# AN ECONOMIC ANALYSIS OF FAMILY PLANNING IN BANGLADESH

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## ABSTRACT

Bangladesh is widely believed to have a population problem. During the past several years there has been a dramatic expansion in the amount of money spent in family planning. This paper examines the economics of that expenditure for the period 1981-82 to 1983-84. The paper has four major sections: a discussion of contraceptive acceptance and demographic impact, a discussion of program costs, a cost-benefit analysis of the program, and a cost-effectiveness analysis of program components.

During the past three years, there has been a significant increase in family planning activity, as measured by service statistics relating to contraceptive acceptance. The acceptance of all major methods of family planning has increased, but the changes have been partially notable for the use of IUD's and vasectomies. The indirectly-measured demographic impact of this contraceptive use has been, and will continue to be, significant.

The costs of family planning are difficult to measure in Bangladesh because 1) there are several agencies and expenditure headings involved, 2) the documentation of actual expenditure, as opposed to budgets, is incomplete for the most recent years and 3) the economic, as opposed to the financial, costs are in some ways difficult to distinguish. Using the available evidence and recognizing the inherent uncertainties, we provide estimates of the costs of family planning for the overall national program and for its components in recent years.

The economic impact of family planning can be measured in a number of ways. At the most general level, the economic impact is the product of a number of units of demographic change produced by the program and the economic value of each unit of change. Recognizing that there is great diversity of opinion on how one should measure the economic benefits of a birth prevented, this section shows that by any of a wide range of measures of the economic value of preventing a birth, the benefits generated by the family planning program in Bangladesh have greatly exceeded the costs.

The last section of the paper examines the economics of three constituent elements of the family planning program: the Social Marketing Program (SMP), the USAID-sponsored non-governmental organization (NGOs), and the rest of the program, called the "Residual." All three of the program components are shown to generate benefits in excess of the costs. The unit costs of the three components vary considerably. When all contraceptive methods are examined, the NGOs have the lowest costs, the Residual program is second, and the SMP is third, in terms of cost per couple year of protection. However, when sterilization and other methods are examined separately, the SMP is shown to be the lowest cost method of delivering non-sterilization methods of contraception, and the NGOs are shown to have the lowest cost of delivering sterilization services.

It is concluded that as long as the program seeks to include both temporary and permanent methods of contraception, the present mix of program elements is easily justified. Family planning is providing a high level of economic return in Bangladesh.

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# I. INTRODUCTION

This paper describes a cost-benefit and cost-effectiveness analysis of the family planning effort in Bangladesh. The analysis should be of use to both the USAID mission and to the GOB in the continuing effort to make effective allocative decisions relating to family planning. It should also serve as a prototype for similar analyses in other countries.

Two mutually reinforcing kinds of analysis are included in this report. First, we present a retrospective cost-benefit analysis of the Bangladesh family planning program for the years 1982-1983. Alternative estimates of the economic benefits of family planning using different methodologies are presented and described. Second, the cost-effectiveness of the components of the program are analyzed for the same years. The above analyses are implemented on the Apple II microcomputer using the Multiplan software package and on the IBM microcomputer using the Lotus 1-2-3 software package with graphics. Each computer implementation is done in such a way as to permit the insertion of new data and new assumptions into the analysis, as desired.

Bangladesh has special characteristics which influence the kinds of economic analysis which can be undertaken. Although family planning activities have a long history as a part of the general development effort, fertility has remained sufficiently high and present measurement of fertility is sufficiently imprecise (and controversial) that observed variations in fertility cannot be used as a measure of program impact.

Consequently, the analysis here relies on indirect methods of assessing impact. Indirect methods add extra analytical steps to the estimation process and oblige us to use data the validity of which has been questioned by some observers. Such methods might not be necessary in projects or countries with more direct evidence of fertility change. A second feature of Bangladesh is that the very multiplicity of donors and implementing agencies, and the problems of accounting for program resources in a uniform and timely fashion, make it impossible to get exact measures of the program costs. Thus, both on the side of impact and on the side of costs, the measures reported in this analysis are somewhat tentative. Nevertheless, the data are sufficiently robust to leave us with the feeling that the general picture presented in our results is reasonably accurate.

We describe here the detailed set of calculations used to estimate the costs and the benefits of family planning. Because of the enormous uncertainties in many aspects of this research, we have attempted to state our biases as clearly as possible and, where appropriate, to provide alternative estimates of key relationships. For example, Tables 8 and 9 provide ten different estimates of the value of a birth prevented. It is impossible to reach closure on all of the key issues involved in this kind of research. We have attempted to provide readers with a good understanding of what appear to us to be the basic estimates of the costs and benefits of undertaking family planning in

Bangladesh and of how they might vary depending on assumptions made in the analysis.

Figure 1 illustrates the logic of the following analysis. The analysis has a number of discrete elements or modules. As proposed here, the four modules on the left side of the diagram are largely independent of one another. Each becomes an input to the components of the analysis on the right side of the diagram. CBA and CEA share most elements. In terms of calculation, the difference between them is that CBA involves the extra step of estimating the value of a birth prevented. Of course, they are in large measure directed to different audiences, as well. In this paper we will begin with a discussion of the elements common to the two kinds of analysis. The next section deals with the costs of the program. It is followed by a discussion of the program's demographic impact. Section IV and V of the paper deal with the CBA and CEA respectively. The last section is a summary.

## II. THE DEMOGRAPHIC IMPACT OF FAMILY PLANNING

There are two general approaches to estimating the demographic impact of family planning. The first, and generally preferred approach, would be to use observed variations over time or space in the fertility of the population and, using appropriate causal models and statistical techniques, to estimate the independent impact of family planning. Unfortunately, the

data and the fact that Bangladesh is generally at an early stage in the fertility transition mitigate against this approach. The second approach is to use the service statistics from the program and complementary information from independent demographic research to construct synthetic estimates of program impact. This is the approach adopted here.

Our estimates of program impact are undertaken in two parts. First, statistics from the implementing agencies are used to estimate the number of contraceptive users by agency and method. Second, a set of multipliers, based on secondary data sources, are used to estimate the number of couple years of protection (CYPs) associated with contraceptive use by method. These two sets of numbers are multiplied to get estimates of aggregate demographic impact as measured by CYPs. These measures can be converted into measures of births prevented (BPs) where desired. The procedures and the problems with each of these steps are discussed below.

## A. SERVICE STATISTICS CONCERNING USERS

There are several sources of inaccuracy or uncertainty concerning the service statistics used for this report. First, with regard to clinical methods such as sterilization or IUDs, audit reports suggest that most users listed in the records are genuine. However, there may be some degree of double-counting in the process of aggregation. It is especially possible that some

of the cases recruited by the NGOs may have been counted by both the government and the NGOs. We have no independent means of estimating the magnitude of this effect and have not dealt with it in the calculation. A comparison of the reported use of sterilization in the 1983 Contraceptive Prevalence Survey with the numbers projected from the service statistics records indicates no major inconsistency. However, attempts to separately estimate the contribution of the NGOs and the government programs to sterilization acceptance may be affected by these reporting inaccuracies. A related problem exists with regard to referrals. The NGOs often recruit cases for sterilization and bring them to the government hospital (or to facilities run by other NGOs, such as the Bangladesh Association for Voluntary Sterilization) for the operation. In these cases we have kept separate records of the referrals so that contraceptive impact can be attributed to either party or, on some weighted basis, to both.

The problems of estimating the number of users of non-clinical methods are even more serious than those associated with clinical methods. The major methods are oral contraceptives and condoms. For these methods we have two sources of information which can be used to estimate their demographic impact. First, program records provide regular reports about the number of units of oral contraceptives or condoms distributed or sold as a part of the national family planning program. Second,

research reports can be used to generate estimates of the actual use those methods by consumers. Where these estimates correspond, our estimate of demographic impact is relatively straightforward. Where they differ, special care is required.

With regard to oral contraceptives, there seems to be a fairly close correspondence between distribution statistics and use as estimated by contraceptive prevalence surveys. Various sources of information suggest a number of users consistent with the estimates that would be derived by dividing the number of cycles of pills reported to have been distributed or sold during the year by about 14. The biological number of cycles required per woman per year is about thirteen, but some loss may occur in the distribution system. We have reported the statistics of distribution and sales in our basic table, and have assumed that 14 cycles are required for a CYP.

There is a larger gap between estimates of sales and distribution of condoms and estimates of use. Condoms are distributed free by the government clinics and sold, at highly subsidized rates, by the Social Marketing Program (SMP). In 1983, about 127.7 million condoms were reported distributed and sold by the national program. Sixty-nine percent of these were sold by the SMP. The 1983 Contraceptive Prevalence Survey found that 1.8% of the eligible women interviewed and 2.7% of the husbands of eligible women reported current use of condoms. If both husband and wife reports are taken into account, in 3.4% of

cases either husband or wife or both reported the use of condoms.[1] There were 15.465 million eligible women in Bangladesh in mid-1983.[2] Depending on whether the husband (2.7%) or the joint rates (3.4%) are applied to this number, there were either 418 or 526 thousand condom users in 1983. Dividing the 127.7 million condoms sold by the estimated number of users suggests that either 306 or 243 condoms are used by each condom using couple per year. These numbers are much larger than the estimated number of condoms needed per couple each year.[3] The unexplained gap increases if lower estimates of condom prevalence are employed. In conclusion, while we assumed 100 condoms per CYP in a previous analysis, new evidence has been developed during the past year which suggests that a higher number is in order. We propose to use the number 300 (corresponding to the CPS husband sample estimate) in the present analysis, but the implications of alternative assumptions can easily be explored.

Information to check the accuracy of use statistics for methods other than condoms and oral contraceptives is lacking. But these methods (Emko, foam tablets and injection) are used by a very small portion of the user population in Bangladesh. Therefore, we have accepted the user reports as given.

The numbers of contraceptive adoptors (sterilization and IUD) or the number of contraceptive units distributed or sold (other methods) during 1982, 1983 and 1984 are shown in Table 1. It is clear from the numbers in the table that there has been a

substantial increase in the use of contraception during the past two years. The acceptors of clinical methods have more than doubled, and there has been a substantial increase in the reported use of pills, condoms and injectables.

## B. IMPACT MULTIPLIERS

Two methods of demographic impact are used in the analysis: couple years of protection (CYP) and births prevented (BP). For either measure it is necessary to translate the measures of contraceptive acceptance shown in Table 1 into measures of demographic impact. The multipliers used to estimate demographic impact are summarized in Table 2.[4] We have assumed for all methods that 3.5 CYP are equivalent to one BP. This number was chosen to reflect the age-specific fertility women in the principal ages of contraceptive use. For women in their late twenties and early thirties, recent estimated age-specific fertility rates are in the range of 275 births per thousand women. Adjustments for currently unmarried women and for the expected high fecundity of contraceptive users would suggest slightly higher rates. When translated into births prevented per CYP, these results suggest a range of 3.0 to 3.5. Since not very much is known about how various methods are actually used by acceptors, there are also possible reasons for thinking these estimates are too favorable. For example, substantial numbers of women may take oral pills irregularly or there may be cases where

both spouses are sterilized. We have not adjusted for such factors, but the software which accompanies this report permits easy adjustments on these issues. A variety of values for the parameters can be examined to assess the impact of programs. Here we try to be relatively conservative but consistent with what we know of the data.

For clinical methods, the number of CYPs per acceptor of each method is estimated using information on the age distribution of acceptors and whatever information on discontinuation or marital dissolution or menopause is available.

