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THE CONSEQUENCES OF ACCELERATED MORTALITY DECLINES FOR FUTURE POPULATION GROWTH AND ECONOMIC PROGRESS IN DEVELOPING COUNTRIES

A Preliminary Exploration

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Abstract

This paper explores the demographic and economic consequences of more rapid mortality decline in the developing countries by presenting the results of (1) population projections based on alternate potentially achievable rates of mortality decline; and (2) illustrative economic projections for two developing countries under different assumptions about the rate of increase in life expectancy.

If mortality conditions in the less developed world as a whole were to improve over the next twenty years one and one-half times or two times as rapidly as currently projected, population would be 2-4 per cent larger in the year 2000, 6-8 per cent larger in the year 2100 when a stable population would have been achieved. The differences would be smaller than this in East Asia and Latin America, larger in Africa and South Asia. *Per capita* incomes would continue to rise in Mexico and Bangladesh between 1975 and 2000, albeit somewhat more slowly than currently anticipated, even should very sharp increases in rate of mortality improvement be achieved.

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I. Introduction and Summary

A. The Issue

The desirability of working to accelerate health improvements in developing countries is becoming increasingly accepted. The September 1978 Alma Ata conference sponsored by WHO and UNICEF has aroused markedly increased interest in expanding primary health care particularly in order to accelerate infant and child mortality declines in the developing countries. International Year of the Child has prompted people in many developing countries to give attention to the health status and needs of children. In recent years the development assistance policy of the United States has incorporated the view that health is a basic human need and that health is a critical factor in the achievement of overall socio-economic objectives.

To some, though, this increasing concern for health is a source of embarrassed discomfort. Few would deny the humanitarian value of improved health and lowered infant and child mortality. But at the same time, there persists what the late John Knowles of the Rockefeller Foundation termed a "'silent' resistance" to expanded public health programs arising from a concern for the population growth consequences of reduced mortality.[1/] As is well known, unprecedented declines in developing country mortality levels, combined with little change in fertility, were what yielded the high rates of population growth in the 1950's and 1960's that have made social and economic development in the developing countries so much more difficult. As desirable as further mortality declines might be on immediate humanitarian grounds, any overall assessment of their desirability should take into account their longer-term potential impact on population growth and the significance of the resulting changes in population size on the well-being of future generations. The needs of future generations clearly need to be

considered along side those of the present; and for all the callousness seemingly embodied in some statements of this concern about the possible consequences of more rapid mortality reduction, it is fully as humane to argue on behalf of those yet to be born as it is to advocate improvements in the well-being of those now alive.

There are, however, two reasons for questioning whether the demographic impact of declining mortality is likely to be as important as is normally assumed by those "silently resisting" an increased concern for health improvements. The first reason is based on technical demographic considerations. That is, the population growth impact of improving mortality conditions declines as progressively higher levels of life expectancy are attained.[2/] In view of the higher levels of life expectancy that now prevail in much of the developing world as a result of the last quarter century's unusually rapid progress, the population growth impact of future mortality declines should be less than that experienced in the past. Second, the measures which lead to mortality reduction tend also to lead to lowered fertility. Those development strategies generally thought to be important for mortality reduction, for example--expanding basic education, increasing the production of small farmers, distributing economic growth more equitably, and so on--are also considered particularly effective in reducing fertility. Also, since with declining mortality parents need fewer births in order to assure that any given number of progeny survives into adulthood, the mere fact of increasing child survival brought by these and other health-related programs is considered by many to be an influence toward lower fertility.

Just to note the existence of such effects is not, though, to prove that more rapid mortality declines would necessarily be innocuous, let alone beneficial for demographic and economic progress. For the possibility remains that the effects are too weak to be of more than limited practical significance. Yet

they can hardly be ignored: the fact that they exist and might be of considerable importance suffices to indicate the inadequacy of simply assuming that faster mortality reductions would inevitably lead to explosive accelerations in population growth. What the existence of these effects does, in other words, is to illustrate the uncertainty that now surrounds the demographic and economic consequences of more rapid mortality decline, a set of issues that deserves much more careful empirical study than it has thus far received.

B. The Approach

In what follows, the issue of the demographic and economic consequences of more rapid mortality decline is addressed in a manner analogous to the way in which the effects of continued high fertility on social and economic progress are routinely assessed. That is, a series of illustrative population projections is prepared, assuming in each case the same course of fertility reduction but a different pace of mortality decline. The result is a set of projected population totals that illustrates the impact on population size of the alternate mortality scenarios employed. Then, since population size figures by themselves provide only a very indirect feel for the levels of human welfare associated with them, the alternate economic projections are used (in two illustrative country cases) as inputs into an economic growth model in order to estimate the impact of more rapid mortaility decline on income levels and other indicies of well-being.

Most earlier studies of population's influence on development have manipulated the course of fertility rather than of mortality. The investigators did so because they correctly recognized that it would be changes in fertility which would heavily influence future population size and in turn economic development. The purpose of this exercise is to illustrate the effect of varying the course of mortality

decline, not to take exception to the importance of earlier findings, but to make use of the techniques developed in the course of fertility research to explore another important population issue.

