007.0007.0010.0010.0023.0023.0052.0052.0088.0132 .0212.0338

Card (ii)

.0531.0841.1747

8. AGDIS, POPD (18,1)
CDR, or RINTR

Variables depend on whether a real or stable population is used for year 1.

A. If a "real" population is to be used:

AGDIS—Age distribution of males, in 5-year age cohort.

POPD(18,1)—Total size of male population in initial year.

CDR—Crude death rate for males in initial year.

Format: (13F6.3/4F6.3, lx, F10.0,F5.2)

Example for ages 0-80+ :

Column

1 10 20 30 40 50 60 70

Card (i)

8.100 9.400 9.800 9.000 8.100 6.600 5.600 5.500 5.900 6.000 5.500 5.000 4.400

Card (ii)

3.700 3.300 2.200 2.300 104299728. 9.40

B. If a stable population is used:

POPD (18.1)—Total size of male population in initial year.

RINTR—Intrinsic rate of population growth, from CONVERSE—table 5.

Format: (F10.0, F6.4)

Example: POPD (18,1)=104,299,728 and RINTR = 0.231

Column

1 10 20 30 40 50 60 70

104299728. .0231

9. OPTS

OPTS—Output options. Corresponding to each table number, a "1" in the respective column means that the table will be printed. a "0" means that the table will not be printed. Each table is independent of another, and a new page is started for each table. Card columns and corresponding tables:

Card column	Table
1.	Input to programme, echo check (1): PROJ, IPROJ, LFTAB, ITYPE, EX or EMX, POPD (18,1), CDR or RINTR.
2.	Input to programme, echo check (2): CBRF1, CDRF1, POPF1 and/or CBRF1, CDRF2, POPF2.
3.	Life-table—year 1.
4.	Initial population distribution.
5.	Life-table—year 2 - IPROJ + 1
6.	Male population projection, without a family planning programme.
7.	Vital rates (birth, death, natural increase) for females, males, and total population without a family planning programme.
8.	Male population projection, under a family planning programme.
9.	Vital rates (birth, death, natural increase) for females, males, and total population under a family planning programme.

Format: (9I1)

Example for: "Yes" on tables 1, 2, 6-9
"No" on tables 3-5:

Column

1	10	20	30	40	50	60	70
110001111							

10. SR

SR—Sex ratio at birth (i.e., no. males/no. females born).

Format: (F4.2)

Example for SR = 1.05:

Column

1	10	20	30	40	50	60	70
1.05							

11. CDRF1

CDRF1—Crude death rates of females without a family planning programme. Input only if PROJ(1)=1. Data is taken from CONVERSE table 9.

Format: (11F7.3)

Example for a 10-year projection (plus initial year):

Column

1	10	20	30	40	50	60	70			
4.500	4.328	4.393	4.445	4.485	4.512	4.559	4.593	4.616	4.629	4.631

12. CDRF2

CDRF2— Crude death rates of females under a family planning programme. Input only if PROJ (2) = 1. Data is taken from CONVERSE table 14. Format is identical to CDRF1.

13. POPF1

POPF1— Total female population, without a family planning programme. Input only if PROJ (2) = 1. Data are taken from CONVERSE table 8.

Format: (6F10.0/5F10.0)

Example for a 10-year projection (plus initial year):

Column						
1	10	20	30	40	50	60
Card (i)						
1012380.	1024876.	1044015.	1064131.	1085203.	1107210.	
Card (ii)						
1129107.	1152771.	1177517.	1203319.	1230155.		

14. POPF2

POPF2— Total female population without a family planning programme, years 1 — IRPOJ + 1. Input only if PROJ (2) = 1. Data is taken from CONVERSE table 13. Format identical to POPF1.

G. RATIOS

RATIOS is a computer programme designed to allow one to explore the consequences of changing the method composition of acceptance during the current year. Evaluation is by expected births averted per acceptor during each subsequent year of the residual target period. Such estimates are obtained for each method and for methods weighted together. In addition, one method is chosen as the standard and ratios of births averted by each other method are calculated in relation to the standard.

No account is taken of the contraception of acceptors prior to, or subsequent to, the current year. Each run, or "case" of RATIOS deals with the consequences of acceptance during a particular programme year.

One important modification is necessary for each facility using RATIOS: in the second section of the programme, following the description of the subroutines, there are two statements referring to device numbers, "NRD = 5," and "NPR = 6." On the IBM 360, a "5" refers to the card reader and a "6" to the line printer. If the user's installation has different device numbers, they may be changed by replacing these cards :

for card reader, NRD = — ,
for line printer, NPR = — .

INPUT REQUIRED

Input Number — Variable(s) on Card

1. — JOB

JOB — Number of cases to be run.

Example for one "m"-value to be calculated:

Column 1	10	20	30	40	50	60	70
01							

2. — NT, D, AGE

NT — Length of target period, either five or ten years.

D — Difference in spouses' ages: husband less wife (either 0, 5, or 10 years).

AGE — Lower limit of five-year age class whose "m"-value is being computed.

Format: (I2, 2F3.0)

Example for length of target period is 10, difference in spouses' ages equals 5, and lower limit of five-year age class is 15.

Column 1	10	20	30	40	50	60	70
10 5.15.							

3. — XL, X5L, XLL, X5LL
or
XL, X10L, XLL, X10LL

Person-years choice depends on whether length of target period NT is 5 or 10.

A. When length of target period is five years:

XL — $_5L_X$
X5L — $_5L_{X+5}$
} i.e. female person-years lived in five-year interval, starting at age X or X+5.