For non-clinical methods we have used the limited information available to us. For condoms, we have assumed that 300 condoms are needed to provide one CYP. For foam tablets we assume 125 pieces per CYP (see footnote 3). For oral contraceptives, we assume that 14 cycles are needed per CYP, based on the amount needed to be congruent with CPS results.

Table 3 summarizes the number of couple years of protection generated by method for the calendar years 1982, 1983 and 1984. It also shows the aggregate number of births prevented. By either measure the overall impact has nearly doubled during this two-year period.

For the purpose of economic analysis, one further refinement of the impact data is required. The measures of impact reported in Table 3 are not adjusted for the interval between the time of contraceptive acceptance and the time when the impact on

fertility takes place. We know that this interval must be at best nine months for temporary methods, such as the condoms or oral pills, and may be as long as four or more years in the case of sterilization. From the point of view of planners, events that are delayed are less important than those which are close to the time of decisions. Thus, we have adjusted the impact of different contraceptive methods by discounting for the interval between use and demographic impact, using the same discount rate (15%) used in the economic analysis described in Section IV (see Table 2 for timing assumptions). This procedure reduces the relative impact of sterilization and raises that of temporary methods.

## III. ESTIMATES OF PROGRAM COSTS

The costs of providing family planning services are difficult to estimate for a number of reasons. There are many agencies involved, and the accounts are maintained in such a manner that it is not easy to distinguish allocations from expenditures for the time periods in question. Also, some of the costs of running family planning are listed under other headings, such as health instead of family planning, and, conversely, some of the expenditures listed under family planning are in significant measure used for other purposes, e.g., the expenditures on the construction of Union Family Welfare Centers (UFWCs).

## Estimates of Program Costs

The main categories of expenditure we have used are the Annual Development Programme (ADP) expenditures, the Revenue Budget expenditures, and the commodity and NGO expenditures, which fall outside of the ADP budget. The estimates for recent years are summarized in Table 5.

Figure 3 illustrates the complex flow of resources with the population sector in Bangladesh. Resources are available either from internal sources or from international donor agencies. The funds available from these three sources flow through three general budget headings. The Revenue Budget, which is used to fund the activities of agencies such as police, tax collection and key personnel from other ministries, such as the Ministry of Health and Population Control, is funded from internal sources of funding. The Annual Development Programme (ADP), the collection of activities oriented towards "development" and implemented by a variety of agencies, is funded partly from internal resources but mostly from funds provided by bilateral and multilateral international assistance. Many of the funds in this category are directed towards specific development activities, such as family planning. Most of the funds available for family planning in Bangladesh are included in either the Revenue Budget or the ADP. There are a few activities which fall outside of both the ADP and the Revenue Budget. USAID, for example, provides contraceptives to both MOHPC and NGO programs and this assistance is in kind. There are also some NGO programs which are not formally budgeted

through the ADP. These activities are approved by the GOB, but are only partially accounted for in the ADP budget. The Planning Commission makes an estimate of what these flows are each year, but our impression is that the amounts actually spent exceed those budgeted by the Planning Commission. In Figure 2, we have included broken arrows to indicate the partial flows assumed by the Planning Commission. In our estimates of the amounts of money spent on family planning, we have summed the three general expenditure headings and adjusted for the extent to which non-ADP expenditures are already included in the Planning Commission's estimates.

For the ADP, several sets of figures have been made available to us. They differ primarily in terms of the estimated percentage of the plan allocation actually spent (see Table 6). There is no way for us to confirm the accuracy of these estimates or to choose directly from among the three alternatives. On the basis of advice from knowledgeable observers in the Planning Commission, we have chosen to use the IMED estimates for the first two fiscal years under consideration and the Planning Commission estimate for 1983-84, for which the IMED data are incomplete. It should be noted that the differences in the estimates of the percentage of the allocated amount spent are very large.

For each year, we have divided the information into that relate to the Ministry of Health and Population Control (MOHPC)

and to the entire sector, including the intersectoral projects. Individual projects in the Ministry component may include some costs that would be more appropriately listed (at least partially) under the health heading (especially the costs of constructing UFWCs), but such expenditures do not constitute more than 14% of Ministry expenditures, or 8% of all expenditures.[5] The expenditures under the Revenue budget are largely used to cover the costs of the senior staff of the MOHPC. Of the total revenue budget expenditures listed under the general heading of Health and Population Control we have included only those relating to the "Family Planning Establishment." Some elements of the Revenue budget, such as expenditures on hospitals or medical colleges are undoubtedly relevant to family planning. They have been left out, but the total amount of expenditure involved is, at most, on the order of magnitude of the expenditures discussed above, which work in the opposite direction.

USAID and other international donors have provided some resources for family planning in Bangladesh that are not reflected in the ADP or the Revenue budget. The support for the social marketing program (SMP) and various NGOs are a significant portion of all expenditures in family planning. In contrast with the programs listed under the ADP or the revenue budget headings, most of the authorized expenditure on the SMP and NGO programs is actually used within the following 12 months. Since funding for

these programs is usually approved late in the U.S. fiscal year, we have assumed that the project costs are actually incurred in the following Bangladeshi fiscal year, which begins in July of each year. Thus, money committed between October 1, 1980 and September 30, 1981 was assumed to be part of program costs in 1981-82. One additional element needs to be added to clarify the budget estimates. The GOB is aware that a portion of the USAID support for family planning comes in the form of commodities and has made a rough estimate ("non R.P.A.") of the amount in the Family Planning scheme component of the ADP. This amount is deducted from the total in order to avoid double counting.

The total expenditure on family planning in Bangladesh, in Taka, is shown in row 7 of Table 5. The dollar equivalent is shown in row 9. A rough approximation to calendar year expenditures is made by averaging the Bangladeshi fiscal years.

## A. THE COST OF THE NON-GOVERNMENT ORGANIZATION (NGO) AND SOCIAL MARKETING PROGRAM (SMP) COMPONENTS OF THE NATIONAL PROGRAM

It is of considerable interest to examine not only the overall program but the various program components as well. Separate estimates can be made, using USAID records, of the costs of the USAID-funded NGO and SMP programs. We have attempted to include all relevant costs in these estimates (including indirect costs and costs relevant to the delivery of services that may relate to the organizational headquarters

outside of Bangladesh). The cost of other, primarily Ministry, programs can be estimated as the difference between the overall expenditure on family planning and the costs of these two special programs. We will call this the "Residual," which also includes non-USAID-funded NGO's. The estimated costs for 1982 and 1983 are presented in Table 13.

## IV. COST-BENEFIT ANALYSIS (CBA)

CBA is a technique developed to assess the relative economic efficiency of projects carried out in different sectors. The basic idea is that economic managers should use the resources at their disposal in the most effective manner possible. Projects or types of economic activity with higher economic returns (or a high ratio of benefits to costs) should be preferred over those with low return.[6] A systematic analysis of all possible projects or activities, using the same assumptions or standards in each case, should permit an assessment of which projects should be accorded the highest priority. If the family planning activities of the government are to be justified in terms of their contribution to development, then they should yield an economic return as high as or higher than other economic activities included in the development budget.

The CBA proceeds in the following manner: First, we estimate the economic value of preventing a birth. Second, we assess the number of births prevented by the family planning

activities for each of the three years under analysis. Multiplying the value of a birth prevented by the number of births prevented yields an estimate of the gross benefits generated by the family planning program. The third step in the analysis is the estimation of the costs of family planning, and the final step is the estimation of the net benefits of the program and of the benefit-cost ratio. Each of these steps is outlined briefly in the following paragraphs. The basic steps in the analysis are first illustrated with a relatively strong set of assumptions (that we call Example 1) and are then repeated using other assumptions.

## A. THE VALUE OF A BIRTH PREVENTED

The value of a birth prevented (VBP) in Bangladesh depends on the national goals espoused by the people of Bangladesh, represented by their government, and on the underlying relationship between population growth and economic development in the Bangladeshi context. On goals, the national planning documents state clearly, "The ultimate purpose [of government planning efforts] is to significantly raise the quality of the life of the common man" (GOB, Planning Commission, The Second Five Year Plan, 1980-85, page 24). In the planning documents of the GOB, a constantly repeated theme is that the central purpose of government economic policy is to assure equitable growth of income and thus to raise the standard of living of the masses.

Estimation of VBP must be approached in this context. If the government can, through its activities, convince or help its citizens to use contraception and thus to reduce fertility and population growth, the economic value of each birth prevented can be estimated as the contribution that reduced fertility makes to the national planning goals.

Since both the definition of the "quality of life" and the scientific evidence on demographic-economic relationships in Bangladesh are open to different interpretations, several approaches can be used to estimate the economic gains for each prevented birth. For this paper we present three alternative sets of estimates. In Example 1, we estimate VBP on the assumption that the primary goal of national planning is to raise per capita GNP and that GNP itself is not affected, on the margin, by changes in the size of population. In Example 2, we examine a number of ways in which population growth may influence the size of GNP. In Example 3, we examine the VBP in terms of the savings in government programs which result from a lower rate of population growth. As a preface to the discussion of the three examples, we describe the demographic assumptions underlying the model.

## 1. Demographic Assumptions Underlying the Estimate of VBP

Figure 3 illustrates the set of demographic assumptions underlying our approach to estimating the value of a birth prevented. Suppose that the government, through its voluntary family planning activities in a given year, causes a reduction in fertility in the following year of 100,000 births--less than a three percent drop in fertility from current levels. For each year into the future the population will now differ from what it would have been had the family planning program not been undertaken. Let us call the population that would have existed without the family planning investment as P(H) for high and the population which results from the intervention as P(L) for low. These populations may differ in a number of respects (size, age structure, etc.), but for our preliminary examination let us concentrate on the total numbers. If 100,000 births were prevented in year one, then in each subsequent year,

P(H) = P(L)
+ survivors of original cohort of 100,000 births prevented
+ any second generation effects.

Thus, at least until the birth cohort begins to have children of its own, the difference between the high and low fertility population is going to be something less than 100,000.

## 2. Example 1: The Pure Denominator Effect

In the first example, we assume that the goal of government policy is to maximize GNP per capita, and GNP is not affected by population size. For this example, we assume that population growth has no net effect on the level of GNP or, alternatively, that positive or negative effects, if any, essentially offset each other.

The assumption that GNP and population growth are independent of one another represents one end of the spectrum of views about economic demographic relations in Bangladesh. There are a number of grounds on which the simplifying assumptions of Example 1 can be justified. First, we are interested in the benefits as measured from the perspective of the nation. Thus, we are concerned with national aggregates such as gross national product or GNP per capita. The possibility that children may be economically productive in the family will only be relevant if that productivity is important at the aggregate level. Moreover, since we are talking about voluntary programs of fertility reduction, it is unlikely that parents will be willing to voluntarily use family planning unless they decide that the economic gains from additional children are small.

Second, it is likely that the relationship will differ greatly depending on the economic institutions and the relative abundance of different factors of production. In Bangladesh, evidence supports the idea that it is difficult for many people

to find productive employment. Land has been increasingly subdivided in recent years, and the need for more labor hours in agriculture is not clear. Capital formation is sufficiently low in the industrial sector that only a small part of the rapidly expanding labor force can find jobs in that sector. Under these circumstances, it seems unlikely that a reduction in the rate of growth in the labor force would have a negative impact on development. Note that we are not asserting that extra members of the labor force will be idle. Since there is little equivalent to unemployment compensation or social security in rural Bangladesh, all economically active workers of the population will seek some sort of a job, at whatever level of remuneration is available. In the process they may end up shifting the labor supply curve and reducing the prevailing wage for all workers. Our assertion under this first example is simply that, on balance, there is likely to be little, if any, addition to total output from a marginal increase in the size of the population.