Fertility research of this kind has traditionally incorporated the implicit assumption that an acceleration in the rate of fertility decline would not alter the pace of mortality decline. As indicated, the approach used here follows this tradition and incorporates an analagous assumption: that is, that the pace of mortality decline can be changed without affecting fertility trends. These assumptions that fertility and mortality trends can be altered independently of one another are almost certainly incorrect and admit potentially signficant distortions into the results. That is, the extent to which population growth is reduced by fertility limitation programs tends to be overstated by ignoring those measures' contribution to mortality reduction (through the important contribution of family planning programs to infant mortality decline, for example). Correspondingly, as in the case of this exploration, the failure to account for the probable contribution of mortality reduction programs to fertility decline leads to an overestimation of the population growth increase resulting from such programs.

Technically, this weakness could be easily overcome simply by assuming a more rapid rate of fertility decline in those population projections incorporating faster paces of mortality decline. Given present ignorance about mortality-fertility relationships, however, there is no acceptably objective way of determining the magnitude of the change in the fertility assumption which should be introduced to correspond with any given acceleration in the rate of mortality decline. On the basis of what is now known, for example, it is not possible to say how much more rapidly fertility would fall were the rate of mortality decline to double. Intuitively, in fact, it seems unlikely that any single, universally valid estimation procedure exists. For the amount of change in fertility

would probably very greatly depend upon the policies and programs by which mortality is reduced. (Mortality decline achieved through general social and economic development, for example, would probably be associated with greater fertility reduction than mortality decline brought by direct health interventions.)

By adhering to the traditional computational assumption that fertility and mortality trends are unrelated to one another, the approach used here avoids this morass of uncertainty. While the figures produced may well overstate the true consequences of intensified efforts to reduce mortality, they are nonetheless instructive as estimates of the worst that might reasonably be feared in terms of accelerated population growth and slowed economic progress.

C. The Methodology, Assumptions, and Findings in Brief

The initial population projections were designed to determine the population growth consequences of the sharpest acceleration in mortality decline that might be realistically envisioned. The mortality trajectory selected for this purpose incorporates a rate of decline one and one-half times as rapid as that of the United Nations medium variant projection until a maximum achievable life expectancy, assumed to be around 75-76 years in the case of all projections is reached. Life expectancy is held constant at this level, thereafter. A second trajectory featuring a decline twice as rapid as the U.N.'s is also computed for illustrative purposes. In each projection, the fertility assumption is that of the U.N. medium variant extrapolated forward until such time as a net reproduction rate of one is achieved. For all projections, the net reproduction rate of one is maintained thereafter, and each projection is continued until a stable population level is reached.

All projections yield large increases in population size, regardless of which mortality assumption is used. For the less developed regions as a whole, population rises by over two thirds between 1975 and 2000 under all three projections,

from 2.9 to between 4.8 - 5.0 billion. The projections incorporating more rapid mortality declines lead to end of-the-twentieth-century populations 2 to 4 per cent larger than those currently expected. A century later, by which time population growth would have ceased altogether, population size would have increased approximately three-fold from its present size under each mortality scenario. The more rapid mortality reductions would produce stationary populations 6 to 8 per cent larger than those of the baseline projection. By major geographic region, the year 2100 differences between the baseline and the more rapid mortality decline projections would vary from 2-3 per cent for East Asia and Latin America to 9-14 per cent for Africa. For Africa, the region most severely affected, these projections would mean a 1975-2100 population increase from around 405 million to 2.5 or 2.6 billion, compared with the 2.3 billion of the baseline projection.

Two country case studies serve as the basis for the exploration of the significance of such demographic differences for economic and social development. Mexico and Bangladesh were selected for this purpose because they represent the wide range of differences that exist in the developing world and are countries for which the necessary data are available. Use of the projections incorporating rates of mortality decline 50 per cent and 100 per cent more rapid than anticipated by these countries' governments produces the somewhat larger populations expected in light of the regional results presented above. The significance of these alternate courses of mortality decline for social and economic development in each country is measured through the use of a relatively simple economic model developed under a USAID contact by The Futures Group.[3/] The mortality and fertility trajectories used for the Mexico and Bangladesh population projections are employed as the demographic parameters; the economic parameters are those based on past Mexican and Bangladeshi trends which were developed by The Futures Group for a report to the World Bank.

In each case the total gross national product is slightly larger under conditions of accelerated mortality decline; and per capita income continues to grow, albeit at a somewhat slower rate after the influence of the more rapid population growth is taken into account. In Bangladesh, with accelerated mortality decline, per capita income would rise from $77 to $84-85 during the 1975-2000 period covered by the model exercise, compared with a year 2000 per capita income of $87 according to the baseline projection. To state the same result another way, the "cost" of achieving a decline of 60 points in the infant mortality rate of between 1975 and 2000 in place of the 40-point decline currently projected would be on the order of 15-20 per cent of the presently-anticipated increment in per capita income. In Mexico, reducing infant mortality by 30 rather than 20 points during the same period would "cost" around 4-5 per cent of the anticipated increase in the 1975 average per capita income of about $1,060.

In brief, the approach and assumptions used yield somewhat more rapid rates of population growth and somewhat slower rates of economic progress under conditions of accelerated mortality decline. But, as indicated at the outset, the assumptions used include several whose effect is to maximize the differences resulting from alternate mortality scenarios. When these are taken into account and when the magnitude of the illustrative mortality accelerations employed is fully appreciated, the significance of the results presented becomes more clear. That is, what is surprising is not that differences exist, but rather that they are not much larger.

