The PROJUSE simulation model for determining family-planning objectives

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1. Introduction
According to the World Bank's 1984 World Development Report, the amount spent annually on family-planning services worldwide currently amounts to more than $2 000 million. Rendering a service to the roughly 65 million women in the developing countries who do not want any further children but lack access to family-planning facilities would require a further $945 million. Such an investment would result in a decline from 4.4 to 3.5 in the total fertility rate (TFR) of Third World countries. According to further estimates by the World Bank, $7 600 million a year will be required by the year 2000 (i.e. an annual increase of 7 % between 1984 and 2000) to reduce the TFR to 2.3 (See World Bank in International Family Planning Perspectives 1984:98).

Current expenditure on family planning by developing countries constitutes less than 1 % of their budgets, while more or less the corresponding amount is contributed by institutions abroad (World Bank Report). Consequently there is much room for improvement, and the authors of the World Bank report state optimistically: "Such increased spending would be ambitious but not hugely expensive in real terms and in many countries would be more than offset by reduction in public expenditure in other sectors" (World Bank 1984:98).

Yinger however holds different views on the matter. He feels that as the resources of private organizations begin to dwindle, family-planning programmes will have to compete increasingly with other important development for funds. The available funds should therefore be used as judiciously as possible, and cost benefit analyses should also be considered in order to assist planners in choosing between investment possibilities in the different sectors (Yinger et al. 1983:pp 4-5).

There is a growing awareness of the need to evaluate family-planning programmes, and accordingly that "...the tools for evaluating the effect of these programmes should be honed to the point where they can be used with reasonable facility and efficiency and with maximum confidence as to the validity of the results that they produce" (United Nations Secretariat 1979:1). When family-planning programmes were initially introduced in the developing countries, people doubted their effectiveness. This scepticism regarding the acceptance and effectiveness of contraception, as well as regarding the impact of contraception on fertility, persisted to the extent that one or another form of evaluation eventually became to be regarded as indispensable to the administrative activities of any family-planning programme.

This called for the introduction of a *modus operandi* that would cater for such a need. Hence the development within the relatively short space of two decades of sophisticated techniques meeting certain requirements. Notwithstanding the phenomenal advances made in this field, some questions still remain to be answered. The techniques which have resulted from this endeavour nevertheless offer a sound basis for use in the evaluation process and for further development.

2. Disadvantage of existing models
Models varying from linear extrapolation to the sophisticated TABRAP and PROJTARG programmes have been developed to determine the nature and extent of family planning required with a view to achieving particular population objectives. Bongaarts (1984) recently also proposed a simple method.

Intensive testing of these methods by the author has however pointed out important shortcomings that make them unsuitable for the South African situation.

One of the disadvantages of the TABRAP programme is that calculations can be made for a maximum period of ten years only. To solve this problem, the initial ten-year projection could be done as usual, while certain variables (e.g. number of users of each method and percentage of married persons in each age group who use a particular method) are then introduced as input data in the subsequent ten-year periods.

From the application of the TABRAP model to South African populations it was found that although provision had been made for users present at the beginning of the projection, unreliable results were obtained when the percentage of married women who used a particular contraceptive method exceeded 35 % (Van Tonder 1982:231). It should be borne in mind, however, that TABRAP was developed at a time when there were few developing countries with established family-planning programmes and accordingly fewer users were supplied from official sources. Consequently the TABRAP model could be used with good effect there.

From the above it is evident that a new model needed to be developed for South Africa. However it was also realized that there were certain advantages in using the existing TABRAP and PROJTARG programmes instead of building a model from scratch.

Although it would seem that the TABRAP model is the more versatile of the two and renders more refined results than PROJTARG, it is also a cumbersome model to operate, mainly because of the limits imposed by the ten-year projection period, which for methodological reasons cannot be extended. In view of the South African setup, which requires continuous calculations for a projection period of at least 30 years, the PROJTARG computer programme appears to be the only alternative. This programme can be extended with comparative ease, making it possible to undertake projections over a period of up to 70 years.

3. The situation in South Africa
The rapid rate of increase of the South African population and that of the black population in particular is regarded
as a matter of grave concern, and reduction of the fertility rates of the different population groups to a more manageable level is accordingly envisaged. In a study of the South African demographic situation, the Science Committee of the President’s Council concluded that uncontrolled population growth could not be permitted in South Africa. In view of the available agricultural resources and especially the limited water supplies, the following recommendations were made (South Africa 1983 : 217):

That it be accepted as the main demographic aim that population growth be influenced by means of a population programme in such a way that the total South African population by the end of the next century will cease to grow, stabilizing at about 80 million.

In order to achieve this objective the following specific demographic and development objectives were recommended:

(a) That it be accepted as an objective that the socio-economic development of all the less-developed groups in the population be promoted in order to reach parity in levels of development during the first half of the next century.

(b) That it be accepted as an objective that the health level of all the groups in the population be promoted to such a degree that parity regarding indices of mortality be reached during the present century at the level prevailing in developed Western countries.

(c) That it be accepted as an objective that the fertility of all the groups in the population be changed to such an extent that the replacement level of an average of two children per woman will be reached as soon as possible, but not later than during the second decade of the next century.

Accordingly the aim of this project is to design a model enabling the authorities concerned to determine whether the proposed reduction in the growth rate of the South African population is a viable proposition. The role of the family-planning programme with regard to the number of users required annually in order to achieve the objective will have to be clearly outlined.

The functioning of the new model will now be explained and subsequently applied to the black population in South Africa.