Third, any reduction in the growth of the labor force through family planning will lag considerably behind the expenditure. Even in Bangladesh, where children are economically active from an early age, a child's marginal contribution is negligible during the first ten or twelve years, and limited for a period beyond that.[7] Thus, any loss to national income because of reduced labor inputs resulting from a reduction of the number

of births taking place in 1985, will not be marked in the economy until some time after the year 2000.

Finally, changes in the number of children in the population will have consequences in addition to those working their way through the labor force. Children will be net consumers during their first years; for example, a high ratio of young dependents may reduce the effective level of investment. All of these factors must be weighed in attempting to assess the impact of changes in the level of fertility on national income.

Let us suppose, then, that national income is independent of population size, at least over the range that we are discussing. In highly developed economies where labor is scarce, this assumption is unrealistic, but for Bangladesh, with its more than ample supply of unskilled labor, it may be reasonable. Then the difference in per capita incomes in the two situations postulated above is

$$\frac{GNP(t)}{P(L,t)} - \frac{GNP(t)}{P(H,t)}$$

The crucial question is, how much income would be required to bridge the gap in the incomes of these two populations, that is, to make the per capita income of the higher population the same as that of the lower population? That amount can be calculated by multiplying the difference as given above by the higher population. This number represents the gain to the people in P(L), for each year in the future, of having reduced fertility in

the original year. Algebraically, the benefit, in any year t, is

$$B(t) = \left(\frac{GNP(t)}{P(L,t)} - \frac{GNP(t)}{P(H,t)}\right) P(H,t)$$

B(t) is not one number but a series of numbers, one representing each year. To get back to a single number, the B(t)'s are multiplied by a discount factor and summed. Thus the value of a birth prevented in year 0 (i.e., VBP (0)) is

$$VBP\ (0) = \sum_{t=0}^{25} \frac{B(t)}{(1+i)^t}$$

where i is the discount rate.

The various steps in the process of estimating the gross value of a birth prevented are shown in Table 7. The estimate derived from the exercise as shown in this table is Tk 15,509. Note that the value depends on the exact empirical assumptions made. In Table 7 we have assumed that we are estimating the value of a birth prevented in 1983-84 as a result of expenditures in 1982-83. We assume the very optimistic rates of GNP and population growth suggested in national planning documents - the discount rate used is 15%[8] - and we have made the projections for 25 years beyond the original expenditures. Since the exact value will depend on the assumptions about both the discount rate and the rate of GNP growth used, we provide an estimate of the range of possible values corresponding to different assumptions in Table 8. For the sake of consistency, our preference would be to use the high discount rate and the national income projections

used by the Planning Commission. Even more important, the estimated VBP depends on the theoretical relationships between the population size and economic variables. Alternative approaches are discussed below.

3. Example 2: Mixed Numerator and Denominator Effects.

It is possible to estimate the VBP by making more complex assumptions about the relationship between GNP and population change than those used in Example 1. Under example 2, we assume that the goal is to maximize per capita GNP, and GNP is a function of population.

We know that economic change is influenced by population growth in many ways. There is a great deal of debate about the nature of the influence, and the literature suggests a number of possible mechanisms. Three possible modes of influence are explored here: 1) that population growth influences GNP through the labor force, 2) that population growth influences GNP through savings and investment mechanisms, and 3) that population growth influences GNP through technology and returns to scale. We also explore the possible combined effects of these mechanisms. Fully specifying these effects would involve the construction of models of great complexity (and controversy) that would fully account for changes in GNP and other economic variables. In this analysis we have concentrated on the marginal effects. That is, we have attempted to estimate the changes which would result in

GNP as a consequence of relatively modest changes in population size. As in Example 1, we concern ourselves with the demographic impact that occurs as the result of family planning activities in one particular year.

A reduction in fertility, as described in the last example, will have a direct influence on the productive capacity of the economy only when the cohort into which the prevented births would have occurred enters the labor force. This means that there will be a lag of about 12 to 15 years before the cohort makes significant labor contributions. The effect of reductions in the size of the labor force can be modelled by deducting an amount equal to the labor force contribution of the missing laborers from the estimated GNP for each year in the future. This contribution can be calculated as the product of the size of the surviving cohort multiplied by the labor force participation rate, multiplied by the marginal product of each of the working members of the cohort. The marginal product in this application can be assumed to vary between 0 and 100% of the average product of labor. The average product is estimated as the national GNP divided by the number of people in the working population.

Table 9 shows the estimate of the value of a birth prevented on the assumption that the GNP in the low population is reduced after a lag by the value of the marginal product that would have been forthcoming from the additional workers. As one can see in the table, the effect is relatively small, and, given the time lag, the discounted contribution to the VBP is modest.

The savings effect works in the opposite direction. Rapid population growth is assumed to reduce the ability of the economy to save and to invest. Two major components of this effect have

been suggested in the literature (Leff, 1969 and Bilsborrow, 1980): the dependency effect and the per capita income effect. A younger population associated with high fertility puts a higher burden on the working population and makes individuals and institutions, such as government, less able to put aside resources for investment. At the same time, everything else being equal, a larger population makes for a lower level of per capita income. Less income also implies less savings. Using the estimated cross-national effects of population growth on savings as our point of departure, we have specified a linear equation relating savings, the dependency ratio, and per capita income. We then used the resulting formula to estimate the additional savings that can be expected to take place with the lower population than with the higher population. Assuming, as is conventional in economic analysis, that this saving is invested and there is no depreciation, we can estimate the effect on national income as the product of the accumulated extra savings and the inverse of the capital output ratio. In this case, the effect of reducing population growth is to increase savings and investment, and, thus, GNP. The effect is cumulative. The application to Bangladesh is difficult, since there is so little savings data from that country, but the use of international data in the manner described may give some sense of the magnitude of the effect.

Table 9 shows the estimated value of a birth prevented on the assumption that population growth influences GNP through savings. In this case the effects are assumed to begin immediately, and to cumulate fairly rapidly.

Research on the determinants of economic development has shown that labor force and savings or investment, by themselves, explain only a small percentage of the observed variation in GNP. "Technology" or technological change is often used to explain the residual. Population growth influences technology in a number of respects, but the net direction and magnitude of the effects is much disputed. Simon (1984), for example, has argued that population growth is likely to have a positive effect on GNP and that much of this effect will be the result of changes in technology or of returns to scale. Myrdal (1968) and the authors of the 1984 World Development Report, in contrast, have argued that the effects of population growth on technology are likely to be negative in conditions such as those existing in Bangladesh.

Following the same marginal approach used to examine the savings effect, technology effects can be measured. The effect in each year would be measured as a deviation from the base projection of national income made by the Planning Commission. The size of the deviation is equal to the technology coefficient multiplied by the percentage difference between the base population and the population reduced by Family Planning, multiplied by the size of GNP in the original Planning Commission

estimate. The magnitude of the coefficient can vary from less than zero (consistent with the Myrdal or WDR effect) to greater than one (consistent with a pure "Simon" effect). We have assumed for our illustration a technology coefficient of 0.33, implying that a one percent increase in the population growth leads to a 0.33% increase in GNP on the margin. Any other effects are assumed additive to this.[9] The magnitude of the technology effect, as shown in Table 9, is quite significant.

Tables 8 and 9 show a range of alternative estimates of VBP under different assumptions. Our preference would be to use the estimate with the high discount rate (because it is used by economic analysts in Bangladesh for the analysis of other projects) and with the combined effects. An infinite number of other estimates are possible by altering the assumptions used in the computer model to project national income. An estimate of Tk 10,000 per birth prevented seems an appropriate but conservative summary figure.

## 4. Example 3: Values of VBP Derived from Estimates of Savings from Government Expenditures

A very different approach to estimating the value of a birth prevented is to examine the effects of population growth on government expenditures (Example 3). This approach has been used by Abel et al. in a benefit-cost analysis of the Thai family planning program and by Chamie et al. in an analysis of the US family planning experience. The measure of benefits used is restricted, since it only relates to government expenditures, but the method has the advantage of permitting a comparison between the level of government expenditures on family planning and the savings which result for other government programs because of the family planning program.

The approach can be used for a number of government sectors. Here we will examine the savings in terms of expenditures on education and total government expenditures. The basic measure of benefits is:

$$\text{Benefit}(t) = \text{Government Expenditure with } P(H) - \text{Government Expenditure with } P(L)$$

In the case of education, the level of expenditure is estimated as the number of persons expected to be of school age at each level, multiplied by the enrollment rate (which is assumed constant in the two situations), multiplied by the project per student level of expenditure on education.[10] The results for the analysis of educational savings are shown in the bottom panel of Table 9. As seen, they yield an estimate of the benefits less

than that of other approaches, since they measure only part of the impact. There are similar impacts in fields such as health, housing, land reform, employment, and a variety of other sectors. Thus, it seems appropriate to measure the VBP in terms of a more broadly based definition of government expenditures.

The last measure of the VBP extends the logic used in estimating the savings in the educational sector to the rest of government expenditures on development. As a measure of development expenditures, we have used the ADP budget, which is projected to grow at the same rate that the Planning Commission projects GNP to be growing. Estimates of the VBP using this approach are lower than those using Examples 1 and 2, but are still higher than those used in the educational sector alone.

The above analysis is complicated, but note that we have not made any separate allowance for employment or some other elements in a basic needs approach to development. To the extent that reduced fertility has implications for employment, education, housing, etc., that are not adequately captured by the per capita GNP criterion, the value of a birth prevented will be larger than the estimates for examples 1 and 2 of Table 9. The use of a relatively high discount rate, a fixed time horizon, and the assumption of no second generation effects all work to make these estimates quite conservative.

## B. THE TOTAL BENEFITS OF THE FAMILY PLANNING PROGRAM

The gains from the family planning program are calculated as the product of 1) the value of a birth prevented and 2) the number of births prevented. The number of births prevented, BP(t), is one of several measures of demographic impact used in the literature. The details of estimating the demographic impact were discussed in Section II. We estimate the undiscounted demographic impact to have been about 4.29 million CYP or 1.23 million BP for the year 1983 (See Table 3). This number needs to be adjusted, through discounting, for the delay between the original program expenditure and time when the "birth prevention" takes place (i.e., the time when the birth would have taken place in the absence of family planning). Table 4 shows this adjustment and, using an estimate of Tk 10,000 for the VBP, shows the calculation of the gross benefit generated by the program (TBG).

$$TBG_{(1983)} = VBP \times BP_{(1983)}$$
$$= Tk\ 10{,}000 \times 911.60 = Tk\ 9{,}116\ millions$$

## C. TOTAL COSTS OF THE FAMILY PLANNING PROGRAM

The total benefits of family planning as estimated in the previous paragraph do not represent the net gain because they do not take account of the cost incurred in implementing the family planning program. Our estimates of the costs are detailed in Section III. For 1983, we estimate the costs to have been, $54.73 million or Tk 1,259 million (See Table 5).

## D. THE NET BENEFITS AND THE BENEFIT-COST RATIO FOR THE NATIONAL FAMILY PLANNING PROGRAM

The net gains from family planning are calculated as the difference between the gross benefits calculated in Section C and the costs as summarized in Section D. For 1983, the calculation is as follows:

$$\text{Net gain} = TB_t - C_t$$
$$= \text{Tk } (9{,}116 - 1{,}259) \text{ million}$$
$$= \text{Tk } 7{,}857 \text{ million}$$
$$\text{The benefit cost ratio} = TB_t / C_t$$
$$= 7.24$$

Table 10 summarizes alternative estimates of benefit-cost ratios in 1982 and 1983 under different assumptions about the value of a birth prevented. Even assuming that the VBP is represented by only savings in government expenditures, the benefit-cost ratio is consistently above 1:1.