It would obviously be unwise to enter into ambitious mortality reduction efforts without undertaking the advance planning necessary to help ensure the most rapid possible concomitant fertility decline. Rarely if ever, though, do the population growth consequences of even dramtically accelerated mortality decline appear to be impossibly "expensive" in terms of the economic growth foregone or so significant as to be unmanageable through effective action. Any government

capable of bringing about accelerations in the rate of mortality decline of the magnitude described here ought to be more than capable of dealing effectively with the relatively modest difficulties that would result, even should the extreme assumptions employed in this exercise prove fully justified.

II. The Demographic Consequences of Accelerated Mortality Declines

A. Methodology, Data and Assumptions

The population projections used as the basis for assessing the demographic consequences of more rapid mortality decline are made by using conventional cohort-component methods.[4/] The initial population is divided into 5-year age groups by sex and is moved ahead five years at a time on the basis of certain assumptions about the course of age-specific mortality and fertility rates. One of these assumptions is that in time a net reproduction rate of 1.0 will be achieved at low levels of fertility and mortality with the result that eventually the populations studied reach a stable size.

All projections start in 1975. Except for the Bangladesh and Mexico projections of section III, population totals for 1975 have been taken from the provisional report, "Demographic Estimates and Projections for the World, Regions and Countries as assessed in 1978," prepared by the United Nations Population Division.[5/] In each baseline projection, except Bangladesh and Mexico, values for fertility and for life expectancy by sex during each five-year period from 1975 to the year 2000 were also taken as given in the medium variant of the 1978 U.N. assessment. The trends for both mortality and fertility provided for the 1975-2000 period by the United Nations were extrapolated linearly for subsequent time periods. The trend in life expectancy was projected beyond the year 2000 until a maximum of 77.5 years for females and 73.8 for males was reached. (These are the highest levels provided by the Coale-Demeny Life tables used.) Coale-Demeny West model life tables were used to determine the pattern of age specific mortality in the projections, and to derive illustrative infant mortality figures corresponding to each level of life expectancy. Implicit in the use of the West family is a more rapid rate of of infant and child mortality decline relative to adult mortality. Fertility was also assumed to follow the trend established in the 1975-2000 period until it reached

a minimum level representing replacement fertility under low mortality conditions which worked out to a total fertility rate of 2.08 at the maximum level of life expectancy employed. Because five year age group distributions were not available in the 1978 U.N. assessment those from the earlier 1973 assessment were used.

As is the usual practice, all projections were extended for at least 70 years beyond the point at which mortality and fertility reach their minimum levels. Extending the projections in this way under the mortality and fertility assumptions used identifies the theoretical, stationary population size which results from the achievement and maintenance of a low fertility-low mortality equilibrium. Since stationary population size was reached in all geographic regions by the year 2100, the date is used as a reference point when making comparisons between regions.

1. Alternate Mortality Assumptions.

The variations in mortality assumptions constitute the analytical focus of this study. With the aim of illustrating the consequences of accelerating rates of mortality decline on population size, three different projections were computed for the less developed regions as a whole and for each major geographic unit. The three projections are identified as the "baseline," "variant 1," and "variant 2." As indicated above, the mortality assumptions for the baseline projection to the year 2000 were taken directly from the United Nations medium variant projection. As also mentioned, for the period beyond 2000 the earlier trend in mortality decline is simply extended until the maximum level of life expectancy is attained. Once the maximum level of life expectancy is reached, that pattern of age-specific mortality is held constant to the end of the projection.

The mortality assumptions in variant 1 were calculated by multiplying the gains in life exectancy for each five year interval presented in the baseline

projection by a factor of 1.5. In other words, a 50 per cent acceleration in the pace of mortality decline is built into the projection in variant 1.

In variant 2, a doubling of the rate of mortality decline is assumed. The gains in life expectancy for each five-year period in the baseline were multiplied by 2 until the same maximum life expectancy as in the other projections was attained. Once that life expectancy was reached, it was maintained to the end of the projection period.

Tables 1-5 outline in detail the assumptions used. As shown in table 1, the United Nations scenario that serves as a baseline assumes for the less developed regions as a whole an eight-year gain in life expectancy from 55 to 63 years (and an implied 37 point fall in infant mortality, from 94 to 57 deaths per 1000 live births), between 1975/80 and 1995/2000. This works out to an average annual increase of 0.4 years, which is essentially an extrapolation of the rate of gain thought to have been achieved during the late 1960s and early 1970s according to the U.N.'s figures. This in turn represnts a distinct slowdown from the 0.77 year average increase recorded in the 1950s. The assumption, in other words, is that the slowdown in the rate of progress observed over the past two decades will be arrested; but that, there will be no return to the rapid rates of progress of earlier times. No one knows, of course, how mortality trends will actually evolve in the future, with the result that no assumptions about future mortality trends can be considered safe from legitimate challenge. The U.N. assumption is slightly more optimistic than that of the U.S. Census Bureau (an increase of 0.38 years annually from 1975 to 2000)[6/] and of the World Bank (roughly comparable to that of the Census Bureau).[7/] But such a small difference, whose limited magnitude is more indicative of general consensus than of signficant discord, is of little practical importance for the kinds of calculations to be undertaken here; and, in general, the U.N. assumption seems as acceptable as any, a reasonable

compromise between the optimism of the primary health care enthusiasts and the pessimium of those who think the slowdown in progress is more likely to continue than to be arrested.