XLL — $_5L^{\bullet}_{X+D}$
X5LL — $_5L^{\bullet}_{X+D+5}$
} i.e. male person-years lived in five-year interval starting at age X+D or X+D+5.

B. When length of target period is 10 years:

XL — $_5L_X$
X10L — $_5L_{X+10}$
} i.e. female person-years lived in five-year interval, starting at age X or X+10.

XLL — $_5L^{\bullet}_{X+D}$
X10LL — $_5L^{\bullet}_{X+D+10}$
} i.e. male person-years lived in five-year interval, starting at age X or X+D+10.

Format: (4F7.0)

Example for when length of target period is 10 years; female initial age is 15 and males are 5 years older:
female years lived 15 to 20 = 442,975;
female years lived 25 to 30 = 430,149;
male years lived 20 to 25 = 427,273;
male years lived 30 to 35 = 411,027.

Column 1	10	20	30	40	50	60	70
442975.430149.427273.411027.							

Repeat all inputs consecutively following the first (NRUNS) input, "NRUNS" times for each "m"-value to be calculated. Example of the set up of a deck of input cards when NRUNS = 2:

Card No. 1: NRUNS (= 2)
No. 2: NT, D, AGE (to calculate first "m"-value)
No. 3: XL, X5L, XLL, X5LL (if NT = 5, for first "m"-value)
or
XL, X10L, XLL, X10LL (if NT = 10, for first "m"-value)
No. 4: NT, D, AGE (second "m"-value)
No. 5: XL, X5L, XLL, X5LL (if NT = 5, for second "m"-value)
or
XL, X10L, XLL, X10LL (if NT = 10, for second "m"-value).

H. CONTINUE

Before using CONTINUE, read the first paragraph of the MORT users' manual. For purposes of estimating the continuation parameters a and r, predicated on the modified exponential function of Mauldin and others,[1] an "observation" consists of a duration since acceptance and the corresponding proportion of acceptors still practising at the end of that duration. When there are only two observations, the auxiliary programme CONTINUE is appropriate.

INPUT REQUIRED

Input Number — Variable(s) on card

1. — NRUNS

NRUNS — Number of jobs to be run.
Format: (I2)
Example for one job to be run:

Column 1	10	20	30	40	50	60	70
01							

2. — T1, T2, P1, P2

T1, T2 — Shorter and longer observed durations since acceptance (in months).
P1, P2 — "Life-table" proportions continuing contraception T1, T2 months after acceptance.
Format: (4F6.3)
Example for one job: T1 = 12; T2 = 24; P1 = .794; P2 = .630:

Column

1	10	20	30	40	50	60	70
12.00024.00000.79400.630							

Repeat Input #2 "NRUNS" times for each job to be run. Example of the set up of a deck of input cards when NRUNS = 2:

Card No. 1: NRUNS (= 2)
No. 2: T1, T2, P1, P2 (for first job)
No. 3: T1, T2, P1, P2 (for second job).

1/ See W.P. Mauldin, D. Nortman and F.F. Stephan, *Studies in Family Planning*, No. 18 (April, 1967), pp. 1-12.

I. CONTINU2

Before using CONTINU2, read the first paragraph of the users' manual for MORT. CONTINU2 provides the estimation procedure, based on the least squares techniques, that estimates the continuation parameters a and r in the case of three or more observations. (When there are only two observations, use CONTINUE, described above.)

INPUT REQUIRED

Input Number — Variable (s) on card

1. — NJOBS

NJOBS — Number of jobs to be run.

Format: (I2)

Example for one job to be run:

Column

1	10	20	30	40	50	60	70
01							

2. — NRUNS, N

NRUNS— Number of age classes, each requiring as input: X (durations since acceptance), G (corresponding proportions still using), and LABEL (description of age classes).

N — Number of observations.

Format: (2I2)

Example when number of age classes are 4 and number of observations are 6.

Column

1	10	20	30	40	50	60	70
0406							

Each of the following inputs are read in consecutively "NRUNS" times.

3. LABEL

LABEL— Used to label age classes in input and output print out. Eight characters are maximum.

Format: (8A1)

Example for labelling age group 20-24:

Column

1	10	20	30	40	50	60	70
20-24							

4. G

G. — Proportion still using after "X" months. There are "N" G's on a card, 1 for each observation.

Format: (NF4.3)

Example:

	Months since accepting					
Age class	6	12	18	24	36	48
20-24	.586	.466	.383	.334	.276	.242

Column

1	10	20	30	40	50	60	70
.586.466.383.334.276.242							

5. X

X — Durations since acceptance. There are "N" X's on a card, 1 for each observation.

Format: (NF3.0)

Example (same as for No. 4 above):

	Months since accepting					
Age class	6	12	18	24	36	48
20-24	.586	.466	.383	.334	.276	.242

Column

1	10	20	30	40	50	60	70
06.12.18.24.36.48.							

Example of the set up of a deck of input cards when NJOBS (number of jobs to be run) = 2 and NRUNS (number of age classes) = 3 for the first job and NRUNS = 2 for the second:

Card No. 1: NJOBS (= 2)
No. 2: NRUNS (=3), N
No. 3: LABEL (for first age class)
No. 4: G (for first age class)
No. 5: X (for first age class)
No. 6: LABEL (for second age class)
No. 7: G (for second age class)
No. 8: X (for second age class)
No. 9: LABEL (for third age class)
No.10: G (for third age class)
No.11: X (for third age class)
No.12: NRUNS (= 2), N
No.13: LABEL (first age class)
No.14: G (first age class)
No.15: X (first age class)
No.16: LABEL (second age class)
No.17: G (second age class)
No.18: X (second age class) .

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