# V. THE COMPONENTS OF THE FAMILY PLANNING PROGRAM: ECONOMIC ASPECTS

## A. COST-BENEFIT ANALYSIS

The results presented in the previous section of this paper relate primarily to the overall national program. They show that family planning in Bangladesh generates far more benefits than costs for the country as a whole. Despite these results, it is relevant to ask whether the economic balance sheet is as favorable for the individual components of the program as it is for the program in its entirety. Answering this question

requires additional data on the components of the program, and unfortunately, these data are only available on the basis of some special assumptions about costs; and, even then, they are available for only a small proportion of the overall program.

In Section III, we described a "residual" approach to the estimation of costs for the USAID-funded NGOs, the SMP and the Residual Program. Essentially, the approach is to use the reported costs for the first two programs and to estimate the costs of the rest of the program as a residual. Since we have separate estimates of the number of contraceptors generated by the two programs and for the national total, we can use the same method to estimate demographic impact. Finally, by making the reasonable assumption that the VBP is the same for the NGO as it is for the rest of the program, we can estimate the benefits and the costs of each of the sub-programs. The "residual" would be quite sensitive to assumptions if it were a small proportion of the whole, but in this case the residual is 75-80% of the budget and not highly variable as a result of assumptions about costs.

Table 11 shows the distribution of contraceptive acceptors by delivery organization and method for 1982 and 1983. This material is parallel to the distribution presented in Table 1. More refined measures of impact are generated in the same way that they were in Sections II and III. All three program sectors are assumed to have the same impact multipliers.[11]

Economic analysis suggests that each of the three components of the national program generates positive and significant economic returns. Table 12 presents a summary of the benefit-cost analysis of the components of the program. The benefits are estimated as the product of the number of the births prevented by each sub-program and the VBP for the country as a whole. The costs are derived from reports concerning each component or by the residual technique described above. As will be clear from the table, the three components generate benefits considerably in excess of the costs. In all cases the ratio of benefits to costs greatly exceeds one. Thus, in terms of the cost-benefit calculation, all of the programs are easily justified.

## B. COST-EFFECTIVENESS ANALYSIS

Cost-effectiveness analysis is an analytic tool used to examine the relative costs of alternative ways of producing an output - in this case, family planning services. With a limited budget and more possible ways of undertaking family planning than can be accommodated under the budget, policy-makers or managers can use CEA to help choose a set of activities which will provide the greatest possible impact for the budget. In Bangladesh, the conditions for using CEA are partially met. There is certainly a limit on resources, but there is also a commitment to offering services to people living in all parts of the country, and to offering couples a choice among methods appropriate both for

spacing and for limiting births. Thus, the scope for shifting resources from rural areas to urban areas, for example, is limited. Nonetheless, it is important to examine the relative costs of different components of the program.

CEA can also be used to examine the efficiency of different units for the purpose of assisting with managerial decisions. Low cost units may use techniques which could be of assistance in improving the performance of high cost units. High cost units may have special problems that senior managers can help resolve. Thus, CEA is a diagnostic, as well as a resource, allocation too (see ESCAP).

CEA differs from CBA in that in CEA no effort is made to estimate the monetary value of the impact of the program under examination. The primary concern of CEA is to estimate the demographic impact of family planning and the costs of family planning. These should be estimated separately for each year and for each organization or activity for which CEA estimates are desired. In this case an attempt is made to estimate the cost-effectiveness of USAID-supported NGOs, the SMP, and the rest of the government program which includes the Ministry's program and those of non-USAID-funded NGOs. In principle, however, the same approach could be used to examine the cost-effectiveness of a wider range of organizations working in the family planning field or of regional units, such as divisions or districts charged with responsibility for the program in particular areas.

For this report we have used two measures of impact: adjusted births prevented (ABP) and couple years of protection (CYP). We prefer the first measure because it adjusts for the time between expenditures on family planning and their impact, using the adjustment factors specified in Table 2. Thus, the tables in the main part of the text are specified in ABP. In Appendix II, we have provided an alternative set of estimates in terms of CYP. Fortunately, the basic order of the results is not altered by the choice of output measures; thus, the most important policy implications are in this instance independent of the impact measure chosen.

## C. ESTIMATES OF COST-EFFECTIVENESS

Cost-effectiveness is estimated by combining the impact and cost measures discussed in Sections II and III and extending the analysis to the components of the program. The results of this exercise are reported in Tables 13 and 14. Table 13 shows the results for the major components of the government program under the basic set of assumptions we recommend. Table 14 shows how these estimates would bary with modification in the assumptions. Here we will summarize some of the principal conclusions.

Under the basic assumptions mentioned in earlier sections, the costs per ABP were considerably lower for the NGOs, taken as a group, than for either the SMP or the Residual Program. This is shown in Table 13. During 1982 the average cost of a ABP for

the overall program was $50.72; in 1983, it rose to $61.50. In both years, the cost per ABP of the NGO activity was somewhat less than two-thirds the cost of either the SMP or the Residual Programs, or both. Since the activities of some NGOs are concentrated in the urban areas and the urban areas are more receptive to family planning, it may be true that NGO costs would be higher if they were asked to work in the rural areas. However, it has often been speculated that the NGO costs are actually higher than costs in the rest of the program, and it is noteworthy that in this analysis their costs per ABP are relatively low. It is also worth noting that in this analysis 1) the NGOs have not been credited with referrals, 2) all overhead costs of running NGOs, including those incurred outside of Bangladesh, have been included and 3) the costs of service provider fees and acceptor reimbursements have been attributed to NGOs. Thus, these results are based on relatively conservative assumptions.

The major force driving the differences among the alternative estimates of cost effectiveness is the set of assumptions about demographic impact. As long as sterilizations are assumed, appropriately in our opinion, to generate a large number of ABPS (or CYPs) and condoms are assumed to have relatively little impact, the relative cost-effectiveness calculation will make organizations such as the Bangladesh Association for Voluntary Sterilization (BAVS) that concentrate

on sterilizations, look very good, and those such as the SMP that concentrate on condoms, look relatively weak. When we assume that 100 condoms generate one CYP, the SMP has the lowest costs per ABP in both 1982 and 1983. With the assumption that 300 condoms are required for a CYP, the cost of generating an ABP through the SMP is slightly higher than it is in the residual Program in 1982; and while it declines between the two years, it is still higher than the NGO cost in 1983. These results can be seen by comparing the findings shown in Table 13 with those shown in Table 14A.

Some observers have suggested that some of the costs of organizing the NGO and SMP programs are borne by the Ministry of Health and Population Control in the form of either costs of administration or, in the case of the NGOs, in the cost of handling contraceptives. We have therefore re-estimated the cost-effectiveness of different units in Table 14B, assuming that 10% of the direct costs of the NGO program and 2% of the costs of the SMP program should be deducted from the Residual costs and added to the respective costs of the NGO and SMP. As seen, this kind of change has only minor effects on the relative costs of the different components.

Care must be exercised in the interpretation of these results. All three of the sub-programs identified for analysis meet the criterion that the benefits they generate exceed the costs. They do differ in cost per ABP, but on the whole they are

not competitive projects. Rather, they are directed towards different markets or social niches; they are designed as complements rather than substitutes. In short, a retrospective examination suggests that all three family planning activities are easily justified in the aggregate.[12]

The complementarity of the different program components can be viewed in a somewhat different manner. It seems clear that the long-run success of the family planning program cannot be based exclusively on sterilization. Survey results and common sense both suggest that many users are not ready for the use of permanent and irreversible methods. Moreover, many couples who will eventually use sterilization begin with temporary and non-clinical methods. Thus, a mix of temporary and permanent methods is essential for a complete program, and the SMP, which has a relatively high overall cost per ABP, has the lowest cost per ABP for methods other than sterilization.

Assuming that there is a need for both temporary and permanent methods, it is interesting to speculate on the cost-effectiveness of alternative ways of delivering each type of contraception. From this perspective, the SMP can be shown to be a cost-effective approach to delivering temporary methods of contraception. Moreover, the Residual Program is a relatively expensive way to deliver sterilization services. In other words, the relative cost-effectiveness of the three major sub-programs is in many respects the result of the mix of contraceptive

methods used by each.

A very tentative estimate of the importance of contraceptive mix is shown in Table 15. Since the Bangladesh Association for Voluntary Sterilization (BAVS) does only sterilizations, we can estimate their cost per ABP associated with sterilization ($26.86 per ABP in 1982). If we assume that the average cost of a Residual Program sterilization equals that of the BAVS, then the costs of delivering conventional contraceptives are estimated as a residual. The total expenditure of the Residual Program was $31.618 million in 1982. Expenditures on sterilization were $26.86 per case, and there were 323,423 sterilizations credited to the Residual Program during the year. Thus, $17.372 million was spent on sterilization, and $14.277 million was spent on other methods. This wourks out to a cost of $72.43 per ABP from conventional contraceptives in the Residual Program.

Under this set of assumptions, the average cost per ABP from conventional contraceptives is higher in the Residual Program than it is in the SMP sector ($61.71). Note that if the cost of a Residual Program sterilization is assumed to equal that of a BAVS sterilization, it follows that the cost of an ABP generated by the Residual Program with conventional contraceptives is even higher.

If the same exercise is applied to the NGO sector, this time assuming that the cost of a sterilization equals the BAVS cost and the rest of NGO expenditures are related to conventional contraceptives, then the cost of an ABP generated by the NGO program through conventional contraceptives turns out to be considerably higher than the cost per ABP for the SMP ($83.77 versus $61.71 in 1982). In short, the analysis indicates that sterilization as a method generates a large impact per dollar of expenditure in all sectors, and that the cost of generating an equivalent impact through conventional contraceptives is much higher. A comparison of the alternative costs of delivering conventional contraceptives suggests that in this domain the SMP costs are the lowest.

This analysis of costs suggests that the conclusions derived from the cost-benefit analysis should be at least somewhat qualified. If there is a limited budget or if there are local conditions where projects are competitive, as might happen in some place where the NGO and Residual Programs are operating in

the same area, the lower cost alternative should be preferred. In terms of longer-term strategy, the relatively low cost per ABP of the NGO and the SMP delivery systems suggest that continuing efforts should be made to identify ways of expanding alternatives to the Residual Program. For example, more NGO activities may be encouraged in the rural areas. This would facilitate the development of new approaches to offering services in the rural areas and would also permit a test of whether the organizational approaches used by the NGOs in the urban areas would result in the same low costs per ABP if offered in the more difficult rural settings. (For a somewhat similar analysis applied to Nepal, see Barnum, 1983.)

## VI. SUMMARY

Family planning is an activity with a high level of economic return in Bangladesh. This is shown by all the various estimates undertaken in Section IV of this paper. Given the high level of return from family planning, it is appropriate that high priority be given to intensifying ways of expanding the scope of family planning activities in the country.

In choosing among the various ways in which the family planning program could be strengthened, two general economic rules provide guidance. First, any activity that will generate benefits larger than costs should be supported, unless it is directly competitive with other activities. Second, when

comparing activities with the same goal(s), those activities with a low cost per unit of output should be preferred to those with high costs. In cases where alternative programs serving the same population exist, the lower cost activity should be preferred.

The empirical results from the cost-effectiveness analysis suggest that there is a large variation among the components of the national program in the costs per unit of output.