The suggestion that variant 1's mortality decline 1.5 times as large as that of the baseline--that is, an improvement of twelve rather than eight years between 1975/80-1995/2000--is about as large as might be reasonably expected emerges from an exploratory effort currently in progress at the Overseas Development Council. To achieve an increase in life expectancy of twelve years, this as-yet incomplete work tentatively suggests, would require something like an annual per capita income growth rate of 3.5 per cent (up from the 2.0 per cent past trend), a rise in adult literacy from 50 per cent to 90 per cent (compared to the near-stagnation at around 50 per cent that has prevailed in recent years), and the immediate world-wide implementation of a moderately effective (i.e., 50 per cent as effective as the most productive pilot projects thus far undertaken) primary health and nutrition care program.

Variant 2's even more ambitious mortality decline assumption of sixteen years rather than eight or twelve years of life expectancy improvement between 1975/80 and 1995-2000 would obviously require even more rapid social, economic, and health program progress. Although any aspiration to achieve such a level may be unrealistic, incorportation of it in a projection exercise was thought nonetheless useful to illustrate the possible population growth impact of a truly dramatic breakthrough.

Ideally, a study of this kind should examine each region and country covered before establishing the alternate variants most appropriate to each. This, however, was not possible in view of the nearly complete absense of information about what would be required to bring about any given degree of acceleration in mortality decline in a specific country setting. Thus, the variants developed

for the less developed regions as a whole were assumed applicable to each of the regions and countries as well. In each case, that is, the United Nations medium variant (or the country's own assumption) is accepted as a baseline; a decline one and one-half times as rapid as that of the baseline serves as the basis for variant 1; and a reduction twice as rapid as the foundation for variant 2.

2. Fertility Assumptions

As indicated, a single set of fertility assumptions was used with all the mortality variants. The starting levels and the rates of decline to the year 2000 for the fertility assumptions are taken directly from the United Nations 1978 medium variant projection. This foresees a fall in the average number of children born to a developing country family from 4.81 in 1975-80 to 3.46 in 1997-2000. This is modestly more optimistic than the Census Bureau's (4.83 in 1975-80 to 3.67 in 1997-2000) but, as was the case of mortality, the difference is not large enough to be of practical significance. As was done in extending mortality trends, the rate of fertility decline for the intervals after 2000 was determined by extrapolating the linear trend established for the 1975-2000 period until fertility reached replacement levels. (Tables 1-5 provide further detail.) Thereafter, fertility was assumed to decline at the same pace as mortality so that an NRR of 1.0 was maintained.[8/]

B. The Findings

1. Less Developed Countries as a whole

Three quarters of the people alive today, or over 3 billion people, live in developing countries. At today's rates, the hypothtical "average" developing-country family is likely to have around five children. At birth, these children have a life expectancy of roughly 55 years. A newborn child faces approximately a 1 in 10 chance of dying before the age of one. Under the highly stylized

assumption that all developing-country families had five children, and given prevailing fertility and mortality rates, a family faces almost a 50-50 chance of losing at least one child. These are the intital demographic conditions in the projections for less developed regions combined.

As discussed above, most observers believe that both fertility and mortality will decline during the next few decades in the developing countries. The United Nations estimates that at the end of the century, the typical family in the developing countries will have between three and four children. Children in the developing countries at birth will have a life expectancy of 63 years. Were this to occur, infant mortality would have declined from 94 to 57 deaths per 1,000 live births. In other words, the average child would face a 1 in 18, rather than the present 1 in 10, chance of dying during his or her first year. Assuming that such developments come to pass, 4.80 billion poeple will be living in the developing countries in the year 2000, approximately two-thirds more than the present 2.89 billion.

Variants 1 and 2 explore the consequences of accelerating this rate of mortality decline. What if, as in variant 1, life expectancy were to increase by twelve rather eight years, which would suggest a drop in infant mortality rates to 40 per thousand. Then the average child in the LDC's at the end of the century would face only a 1 in 25 chance of dying in infancy. With such improvements, these children could expect to live 67 years rather than 63. The data in table 6 indicate that as a result of accelerating mortality declines in this way, the total population in the developing regions would be 4.90 billion in the year 2000, a total 2.0 per cent higher than in the baseline projection. The 1975 LDC population of 2.89 billion, in other words, would have increased by 70 rather than by 66 per cent.

What would happen were mortality to decline even more rapidly were--life expectancy to increase by 16 instead of 8 or 12 years by the year 2000? If this mortality scenario of variant 2 were realized, newborns in an average developing-country family twenty years from now would face only a 1 in 42 chance of dying before age 1 and would, at mortality conditions then prevailing, have a life expectnacy of 71 years. Such a dramatic change in the pace of mortality decline would produce a year 2000 population of 5.00 billion, a total 4.0 per cent higher than the of 4.80 billion expected in the baseline projection.

The long-range implications of each set of assumptions must also be considered before drawing conclusions. Projections one hundred years or more into the future cannot, of course, be considered as anything more than illustrative; and their immediate policy relevance is limited. But such long-range computations are necessary for a full appreciation of the consequences of population trends, which become only partly visible in the initial twenty-five to fifty years.