4. Methodological aspects of the model

The PROJUSE (projection of users) model can be divided into two components, namely an adapted PROJTRG model and a component in which certain outputs of the TABRAP model are used as input to determine the required number of users for a particular population target. Conversion of the number of annual visitors to family-planning clinics on the assumption that normally between three and four times as many persons in a population accept contraception as those who use it, forms part of the last section of the computer programme.

4.1 Adaption of the PROJTRG model

In the PROJTRG model calculations are performed on the assumption that no users are present at the beginning of the projection period. This model is therefore based on the premise that no family-planning programme has been established, and thus determines the number of new acceptors of contraception required annually to achieve a certain objective. A number of changes to the existing PROJTRG model were required with regard to fertility rates and L(x) values in order to achieve a more flexible model:

(a) An indication is given regarding the year in which a particular group can be expected to achieve a TFR of 2.1, and fertility rates according to age are entered into the model per calendar year, thereby rendering the model easier to manipulate.

(b) Three sets of L(x) values are used, compared with two sets in the existing PROJTRG model. The first set concerns the basis year while the second set indicates the estimated mortality in the year in which a TFR of 2.1 is achieved. The third set of L(x) values can be for any calendar year after the year in which a TFR of 2.1 has been achieved. Linear interpolation is performed between the three sets of values in order to obtain intermediate values.

Further calculations are then performed in the usual way through the PROJTRG computer programme. As end result the number of new acceptors of contraception required annually to achieve the particular fertility targets is indicated.

4.2 Conversion of visitors to clinics to users of methods

The number of clients who receive a certain contraceptive over a particular period, for instance one year, is not an indication of the number of users in a population at a particular time as they may have visited the clinic more than once a year. These raw data should therefore be converted to users, and this is done by means of the CYP index (couple years of protection) (see Whishik, Chen 1973).

4.3 Decline in the number of initial users

The number of users present in a population at a given time will decline mainly as a result of discontinuation of contraceptive use. Consequently the third step in the PROJUSE model entails calculating which percentage of initial users of each method (calculated in 4.2) will still be users in each of the projection years, by applying the equation \( y = ae^{-ft} \) (for each method separately).

4.4 Determining the required number of additional users to achieve the objective

The remaining number of initial users (calculated in 4.3) is subsequently compared with the required number of users of the PROJTRG model (calculated in 4.1). The difference indicates the number of additional users required annually in order to achieve a particular objective.

4.5 Calculating the cumulative net number of users

The average number of users over the projection period is calculated by dividing the cumulative number of additional users (calculated in 4.4) by the number of projection years. Division according to method used is also done by using the same per centual distribution as with the initial acceptors. In a subsequent step it is assumed that these users of each method can in fact be recruited and that the average number enters the programme for each projection year. Next the decline in users is also determined by applying the equation \( y = ae^{-ft} \) (for each method separately). In other words the number for each calendar year indicates the average number of users entering annually (calculated above) added to the remaining number of recruits of previous years.

4.6 Number of users in the PROJUSE model

The last step involves calculating the required number of users in each projection year to achieve a particular objective. This is done by obtaining the sum of (a) initial acceptors still using a certain method during a particular year, and (b) newly recruited users.

Applying the PROJUSE model to the black population in the RSA

The example is based on the proposed stabilization of the black population at 66.9 million in the year 2050 (the total population will then be 80.0 million). It was assumed that the following per centual distribution of the use of the different methods applied for blacks in 1984 : pill 33.0, IUD 13.0, injection 41.5 and sterilization 12.5. It was also assumed that the above distribution would remain unchanged throughout the projection period.
The average estimated duration of use by the above population group was 18 months for the pill, 24 months for the injection and 2.5 years for the IUD, while it was assumed that on average women would still have had 12 fecund years after sterilization before the onset of menopause. The estimated number of black users of some contraceptive method or other in 1984 already amounted to 926,050 (i.e. 40% of the exposed women), and for the Department of Health and Welfare under whose control the family-planning programme falls, it is essential to determine the annual increase in users required in order to achieve the above population objectives. This estimate was done by means of the PROJUSE model and the results obtained through this model are indicated in Table 1.

From Table 1 it appears that the 926,050 users in 1984 will have decreased to 5,284 by 2010 if it is assumed that each method will be used for the period indicated above (see Column 5 of Table 1). New acceptors should therefore be recruited in order to achieve the required number (as prescribed by the PROJTAG model — Column 6 in Table 1).

According to calculations with the model it was also determined that the 1.35 million female users of contraception required by 1990 will have to increase to 2.57 million by the year 2000, while by 2010 the number of users will have to represent 71.1% of the exposed population in order to achieve the stated objective.

### Conclusion

The PROJUSE Model that has been developed still has certain shortcomings and will require more thorough testing. It nevertheless seems a useful model for calculating the number of users required to achieve certain population targets. Particularly where a family-planning programme has been functioning in a country for some time and a large percentage of women are already enjoying protection, the PROJUSE model appears to be an improvement on TABRAP and PROJTAG.

### Notes

1. $a$ represents the percentage of women receiving a particular contraceptive and who do begin to use it, while $r$ represents the annual discontinuation rate.
2. Fecund, married, non pregnant 15-49 years.
3. For the purpose of the PROJUSE model new acceptors are defined more widely in order to include those who continue using a certain method for longer than the average period. If the pill for instance, is used for longer than 18 months, the person concerned will be classified as a new acceptor.

### References


Norman, D.L. 1975. Contact practice required to meet a prescribed crude birth rate target: a proposed microsimulation model (TABRAP) and hypothetical illustrations. Demography 12, August: 471-490.