Much of the variation in costs per ABP is the result of the strong impact of sterilization. Obviously, it is important to continue efforts to encourage as much progress in voluntary sterilization as possible. However, sterilization efforts need to be complemented by programs offering other methods.

Taken as an aggregate, including clinical NGOs, the costs are lower among the NGOs than in the rest of the program. This suggests that NGO activity should be continued and expanded wherever feasible. Since there is a great deal of variation among the NGOs in terms of their cost per CYP generated, high-cost NGOs should be examined to see whether there are ways of reducing unit costs within the present programs or whether there are alternative ways of delivering the same services at a lower unit cost.

The SMP costs are relatively high, but the demographic impact assumptions on which this conclusion is based are controversial. The fact that the SMP is the one activity examined here that is based entirely on non-clinical

contraceptives makes comparison difficult. The SMP seems to be a low-cost approach to the delivery of conventional contraceptives. In any event, the economic benefits generated by the SMP are far greater than the costs, and since the SMP serves a different clientele than other delivery activities, it should be expanded and strengthened to the extent the budget permits. If the overall program faces a budget constraint, both the GOB and donors may want to examine the balance between sterilization and conventional contraceptives. Given the cost per ABP of delivering conventional contraceptives through the SMP and alternative delivery systems, an explicit decision may have to be made either to sacrifice short run impact by reducing funding for sterilization or finding the extra resources required to support the emphasis on conventional contraception. It may be noted that administrative efforts to reduce costs may be stimulated by differing cost-effectiveness ratios. For example, the costs of the SMP could be greatly lowered if the cost of commodities could be reduced. It might be worth exploring multiple donor arrangements to see whether commodities could be purchased for the SMP outside of the USAID "buy American" policy.

The Residual Program has been treated as a single unit in this analysis for lack of information on its constituent elements. This program, like the SMP, generates far more economic return than it costs. Thus, it should continue to be supported. However, since it is so large, continuing efforts

should be made to examine various aspects - including economic ones - of the component parts of the larger program.

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## FOOTNOTES

1. The results of the 1983 CPS sample are difficult to interpret since three separate samples were involved. If the results of the usual CPS sample of eligible women are used, the estimated prevalence is 1.5%. Since women are known to under-report condom use, the second sample, consisting of husbands of eligible women who were not interviewed, may provide a more accurate estimate. In this sample, the reported prevalence was 2.7%. The third sample consists of couples where both husband and wife were interviewed. In this sample, 1.8% of the wives and 2.7% of the husbands reported the use of condoms. Only 1.1% of the couples were in agreement about the use of condoms. If we add that percentage of wives who reported condom use when their husbands did not (1.8% - 1.1% = 0.7%) to the percentage of husbands reporting condom use, we get the highest possible estimate, 3.4% (2.7% + 0.7% = 3.4%), from this sample. While some case could be made for a lower estimate, we tend to believe this is the most accurate single number. In the text we have used the 2.7% estimate to be consistent with other studies and to provide a conservative bias to this analysis.

2. This number is based on the Planning Commission's projections from the 1981 Census.

3. Recent research suggests about 127 intercourses per year. See Ghyasuddin Ahmed and Nancy E. Williamson, "The Case of the Missing Condoms, Results of the 1983 Bangladesh Condom Users Survey," mimeo, paper prepared for APHA meeting, November 1984.

4. The voluntary sterilization rate is based on decrement tables, using data from life tables generated on the basis of research undertaken in Matlab, by the ICDDR,B, and BAVS age distributions. The IUD rate is based on continuation rates generated by a recent survey. (See Evaluation of Strengthening the IUD Program, PIACT, October 1984.)

5. It should be noted that these adjustments assume that expenditures on UFWCs are the same percentage of total expenditures that allocation for UFWCs are of total allocations for population and family planning. In later examples we include expenditures on UFWCs as a part of the total. Obviously, leaving them out would make family planning appear to be an even more favorable investment. It would also make the Residual sector somewhat more cost-effective. It would not, however, change any of the basic results of the CBA or CEA analysis. Moreover, since the Government of Bangladesh has argued that these investments in the health sector are part of its basic combined health and population strategy, it seems appropriate to include them.

6. The criteria for program choice are actually more complicated than suggested here. In particular, interdependence among possible projects complicates the choice process. Two possible projects oriented to the same population would be an example of interdependent projects.

7. While there has been some research on the economic contribution of children in Bangladesh, it has usually focused on the average, rather than the marginal, contribution. That is, it does not take into account the extent to which child labor substitutes for that of other members of the family or the community.

8. This rate was chosen because it is the rate used by economists doing project analysis at the USAID office in Dhaka. This rate seems reasonable for a country in which capital is scarce. Note that the rate can be changed in the computer software provided with this report. Lower rates typically yield higher estimates of the VBP, since the effects of a reduced population take a long time to work out and are heavily discounted by the use of relatively high discount rate, such as 15%. On balance, then, the use of the 15% rate tends to make these estimates of the VBP rather high.

9. The authors of this report actually feel that the true effect in conditions such as those existing in Bangladesh and on the margin is more likely to be close to zero. We have used the higher number to assure that there is some conservative bias in our estimates.

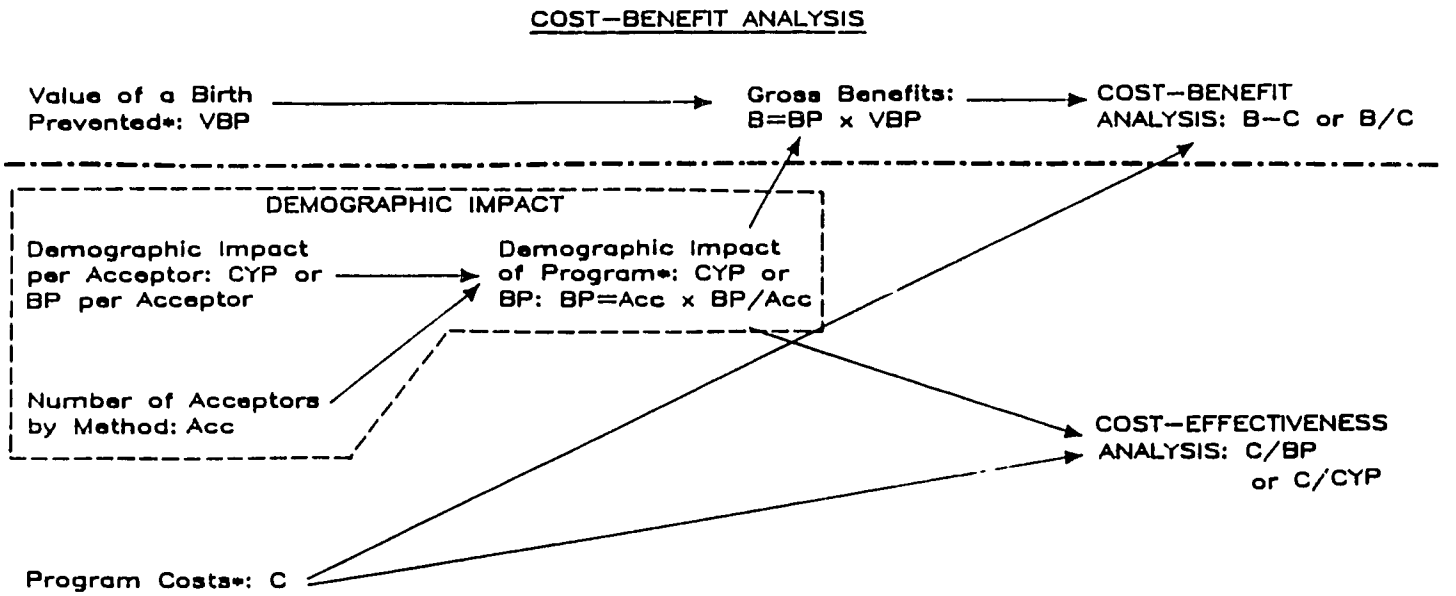
10. It is probably true that the GOB would be unable or unwilling to maintain the level of expenditure per pupil constant in the two situations, but, since there is a rational commitment to attempting to improve educational opportunities and achievements, it seems reasonable to think that the opportunity cost of high fertility can be measured in this way.

11. We make this assumption because we lack the detailed information that would make more refined judgments possible. Even though details are lacking, it is clear that there are variations in the age of acceptors by delivery organization and that variations in the quality of services may lead to higher continuation rates, and, thus, greater effectiveness for some organizations.

12. It should be reiterated that the impacts estimated here are gross effects; that is, they do not take into account the different populations with which the three programs are dealing. It is possible that the target groups for the NGO or SMP programs may be easier to motivate than those of the Residual Program. Some of the users of these programs might switch to other methods in the absence of these particular delivery systems. In other words, the net effects would differ substantially from the gross effects.

# FIGURES

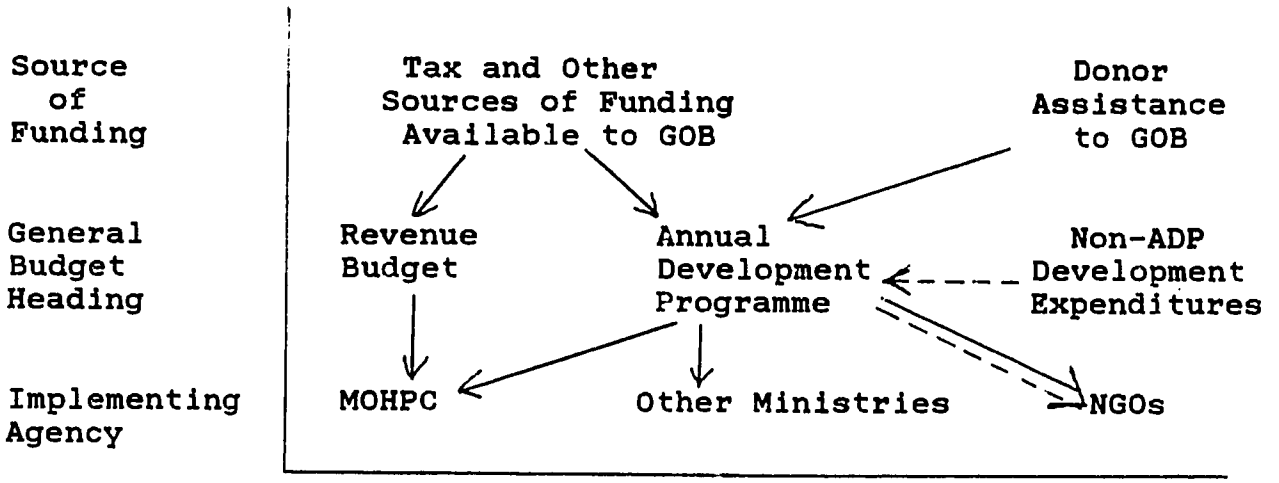
## Figure 1. A Schematic Representation of the Calculations involved in Cost–benefit and Cost–effectiveness Analysis




*To facilitate comparisons of projects with different impacts over time, these variables should be suitably discounted.