As the data in table 6 show, if the projections are run through the 21st century, then the pace of mortality declines assumed in variant 1 yields a stable population for the less developed regions of 8.94 billion, 5.7 per cent larger than the 8.46 of the baseline. The even more rapid decline of variant 2 would lead after 125 years to a stable population of 9.16 billion, 8.3 per cent larger than the extrapolated baseline assumptions of the United Nations would yield.

2. Geographic Regions

The variety of demographic conditions underlying the mean values for the less developed regions in 1975 surface when projections are set up for each major geographic region of the Third World. The data in table 7 show the results of applying the assumptions discussed above: namely, that fertility in each region follows the path indicated for that region by the United Nations medium variant

projection; that mortality also declines according to the United Nations medium trajectory (baseline), one-and-one-half as rapidly as that trajectory (variant 1), or twice as rapidly (variant 2).

As table 7's data indicate, there are significant regional variations. These are closely associated with the starting life expectancy level of the region concerned. When the initial level of life expectancy is relatively high, accelerating the rate at which the gains remaining before maximum levels are achieved has only a small impact on population growth. When the starting levels are lower, accelerations in the pace of mortality gain makes a larger difference. Thus, the consequences of more rapid progress in mortality are less in East Asia and Latin America than in Africa or South Asia. In no case, however, is the difference in population size associated with differences in the pace of mortality decline large relative to the natural increase that would occur between now and the time of stabilization under even the most pessimistic mortality scenario employed. Population in all the developing regions, in other words, is destined to grow very rapidly even under the modest declines in mortality assumed in the baseline projections.

Africa's mortality rates of the mid-1970s were the highest in the world. Average life expectancy for the region is estimated to be 49 years in the 1975-80 period; the associated infant mortality would be around 128. In the baseline projection as shown in table 2, life expectancy would increase 9 years from 49 to 58 years by 1997-2000 in line with the United Nations projection of an annual life expectancy gain of about one-half year to the year 2000. At this rate of progress, infant mortality would decline from 128 to 80 during those same twenty years. High fertility in Africa is expected to decline, but not dramatically, by 1.4 points from a total fertility rate of 6.3 to 4.9, according to the United Nations assumption. Thus, despite high mortality, Africa's population will more

than double by the end of the century, as indicated in table 7. By the end of the following century, Africa's population would grow by a factor of five, from 405 million to its ultimate stable level of 2.267 billion under the baseline assumptions used.

What would be the consequences of accelerating the pace of mortality declines for Africa's future population size? Under variant 1, life expectancy would increase from 49 to 63 years during the next twenty years, 50 per cent or approximately five years more than anticipated by the United Nations in the baseline. Were this to happen, Africa's total population would be about 3 per cent larger in the year 2000: 873 rather than 850 million. The additional five years in average life expectancy, in other words, would mean an additional 23 million people by the year 2000. If the infant mortality rate were to drop dramatically from 128 to 40 by 1995-2000 as hypothesized in variant 2 (as life expectancy rose from 49 to 67 years), then Africa's year 2000 total population would be roughly 895 million, or slightly over 5 per cent more than the 850 million people projected in the baseline.

For the longer-range implications of differences among the various assumed rates of mortality reduction, one needs to look at the projections run to the end of the 21st century. According to the baseline assumptions, Africa's population in 2100 would be 2.267 billion. (See table 7.) If the assumptions of variant 1 are projected forward until a fertility-mortality equilibrium is achieved, and if the equilibrium is then maintained until population growth equals zero, the outcome at 2100 is a total population of 2.475 billion, 9.2 per cent higher than the baseline population. The assumptions of variant 2 extended to 2100 yield a total population of 2.586 billion, 14.1 per cent higher than the baseline. The additional 14 per cent represents some 319 million people a century and a quarter

from now, compared with the 1975-2100 gain of 1.863 billion that would occur anyway even should mortality decline as slowly as anticipated in the baseline projection.

East Asia's fertility and mortality levels contrast strikingly with those of Africa. Fertility, highest in Africa, is lower in East Asia than in any other region of the developing world. Conversely, mortality is highest in Africa, lowest in East Asia. Life expectancy is estimated to be 65 years in East Asia in the late 1970s. (See Table 3.) Because of such relatively low mortality levels in East Asia, the population growth effect of additional gains in life expectancy or declines in infant mortality are quite small. Accelerating the pace at which mortality declines as is done in variants 1 and 2, for example, results in population totals about 1.5 per cent or 2.5 per cent larger by the year 2000, depending on the variant. (See Table 7.)

If, as in variant 1, declines in infant mortality can be speeded up so that in twenty years East Asia's newborns face the risk of dying now confronting the newborn child in North America, then East Asia's population would be 20 million larger than expected according to the baseline projection. Adding these 20 million people would lead to a population just under 1.5 per cent larger than the 1,406 billion anticipated by the year 2000 in the baseline projection. If variant 1 were extended until growth ceases, the final stable population total would be just over 1.5 per cent, or 27 million people, larger than the 2100 stable population of 1,750 million under the baseline assumptions.

If the pace of mortality decline in the baseline were acclerated by a factor of two, as in variant 2, East Asia's life expectancy would be at the maximum level by the year 2000. Infant mortality would at a theoretical minimum of 11 deaths per thousand live births. As the data in table 7 indicate, population size at the end of this century and the next would be 2.6 per cent higher in variant 2 than in the baseline.