Figure 2

The Flow of Family Planning Expenditures in Bangladesh



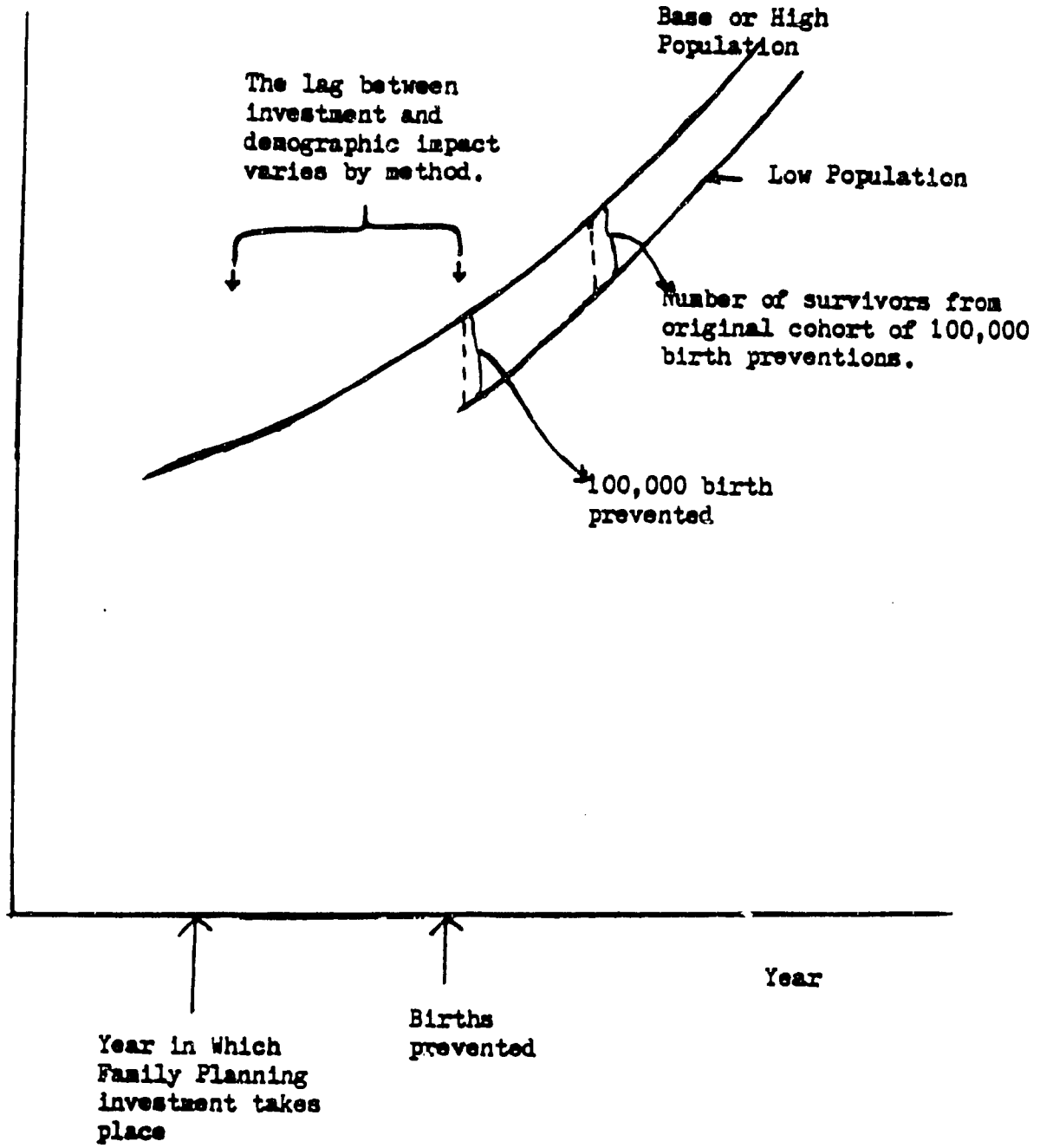



FIGURE 3: A GRAPHICAL ILLUSTRATION OF BIRTH PREVENTIONS

**TABLES**

Table 1

Contraceptive Distribution by Year and Method

| Method | Unit | Year | | |
|---|---|---|---|---|
| | | 1982 | 1983 | 1984 |
| Oral Pill | cycles (1000) | 8122 | 8839 | 10935 |
| Condom | pieces (million) | 107 | 128 | 157 |
| Emko | vials (1000) | 67 | 72 | 64 |
| Foam Tab | pieces (million) | 4 | 6 | 4 |
| Injection | units (1000) | 64 | 108 | 141 |
| IUD/Cu T | units (1000) | 108 | 182 | 400 |
| Tubectomy | operations (1000) | 297 | 290 | 336 |
| Vasectomy | operations (1000) | 97 | 113 | 306 |

Table 2

Assumptions Used for Calculating Demographic Impact of Contraceptive use

A. Temporary methods

| Method | Units per CYP | CYPs per BP | Units per BP | Discount Rate | Adjustment Factor* |
|---|---|---|---|---|---|
| Oral Pill | 14.00 | 3.5 | 49.000 | 15 | 0.87 |
| Condom | 300.00 | 3.5 | 1050.000 | 15 | 0.87 |
| Emko | 5.33 | 3.5 | 18.655 | 15 | 0.87 |
| Foam Tab | 125.00 | 3.5 | 437.500 | 15 | 0.87 |
| Injection | 4.00 | 3.5 | 14.000 | 15 | 0.87 |

B. Long-term methods

| Method | Units per CYP | CYPs per BP | Units per BP | Discount Rate | Adjustment Factor* |
|---|---|---|---|---|---|
| IUD/Cu T | 2.45 | 3.5 | 0.70 | 15 | 0.756 |
| Tubectomy | 7.75 | 3.5 | 2.21 | 15 | 0.572 |
| Vasectomy | 7.75 | 3.5 | 2.21 | 15 | 0.572 |

* Average expected lifetime of effects of method used in calculating adjustment factors:
  Temporary methods= 1.0 year
  IUD/Copper Tube= 2.0 years
  Sterilizations= 4.0 years

Table 3

Total Number of Births Prevented and Total Couple Years of Protection by Year of Contraceptive Adoption and by Method (lak)

| Method | 1982 | 1983 | 1984 |
|---|---|---|---|
| Oral pill | 5.80 | 6.31 | 7.81 |
| Condom | 3.58 | 4.26 | 5.23 |
| Emko | 0.13 | 0.14 | 0.12 |
| Foam Tab | 0.33 | 0.44 | 0.32 |
| Injection | 0.16 | 0.27 | 0.35 |
| IUD/Cu T | 2.65 | 4.45 | 9.80 |
| Tubectomy | 23.05 | 22.47 | 26.04 |
| Vasectomy | 7.51 | 8.76 | 23.72 |
| Total CYP | 43.20 | 47.10 | 73.39 |
| Total B.P. | 12.34 | 13.46 | 20.97 |

Note: see Table 2 for assumptions used in calculations

Table 4

Adjusted Births Prevented by Year of Contraceptive Adoption and Method (thousands)

| Method | 1982 | 1983 | 1984 |
|---|---|---|---|
| Oral pill | 144.135 | 156.855 | 194.055 |
| Condom | 88.919 | 105.731 | 130.021 |
| Emko | 3.146 | 3.355 | 2.983 |
| Foam Tab | 8.240 | 11.030 | 7.950 |
| Injection | 4.005 | 6.678 | 8.758 |
| IUD/Cu T | 57.239 | 96.089 | 211.720 |
| Tubectomy | 376.474 | 367.132 | 425.384 |
| Vasectomy | 122.642 | 143.132 | 387.404 |
| Total | 804.801 | 890.002 | 1368.275 |

Note: see Table 2 for assumptions used in calculations

Table 5: Expenditure on Family Planning in Bangladesh
1981-82, 1982-83, 198384

| Item | 1981 -1982 | | 1982-1983 | | 1983-1984 | |
|---|---|---|---|---|---|---|
| | Alloc. | Expend. | Alloc. | Expend. | Alloc. | Expend. |
| | | A. In lac Taka | | | | |
| 1. ADP:Ministry(a) | 7869.00 | 3424.57 | 7657.26 | 6397.87 | 9975.00 | 8490.38 |
| Multisectoral(a) | 759.00 | 580.43 | 907.74 | 726.13 | 913.00 | 879.00 |
| Subtotal | 8628.00 | 4005.00 | 8565.00 | 7124.00 | 10888.00 | 9369.38 |
| 2. Revenue Budget(b) | 1120.00 | 1321.00 | 1231.00 | 1452.00 (c) | 1291.00 | 1523.00 |
| 3. Total GOB | | 5326.00 | | 8576.00 | | 10892.38 |
| 4. Non-ADP or project commodity and NGO support | 1350.08 (d) | 1350.08 | 3812.64 | 3812.64 | 3685.71 | 3685.71 |
| 5. Unadjusted total | | 6676.08 | | 12388.64 | | 14578.09 |
| 6. Adjustment(e) to avoid ADP overlap | | -893.00 | | -790.00 | | -960.00 |
| 7.Adjusted Grand Total | | 5783.08 | | 11598.64 | | 13618.09 |
| 8.Estimated expend. in calendar year | | | 8690.86 | | 12608.37 | |
| | | A. In $ millions U.S. | | | | |
| 9. Dollar conversion (Tk/$) | | 20.00 | | 22.00 | | 24.00 |
| 10.Estimated expend. in BDG Fiscal Year in $ | | 28.92 | | 52.72 | | 56.74 |
| 11.Estimated expend. in calendar yr. '82&'83 | | | 40.82 | | 54.73 | |

Sources and Notes:

(a) ADP expenditure on Family Planning
Source: Planning Commission.

(b) Source: GOB, Demands for Grants and Appropriations, 1983-84, p.113.

(c) Revenue Budget expenditures are assumed to be 1.18 x reported 1981-82 allocations.

(d) Allocation for US fiscal year is assumed to be fully spent next BD fiscal year.

(e) Planning Commission estimates under Row 1 already include this amount as an estimate of Row 4.

Table 6

Alternative Estimates of the Percentage of the ADP Allocation for Population and Family Planning Actually Spent

| A. Ministry of Health annd Population Control Expenditure | | | |
|---|---|---|---|
| Year | Planning Commission | IMED | Ministry |
| 1981-82 | 68.05 | 43.51 | 53.22 |
| 1982-83 | 95.02 | 83.55 | 67.21 |
| 1983-84 | 86.85 | 78.05 * | 62.35 |
| **B. Total ADP Expenditure by All Agencies** | | | |
| Year | Planning Commission | IMED | Ministry |
| 1981-82 | 69.24 | 46.39 | ---- |
| 1982-83 | 91.01 | 83.17 | ---- |
| 1983-84 | 88.00 | 78.05 | ---- |

* Estimate based on 9 mos.