Latin America provides an additional illustration of the point that accelerating the rate at which the remaining improvement in mortality conditions is made has only a small impact on population growth when the initial level of life expectancy is relatively high. According to the United Nations, life expectancy in Latin America was 63.5 years in the late 1970s. This same U.N. assessment, and thus the baseline projection, anticipated that life expectancy would increase to 70 years, for a gain of roughly six and one half years, by the end of the century. Extrapolation of variant 1's projected 50 per cent larger gain of nine and one half years by the century's end would lead to achievement of the maximum life expectancy level just after the year 2000; under variant 2, the maximum level would be achieved before 2000.

The results presented in table 7 indicate that acelerating the pace of mortality declines in Latin America would cause an increase of about 1 per cent in the year 2000 population total in the case of variant 1, or a 2.5 per cent increase in the case of variant 2. The additional 7 or 15 million people at the end of this century as a result of changing the pace of mortality decline would be quite small compared with the increase of over 280 million that's projected as occurring between 1975 and 2000 even should mortality decline slowly as in the baseline scenario.

South Asia, which includes countries all the way from the Gaza Strip east to the Philippines, had a total population of 1.2 billion in 1975. The United Nations estimated that in the late 1970s, life expectancy was roughly 52 years, which would correspond to an infant mortality rate of over 110, and that the total fertility rate was 5.5. The population for the region was projected to be 2.094 billion by 2000 according to the U.N. assumptions used in the baseline projection.

Accelerating the pace of mortality declines in South Asia, as in variant 1 and variant 2, would result in percentage increases above the baseline smaller than those in Africa but larger than those of East Asia or Latin America. The

faster decline projected under variant 1, for example, would lead to a population increase of 77 per cent between 1975 and 2000 and of 316 per cent between 1975 and 2100, compared with 73 and 295 per cent, respectively, according to the baseline scenario. At each of the two points in time, the variant 1 population would be between 1 and 2 per cent larger than the baseline population.

Doubling the declines in mortality as in variant 2 would add 18 years to life expectancy between 1975-80 and 1995-2000, bringing the average to 70 years by the year 2000 and reduce infant mortality by 84 points, from 112 to 28. (See Table 5.) Such spectacular improvements in South Asia's mortality prospects would result in a 4.8 per cent increment in population size in the year 2000 over that of the baseline population, for a total of close to 2.2 billion by that time. The additional 4.8 per cent is equivalent to some 100 million people. By the time growth would stop, variant 2 would yield a total just under eleven per cent higher than that of baseline projections.

III. The Economic Consequences of Accelerated Mortality Declines

Thus far, the consequences of accelerating declines in mortality have been described in strictly demographic terms. While it is important to have clearly in mind the population size implications of any policy option, a concern about the effect which changes in population size and composition will have on national economic and social objectives is obviously also important.

Further, policy decisions to support primary health care programs, to expand educational opportunities, to increase employment, to improve income distribution or food subsidy programs, all of which could influence the rate of mortality decline, will ultimately be made by national governments. National governments will use their own data and estimates of demographic and economic variables in arriving at policy decisions.

In order to respond to these two issues, population projections with alternate scenarios of mortality decline using national population data and assumptions regarding changes in fertility and mortality were computed for two very different illustrative developing countries: Bangladesh and Mexico. Then, to estimate the demographic trajectories' economic implications, the demographic projections were run in conjunction with a simple economic forecasting model.

A. Population Projections

Bangladesh, according to its own national estimates, had a population of 79 million in the mid-1970s. Life expectancy was thought to be just over 47 years, infant mortality was set at between 135 and 150, and the total fertility rate was estimated to be 5.20. Demographic and economic conditions in Bangladesh are difficult at best. Per capita GNP in 1975 was just $77. Mortality conditions appear to have been improving only slowly if at all. United Nation's figures, in fact, show an actual decline in life expectancy of over two years during the recent difficult period of 1965-70 to 1970-75.

The Bangladesh government's official population projections assume that this setback was only temporary, and that life expectancy will improve in future years at approximately the same rate as in the less developed regions as a whole. (The United Nations is even more optimistic, suggesting a ten-year improvement in Bangladesh's life expectancy between 1975-80 and 1995-2000, compared with the 7.6 year increase assumed by the Bangladesh Government for this period.)

While progress at such a rate perhaps could occur, it also seems at least possible that the unfortunate mortality developments of the early 1970s marked the beginning of a slowing trend of improvement rather than a one-time departure from the more encouraging trajectory of earlier years. If so, then a more somber view would be justifiable. Thus, for Bangladesh, there are two sets of population projections, each consisting of a baseline and two variants. The first set (labelled A) is based on the official Bangladeshi assumptions; the second illustrative set (labelled B) is founded on the assumption that mortality progress will be only roughly one-half as fast.

In Bangladesh, the Bureau of Statistics in the Planning Ministry publishes estimates of population totals, vital statistics, and population projections to the year 2025 on a regular basis.[9/] The official projections, identified as "baseline A" figures in table 8, assume an increase in life expectancy of 7.6 years from 47.3 to 54.9 years, implying a 39 point drop in infant mortality, over the next twenty years. The official projections also assume a one-third decline in the total fertility rate during the same period. According to these assumptions, between 1975 and 2000 the population of Bangladesh will grow from 79 to 124.7 million. (See the baseline A projection of Table 9.) Extending these baseline assumptions to the low fertility-low mortality replacement level results in a year 2100 population of 238 million--three times the initial 1975 total.