Table 7

The calculation of the value of preventing a birth under assumption 1. (GNP is independent of pop change) [in taka]

| Fiscal Year | GNP (million) | GNP/Base high pop | GNP/Rslt low pop | Total benefits (m) | Value of pvt a birth |
|---|---|---|---|---|---|
| 1982-83 | 220,345 | 2348 | 2348 | 0 | 0 |
| 1983-84 | 228,057 | 2366 | 2368 | 237 | 2368 |
| 1984-85 | 236,039 | 2385 | 2387 | 207 | 2071 |
| 1985-86 | 244,300 | 2406 | 2408 | 199 | 1992 |
| 1986-87 | 252,851 | 2428 | 2430 | 196 | 1962 |
| 1987-88 | 261,954 | 2455 | 2457 | 195 | 1954 |
| 1988-89 | 271,646 | 2485 | 2487 | 196 | 1959 |
| 1989-90 | 281,968 | 2520 | 2522 | 198 | 1977 |
| 1990-91 | 292,965 | 2560 | 2561 | 200 | 1999 |
| 1991-92 | 304,684 | 2604 | 2606 | 203 | 2025 |
| 1992-93 | 316,262 | 2646 | 2648 | 205 | 2048 |
| 1993-94 | 327,647 | 2684 | 2686 | 207 | 2069 |
| 1994-95 | 338,787 | 2719 | 2721 | 209 | 2092 |
| 1995-96 | 349,628 | 2750 | 2752 | 211 | 2112 |
| 1996-97 | 360,117 | 2777 | 2779 | 213 | 2129 |
| 1997-98 | 371,641 | 2811 | 2813 | 215 | 2150 |
| 1998-99 | 384,277 | 2852 | 2854 | 218 | 2177 |
| '99-2000 | 398,111 | 2899 | 2901 | 221 | 2208 |
| 2000-01 | 413,239 | 2954 | 2955 | 224 | 2243 |
| 2001-02 | 429,769 | 3015 | 3017 | 228 | 2283 |
| 2002-03 | 448,678 | 3089 | 3091 | 233 | 2333 |
| 2003-04 | 470,215 | 3179 | 3180 | 239 | 2394 |
| 2004-05 | 494,666 | 3284 | 3286 | 247 | 2465 |
| 2005-06 | 522,367 | 3408 | 3410 | 255 | 2550 |
| 2006-07 | 553,709 | 3551 | 3553 | 265 | 2648 |
| 2007-08 | 584,717 | 3687 | 3689 | 274 | 2741 |

Total present value of preventing a birth=

Table 8

THE VALUE OF A BIRTH PREVENTED UNDER ALTERNATIVE ASSUMPTIONS (Tk.)

| Discount rate | INCOME GROWTH RATE: Planned growth | Constant 5%/yr. |
|---|---|---|
| 15% | 15,570 | 17,135 |
| 10% | 21,078 | 23,706 |

Table 9

Alternative Estimates of the Value of a Birth Prevented
Discount Rate=15%, Values in Taka, for 1983-84

| ASSUMPTION | VALUE OF A BIRTH PREVENTED |
|---|---|
| A. Effects on Per Capita Income: | |
| 1. Pure Denominator Effect (INDEP) | 15,570 |
| 2. Mixed Numerator and Denominator Effects: | |
| a) Population growth increases Labor Force and thus GNP (LAB FORCE). | 12,309 |
| b) Population growth discourages saving and thus decreases GNP (SAVING). | 19,062 |
| c) Population growth forces technological innovation increasing GNP (TECH). | 10,432 |
| d) Combined 2a, 2b, and 2c effects. | 10,664 |
| B. Effects Resulting from Social Expenditure Savings: | |
| 1. Savings in education sector (EDUC). | 580 |
| 2. Savings in all ADP Expenditures (ADP). | 1,905 |

Table 10

Benefit-Cost Calculation for the Bangladesh Family Planning Program in 1982

| Adjusted BP (thousand) | Value of BP (Tk.) | Total Benefits (million Tk) | Total Expenditures | Benefits /Cost |
|---|---|---|---|---|
| 155.6 | 15570 | 2423 | 869 | 2.79 |
| | 10000 | 1556 | | 1.79 |
| | 1905 | 296 | | 0.34 |

Benefit-Cost Calculation for the Bangladesh Family Planning Program in 1983

| Adjusted BP (thousand) | Value of BP (Tk.) | Total Benefits (million Tk) | Total Expenditures | Benefits /Cost |
|---|---|---|---|---|
| 174.6 | 15570 | 2718 | | 1261 |
| | 10000 | 1746 | | |
| | 1905 | 333 | | |

Table 11

Distribution and Performance by SMP, USAID funded NGOs and Residual in 1982

| Method | SMP | NGOs | Residual* | Total |
|---|---|---|---|---|
| Oral Pill | 1,104,710 | 1,004,931 | 6,012,355 | 8,121,996 |
| Condom | 68,476,348 | 5,226,635 | 33,666,696 | 107,369,679 |
| Emko | 0 | 10,591 | 56,898 | 67,489 |
| Foam Tab | 3,508,696 | 48,893 | 588,303 | 4,145,892 |
| Injection | 0 | 8,876 | 55,609 | 64,485 |
| IUD/Cu T | 0 | 3,967 | 104,174 | 108,141 |
| Tubectomy | 0 | 46,404 | 250,963 | 297,367 |
| Vasectomy | 0 | 24,412 | 72,460 | 96,872 |

Distribution and Performance by SMP, USAID funded NGOs and Residual in 1983

| Method | SMP | NGOs | Residual | Total |
|---|---|---|---|---|
| Oral Pill | 1,543,061 | 1,446,745 | 5,848,989 | 8,838,795 |
| Condom | 88,295,793 | 8,614,816 | 30,759,615 | 127,670,224 |
| Emko | 0 | 9,001 | 62,976 | 71,977 |
| Foam Tab | 4,505,294 | 200,380 | 843,758 | 5,549,432 |
| Injection | 0 | 16,143 | 91,367 | 107,510 |
| IUD/Cu T | 0 | 7,393 | 174,147 | 181,540 |
| Tubectomy | 0 | 43,308 | 246,680 | 289,988 |
| Vasectomy | 0 | 32,962 | 80,094 | 113,056 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

Table 12

Benefit-Cost Calculation for the Components of the Bangladesh Family Planning Program

| Year | Source | Benefits (B) (Tk in m) | Costs (C) (Tk in m) | Net Contribution (Tk in m) | B/C Ratio |
|---|---|---|---|---|---|
| 1982 | SMP | 207 | 108 | 99 | 1.9 |
| | NGO | 209 | 85 | 124 | 2.5 |
| | Residual* | 1140 | 665 | 476 | 1.7 |
| | Total | 1556 | 857 | 699 | 1.8 |
| 1983 | SMP | 272 | 146 | 126 | 1.9 |
| | NGO | 252 | 100 | 152 | 2.5 |
| | Residual* | 1222 | 1012 | 209 | 1.2 |
| | Total | 1746 | 1259 | 487 | 1.4 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

Table 13

Cost Effectiveness of the National Program by Sub-component: Standard Assumptions

| Year | Source | Cost (million $) | Impact** (million ABP | Cost-Eff. Ratio |
|---|---|---|---|---|
| 1982 | Residual* | 31.648 | 0.606 | 52.186 |
| | SMP | 5.140 | 0.083 | 61.714 |
| | NGOs | 4.030 | 0.115 | 35.025 |
| | TOTAL | 40.818 | 0.805 | 50.718 |
| 1983 | Residual | 44.021 | 0.645 | 68.204 |
| | SMP | 6.360 | 0.109 | 58.103 |
| | NGOs | 4.350 | 0.135 | 32.200 |
| | TOTAL | 54.732 | 0.890 | 61.496 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

** ABP Assumptions are in Table 2

Table 14A

Sensitivity Explorations of Cost Effectiveness Analysis of the National Program by Sub-Component: Estimates with Changes in the Impact Assumptions

| Year | Source | Cost (million $) | Impact** (million ABP) | Cost-Eff. Ratio |
|---|---|---|---|---|
| 1982 | Residual* | 31.648 | 0.670 | 47.206 |
| | SMP | 5.140 | 0.198 | 25.932 |
| | NGOs | 4.030 | 0.125 | 32.217 |
| | TOTAL | 40.818 | 0.994 | 41.076 |
| 1983 | Residual | 44.021 | 0.704 | 62.497 |
| | SMP | 6.360 | 0.258 | 24.669 |
| | NGOs | 4.350 | 0.151 | 28.744 |
| | TOTAL | 54.732 | 1.114 | 49.151 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

** Assumptions as in Table 13 except 100 condoms = 1 CYP, & 13 cycles of oral pills = 1 CYP

Table 14B

Sensitivity Explorations of Cost Effectiveness Analysis of the National Program by Sub-Component: Estimates with Changes in the Impact Assumptions

| Year | Source | Cost** (million $) | Impact (million ABP) | Cost-Eff. Ratio |
|---|---|---|---|---|
| 1982 | Residual* | 31.143 | 0.606 | 51.352 |
| | SMP | 5.243 | 0.083 | 62.948 |
| | NGOs | 4.433 | 0.115 | 38.527 |
| | TOTAL | 40.818 | 0.805 | 50.718 |
| 1983 | Residual | 43.459 | 0.645 | 67.333 |
| | SMP | 6.487 | 0.109 | 59.265 |
| | NGOs | 4.785 | 0.135 | 35.420 |
| | TOTAL | 54.732 | 0.890 | 61.496 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

** 10% of NGO Cost added for indirect NGO costs; 2% of SMP Costs added for indirect SMP costs

Table 15a

Estimated Cost per Adjusted Birth Prevented (ABP) of Generating B.P.'s through Sterilization and Methods Other than Sterilization by Delivery Agency in 1982 ($US)

| | | |
|---|---|---|
| Total Budget of the Residual Program (R.P.) (in million $US) | | 31.648 |
| Money Spent on Sterilization (by R.P.) (# sterilizations x cost/case) | | |
| # sterilizations | 323,423 | |
| X BAVS cost (cost/ABP x ABP/ster.) | $26.86 | |
| X multiplier | 2.0 | 17.372 |
| Money Spent by Residual Program on Methods Other than Sterilization (in million $US) | | 14.277 |
| Number of ABP by Residual Program by Sterilization (million) | | 0.409 |
| Number of ABP by Residual Program on Methods Other than Sterilization (million) | | 0.197 |
| Cost per ABP by Sterilization in Residual Program | | $42.43 |
| Cost per ABP by BAVS Sterilization | | $21.21 |
| Cost per ABP in R.P., Methods Other than Sterilization | | $72.47 |
| Cost per ABP by SMP, Methods Other than Sterilization | | $61.71 |
| Total Budget of NGOs (million $US) | | 4.030 |
| Money Spent on Sterilization (million $US) (# steriliz. x cost/case) | | |
| # sterilizations | 70,816 | |
| X BAVS cost (cost/ABP x ABP/ster.) | $26.86 | 1.902 |
| Money Spent on Other Methods by NGOs (million $US) =Total-Expenditures on Sterilization | | 2.128 |
| Total ABP Generated by NGOs, Methods Other than Sterilization (million) | | 0.025 |
| Cost per ABP by NGO Program, Methods Other than Sterilization | | $83.77 |

Table 15b

Estimated Cost per Adjusted Birth Prevented (ABP) of Generating B.P.'s through Sterilization and Methods Other than Sterilization by Delivery Agency in 1983 ($US)

| | | |
|---|---|---|
| Total Budget of the Residual Program (R.P.) (in million $US) | | 44.021 |
| Money Spent on Sterilization (by R.P.) (# sterilizations x cost/case) | | |
| # sterilizations | 326,774 | |
| X BAVS cost (cost/ABP x ABP/ster.) | $26.38 | |
| X multiplier | 2.0 | 17.244 |
| Money Spent by Residual Program on Methods Other than Sterilization (in million $US) | | 26.778 |
| Number of ABP by Residual Program by Sterilization (million) | | 0.414 |
| Number of ABP by Residual Program on Methods Other than Sterilization (million) | | 0.232 |
| Cost per ABP by Sterilization in Residual Program | | $41.68 |
| Cost per ABP by BAVS Sterilization | | $20.84 |
| Cost per ABP in R.P., Methods Other than Sterilization | | $115.55 |
| Cost per ABP by SMP, Methods Other than Sterilization | | $58.10 |
| Total Budget of NGOs (million $US) | | 4.350 |
| Money Spent on Sterilization (million $US) (# steriliz. x cost/case) | | |
| # sterilizations | 76,270 | |
| X BAVS cost (cost/ABP x ABP/ster.) | $26.38 | 2.012 |
| Money Spent on Other Methods by NGOs (million $US) =Total-Expenditures on Sterilization | | 2.338 |
| Total ABP Generated by NGOs, Methods Other than Sterilization (million) | | 0.039 |
| Cost per ABP by NGO Program, Methods Other than Sterilization | | $60.66 |

# APPENDIX I

## VARIATIONS IN COST-EFFECTIVENESS AMONG AID-FUNDED NGOs

Table A-1, prepared on the same basis as the cost-effectiveness tables in the body of the text, illustrates the differences among the AID funded NGOs in terms of cost-effectiveness. The BAVS, with its concentration on sterilization, demonstrates the lowest unit costs, in large measure because of the high level of demographic impact associated with sterilization. Two special issues are raised in an examination of individual NGO performance. The first is that the measure of demographic impact is influenced by the assumptions that are made about referrals. Table A-1 shows calculated levels of cost-effectiveness, both including and not including referrals. Some of the NGOs refer a great many cases to other organizations for services. In the text, Tables 13 and 14 have been calculated on the assumption that full credit for all referrals should be given to the agency that provides the service. The total column of Table A-1 suggests that this assumption leads to estimates of the cost per CYP about 20% higher than would have been the result if the recruiting agency were given full credit for the case.