Projections 1A and 2A of table 9, repeat the official Bangladeshi fertility assumptions but assume different courses of mortality decline. As in the previous series, the first variant accelerates the decline of baseline A by a factor of 1.5 and the second variant multiplies the baseline A decline by a factor of 2.0. The results of altering the mortality declines are presented in table 9.

Under variant 1A infant mortality would decline from 136 to 76 over the twenty year period--a decline of 21 points more than projected by the baseline. The additional improvements in levels of mortality in Bangladesh would result in a population of 128 million, 2.3 per cent higher than the baseline, at the end of this century.

If twenty years from now the people of Bangladesh could enjoy the mortality prospects now enjoyed in the Latin American region, as variant 2A projects, a newborn's chances of dying during infancy would drop dramatically from 1:7 in 1975-80 to 1:17 twenty years later. Were this to happen, Bangladesh's population in the year 2000 would be 130 million, or 4.4 per cent larger than that of baseline A.

Another way to compare the outcomes under variant 2A and baseline A is to calculate the number of infant deaths expected in the year 2000 under the two projections. According to the assumptions of baseline projection A during the 1995-2000 interval, there would be 3.3 million births annually. Applying the infant mortality rate of 97/1000 anticipated for that five year period to those births results in an estimated 321,000 infant deaths annually. Compared to this baseline scenario, variant 2A anticipates 3.4 million births but, given the lower infant mortality rate of 59/2000, projects an annual total of just under 200,000 infant deaths. For any one year between 1995-2000, then, 121,000 fewer infant deaths would occur if mortality declines were accelerated as assumed in variant 2A.

When the government projections are compared with the recent United Nations assessment, incidentially, one finds that while mortality levels and assumptions concerning changes in mortality are nearly identical, the fertility data and assumptions are quite different. The U.N. estimates that Bangladesh's total fertility rate in 1975 was 6.7, for example, a figure considerably higher than the national government's estimate of 5.2; and the pace of fertility decline projected is also notably different. Applying the U.N. set of fertility assumptions changes the size of the population of Bangladesh in the year 2000--yielding a year 2000 population of about 150 million, rather than the 125 million of baseline A, for example--but does not significantly affect the differences in the size of the increase due to varying mortality assumptions. Variants 1 and 2 yield year 2000 popultion totals 2.6 per cent and 4.6 per cent higher than the baseline when the U.N.'s fertility assumptions are used, percentage increases nearly identical to those in the series using national statistics. Thus, differences in fertility of the sort suggested in the contrast between the Bangladesh government's and the United Nations' assessments do not change the conclusions arrived at above concerning the population size implications of alternate paths of mortality decline.

The longer-range implications, beyond the year 2000, are also important for Bangladesh. As noted earlier in discussing the projections for the African region, if initial levels of life expectancy are below 50, then over a long period the effect of speeding up mortality declines will be greater than if initial life expectancy is over 60. Under the asssumptions used, crude birth and death rates in Bangladesh will have come close to equalling one another at minimum levels, and population growth will have nearly stopped by the year 2100. Accelerating the declines in mortality between 1975 and 2025 by the amounts indicated, has the effect of increasing the year 2100 baseline population size by 16.5 per cent in the case of variant 1A or by 23.3 per cent in the case of variant 2A. Bangladesh's population

would increase by 3.5 times under variant 1A and by 3.7 times acording to variant 1B, compared with 3.0 times under baseline A, between 1975 and eventual stabilization around 2100 A.D.

The second set (set B) of baseline mortality assumptions of table 8 and baseline population projection B in table 9 incorporate the more pessimistic prognosis that the rate of improvement will be approximately one half that indicated by the Bangladesh government's projections: that is, 3.6 instead of 7.6 years during the period 1975-80 and 1995-2000, and then similarly one half the amount of increase shown in baseline A for subsequent periods. While this particular value was arbitrairily selected, it usefully illustrates the implications of a set of assumptions that is significantly less optimistic than those of the Bangladesh government or the United Nations without being so gloomy as to be defeatist in nature. As in other projections, variant 1B assumes that life expectancy increases 1.5 times as much during each time period as under baseline B; variant 2B is based on an increase 2.0 times as rapid. In each case, the fertility trajectory is that of the Bangladesh government used in series A.

When these asumptions are used, the difference in population size among the alternate variants is much smaller than the differences among the alternate variants of the "A" set of projections--1.1 to 2.4 per cent rather than 2.2 to 4.3 per cent in 2000 A.D.; 6.8 to 12.7 per cent compared with 16.5 and 23.3 per cent in 2100 A.D. Thus, if one is less optimistic than the Bangladesh government or the United Nations about the amount of progress that is likely to be achieved given current trends or as a result of an all-out effort, the population growth consequences of moving from the likely to the optimum trajectory are much smaller.

Conditions in Mexico provide an interesting contrast to the situation in Bangladesh. The Mexican government's Bureau of Statistics estimates that Mexican life expectancy in 1975-1980 is around 65 years, nearly 20 years higher than in

Bangladesh, and that it will increase to approximately 70 years at the end of the century.[10/] Fertility levels in Mexico, though, were high like those in Bangladesh: the Bureau's estimates place Mexico's total fertility rate in the mid-1970s at 6.4, a level well above the Bangladesh government's estimate for that country. Thus, officially-estimated the annual population growth rate during the 1975-80 period was over 50 per cent higher in Mexico than in Bangladesh: 3.6 per cent, as compared with 2.3 per cent.