Second, since some of the costs of contraceptive supplies fall outside of the NGO budget, we have calculated the cost per CYP both with and without the contraceptive cost. Note that, as one would expect, the NGO cost per CYP is highest when the full cost of the contraceptives are included and when the NGOs are not given credit for referrals. These are the assumptions used in

Tables 13 and 14 in the main body of the paper.

Both in 1982 and 1983, there is considerable variation among the NGOs in the cost per CYP of the services they provide. In both years the highest cost NGOs are providing services at a cost in excess of the average cost per CYP of any of the major sub-components of the national program, as reported in Table 13. The costs per CYP of FPSTC, TAF and Pathfinder seem particularly high and may bear careful scrutiny. In part, these high costs may reflect high startup costs, since both FPSTC and TAF had begun their activities relatively recently in 1983, and their costs fell substantially in 1983. Where any of these high cost organizations are in competition with lower cost providers, such as the BAVS, it may be appropriate to ask whether that part of the organization's activity should be continued. However, even the high cost NGOs are providing services at a cost which can be justified in terms of the benefit-cost ratio discussed in the earlier part of the paper.

Table A-2 parallels Table A-1, except that the assumption as to the number of condoms required to produce one CYP has been changed from 300 to 100. As might be expected, under this new set of assumptions the efficiency of organizations which provide condoms among their other services is relatively increased.

Table A-1

Cost Analysis of Individual USAID funded NGOs
Alternative Impact Assumption
300 condoms/CYP

| Unit cost | FPIA | TAF | BAVS | BFPA | FPSTC | PFinder | Total |
|---|---|---|---|---|---|---|---|
| Referral not included | | 1982 | | | | | |
| With CCost | 73.83 | 91.10 | 21.21 | 51.19 | 123.91 | 66.46 | 34.76 |
| Without CC | 55.46 | 72.66 | 11.92 | 27.38 | 103.66 | 53.63 | 23.39 |
| Referral included | | 1982 | | | | | |
| With CCost | 26.49 | 61.56 | 21.21 | 20.40 | 28.93 | 45.05 | 26.32 |
| Without CC | 19.90 | 49.09 | 11.92 | 10.91 | 24.20 | 36.36 | 17.71 |
| Referral not included | | 1983 | | | | | |
| With CCost | 55.19 | 45.87 | 20.84 | 42.78 | 45.68 | 51.03 | 31.86 |
| Without CC | 38.36 | 26.29 | 11.75 | 18.75 | 27.02 | 37.86 | 19.86 |
| Referral included | | 1983 | | | | | |
| With CCost | 33.17 | 22.58 | 20.84 | 14.67 | 6.96 | 34.98 | 23.30 |
| Without CC | 23.05 | 12.94 | 11.75 | 6.43 | 4.12 | 25.95 | 14.52 |

Table A-2

Cost Analysis of Individual USAID funded NGOs
Alternative Impact Assumption
100 condoms/CYP

| Unit cost | FPIA | TAF | BAVS | BFPA | FPSTC | PFinder | Total |
|---|---|---|---|---|---|---|---|
| Referral not included | | 1982 | | | | | |
| With CCost | 57.06 | 70.60 | 21.21 | 35.92 | 91.81 | 58.96 | 32.57 |
| W/out CCost | 42.86 | 56.31 | 11.92 | 19.21 | 76.81 | 47.58 | 21.92 |
| Referral included | | 1982 | | | | | |
| With CCost | 23.96 | 51.46 | 21.21 | 17.44 | 26.75 | 41.48 | 25.05 |
| Without CC | 18.00 | 41.04 | 11.92 | 9.33 | 22.38 | 33.47 | 16.85 |
| Referral not included | | 1983 | | | | | |
| With CCost | 44.04 | 34.65 | 20.84 | 29.06 | 34.49 | 44.88 | 29.12 |
| Without CCo | 30.61 | 19.86 | 11.75 | 12.74 | 20.40 | 33.30 | 18.15 |
| Referral included | | 1983 | | | | | |
| With CCost | 28.79 | 19.47 | 20.84 | 12.62 | 6.63 | 31.97 | 21.80 |
| Without CC | 20.01 | 11.16 | 11.75 | 5.53 | 3.92 | 23.72 | 13.59 |

# APPENDIX II

## ALTERNATIVE ESTIMATES OF COST-EFFECTIVENESS IN TERMS OF COUPLE YEARS OF PROTECTION (CYP)

Table 13

Cost Effectiveness Analysis of the National Program by Sub-Component: Standard Assumptions

| Year | Source | Cost (million $) | Impact** (million CYP) | Cost-Eff. Ratio |
|---|---|---|---|---|
| 1982 | Residual* | 31.648 | 3.333 | 9.496 |
| | SMP | 5.140 | 0.335 | 15.333 |
| | NGOs | 4.030 | 0.652 | 6.178 |
| | TOTAL | 40.818 | 4.320 | 9.448 |
| 1983 | Residual | 44.021 | 3.521 | 12.503 |
| | SMP | 6.360 | 0.441 | 14.436 |
| | NGOs | 4.350 | 0.749 | 5.811 |
| | TOTAL | 54.732 | 4.710 | 11.620 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

** CYP Assumptions are in Table 2

Table 14A

Cost Effectiveness Analysis of the National Program by Sub-Component

| Year | Source | Cost (million $) | Impact** (million CYP) | Cost-Eff. Ratio |
|---|---|---|---|---|
| 1982 | Residual* | 31.648 | 3.590 | 8.815 |
| | SMP | 5.140 | 0.798 | 6.443 |
| | NGOs | 4.030 | 0.693 | 5.818 |
| | TOTAL | 40.818 | 5.081 | 8.034 |
| 1983 | Residual | 44.021 | 3.758 | 11.714 |
| | SMP | 6.360 | 1.038 | 6.129 |
| | NGOs | 4.350 | 0.814 | 5.344 |
| | TOTAL | 54.732 | 5.610 | 9.757 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

** Assumptions as in Table 13 except 100 condoms = 1 CYP, & 13 cycles of oral pills = 1 CYP

Table 14B

Cost Effectiveness Analysis of the National Program by Sub-Component

| Year | Source | Cost** (million $) | Impact*** (million CYP) | Cost-Eff. Ratio |
|---|---|---|---|---|
| 1982 | Residual* | 31.143 | 3.333 | 9.344 |
| | SMP | 5.243 | 0.335 | 15.639 |
| | NGOs | 4.433 | 0.652 | 6.795 |
| | TOTAL | 40.818 | 4.320 | 9.448 |
| 1983 | Residual | 43.459 | 3.521 | 12.343 |
| | SMP | 6.487 | 0.441 | 14.724 |
| | NGOs | 4.785 | 0.749 | 6.392 |
| | TOTAL | 54.732 | 4.710 | 11.620 |

* "Residual" includes all family planning program services except those delivered under the SMP and USAID-funded NGOs

** 10% of NGO Cost added for indirect NGO costs; 2% of SMP Costs added for indirect SMP costs

*** CYP Assumptions are in Table 2

Table 15a

Estimated Cost per Couple Year of Protection (CYP) of Generating CYPs through Sterilization and Methods Other than Sterilization by Delivery Agency in 1982 ($US)

| | | |
|---|---|---|
| Total Budget of the Residual Program (R.P.) (in million $US) | | 31.648 |
| Money Spent on Sterilization (by R.P.) (# sterilizations x cost/case) | | |
| # sterilizations | 323,423 | |
| X BAVS cost (cost/CYP x CYP/ster.) | $26.86 | |
| X multiplier | 2.0 | 17.375 |
| Money Spent by Residual Program on Methods Other than Sterilization (in million $US) | | 14.273 |
| Number of CYP by Residual Program by Sterilization (million) | | 2.507 |
| Number of CYP by Residual Program on Methods Other than Sterilization (million) | | 0.826 |
| Cost per CYP by Sterilization in Residual Program | | $6.93 |
| Cost per CYP by BAVS Sterilization | | $3.47 |
| Cost per CYP in R.P., Methods Other than Sterilization | | $17.28 |
| Cost per CYP by SMP, Methods Other than Sterilization | | $15.33 |
| Total Budget of NGOs (million $US) | | 4.030 |
| Money Spent on Sterilization (million $US) (# steriliz. x cost/case) | | |
| # sterilizations | 70,816 | |
| X BAVS cost (cost/CYP x CYP/ster.) | $26.86 | 1.902 |
| Money Spent on Other Methods by NGOs (million $US) =Total-Expenditures on Sterilization | | 2.128 |
| Total CYP Generated by NGOs, Methods Other than Sterilization (million) | | 0.104 |
| Cost per CYP by NGO Program, Methods Other than Sterilization | | $20.55 |

Table 15b

Estimated Cost per Couple Year of Protection (CYP) of Generating CYPs through Sterilization and Methods Other than Sterilization by Delivery Agency in 1983 ($US)

| | | |
|---|---|---|
| Total Budget of the Residual Program (R.P.) (in million $US) | | 44.021 |
| Money Spent on Sterilization (by R.P.) (# sterilizations x cost/case) | | |
| # sterilizations | 326,774 | |
| X BAVS cost (cost/CYP x CYP/ster.) | $26.41 | |
| X multiplier | 2.0 | 17.259 |
| Money Spent by Residual Program on Methods Other than Sterilization (in million $US) | | 26.762 |
| Number of CYP by Residual Program by Sterilization (million) | | 2.532 |
| Number of CYP by Residual Program on Methods Other than Sterilization (million) | | 0.988 |
| Cost per CYP by Sterilization in Residual Program | | $6.81 |
| Cost per CYP by BAVS Sterilization | | $3.41 |
| Cost per CYP in R.P., Methods Other than Sterilization | | $27.08 |
| Cost per CYP by SMP, Methods Other than Sterilization | | $14.44 |
| Total Budget of NGOs (million $US) | | 4.350 |
| Money Spent on Sterilization (million $US) (# steriliz. x cost/case) | | |
| # sterilizations | 76,270 | |
| X BAVS cost (cost/CYP x CYP/ster.) | $26.41 | 2.014 |
| Money Spent on Other Methods by NGOs (million $US) =Total-Expenditures on Sterilization | | 2.336 |
| Total CYP Generated by NGOs, Methods Other than Sterilization (million) | | 0.157 |
| Cost per CYP by NGO Program, Methods Other than Sterilization | | $14.83 |