Looking toward the future, the Mexican national projections anticipate only a slow decline in fertility. The government's assumptions call for a decline of only 20 per cent to a total fertility rate of 5.1 in the year 2000. After fifty years, the total fertility rate would still be over 2.7.

According to these assumptions, as extrapolated and presented in table 10, Mexico's 1975 population of 60 million would increase to 142 million in twenty-five years, then to 456 million a hundred years after that when population growth would have ceased. Mexico's population, in other words, would increase by over seven times before stabilizing according to this baseline projection--compared with the threefold increase to be experienced in Bangladesh between 1975 and stabilization, according to the baseline-A projection made on the basis of the government's data. It is the prospect of population growth such as this which has startled economists and demographers.

As in the projections of earlier sections, variants 1 and 2 illustrate the population size consequences of life expectancy increases 1.5 and 2.0 times as rapid as that of the baseline just described. Those projections indicate clearly that alternations in the course of mortality decline in Mexico would make little difference in this prospect. As the data of table 11 show, accelerating the rate at which life expectancy increases from 65 to 75 years has only a small effect

on population growth. For example, in variant 1 life expectancy increases to 73 years after two decades rather than to the 70 years assumed in the baseline projection. The resulting population size according to variant 1 is only 1.0 per cent larger than that of the baseline in the year 2000, and 2.0 per cent larger a century later. In variant 2, the maximum life expectancy is reached by 1995-2000. Infant mortality rates by then would have declined from the present to 11 per 1000 live births. Such a dramatic decline in mortality would cause Mexico's population to grow to 144 million by the end of this century, a total of 2.0 per cent higher than the current national projections estimate for that time; to 470 million, 3.1 per cent higher, by the year 2100.

While there is general agreement among Mexican government, United Nations and U.S. Census Bureau authorities about likely future mortality trends in Mexico, the level of fertility and the course of its decline are, as in the case of Bangladesh, sources of considerable uncertainity. The most recent report available, by the U.S. Census Brueau, suggests that fertility may be much lower and falling much more rapidly than indicated by earlier reports.[11/] Were this assessment to prove correct, and were the rapid rate of fertility decrease of recent years to continue into the future, the conclusion concerning the pace of mortality decline's limited influence on ultimate population size would not be affected. But the impact on population size would be dramatic, far greater than that caused by any imaginable alteration in the rate of mortality fall.

The second set of projections for Mexico shown in table 11 illustrates these points by assuming a rapid course of fertility decline based on an extrapolation of the trend of the past decade as reported by the U.S. Census Bureau, combined with the mortality assumptions stated earlier. Assuming the 1975-80 total fertility rate to be the 5.18 given by the Census Bureau for 1977-78, this rapid fertility fall would, if continued, lead to total fertility of 2.18 in 1997-2000 and a replacement level

shortly thereafter. The population size differences resulting from the alternate mortality variants used is even smaller than under the the Mexican government's less optimistic fertility scenario, but the population size resulting from the different fertility assumptions is greatly different: the population size would stablize at under 150 million, less than one-third of the 455-480 million under the slower fertility decline projection. While these particular numbers may represent an extreme case, they nonetheless serve to illustrate an important point of broader relevance. That is, in countries where mortality is already relatively low and fertility still high, the slightly larger increments in population size caused by accelerated declines in mortality would be minor compared to the very large differences associated with alterations in fertility levels.

B. Economic Projections

Assessment of the economic consequences of the alternate population scenarios outlined is based on the RAPID economic forecasting model of the Washington D.C. office of The Futures Group. "RAPID" is an acronym for "Resources for Awareness of Population Impact on Development." The model was developed under contract with the U.S. Agency for International Development. Its purpose is to facilitate the preparations of demographic-economic analyses for specific developing countries that can, in the words of the model's creators, help "promote an awareness and common understanding among developing country planners and policymakers of the relationship between population growth and socioeconomic development." While the model has thus far been used principally to illustrate the social and economic implications of alternate patterns of fertility decline, it can also be applied to changes in population growth resulting from alternate mortality trends.

The model is based on a Cobb-Douglas production function which relates total output to the size of the capital stock, to the amount of employed labor, and to the rate of technological progress. The production function thus assumes three

sources of economic growth: increases in the amount of capital, increases in the size of the employed labor force, and accelerations in the rate of technological progress. Each of the three sources of growth is in turn determined by a number of other factors, including the size and age distribution of the population at different points of time.

The Futures Group presentation to the World Bank resulted in the preparation of estimated values for the economic factors used by the RAPID model for a large number of developing countries, including Bangladesh and Mexico. For both Bangladesh and Mexico, the estimates of the economic factors were made on the basis of past trends. Combining these economic assumptions with the various population scenarios for Bangladesh and Mexico presented in Tables 8 through 11 produces the result for the year 2000 presented in Tables 12 through 14. In keeping with general practice which recognizes the limitations of long-term economic forecasting, no economic projections were calculated beyond this date.

The economic projection exercise for Mexico starts from initial 1975 values of $65.46 billion for total GNP and $1,062 for GNP per capita, as indicated in Table 12. In 1975 the Mexican labor force included 16.99 million people, and required 523,000 new jobs annually to absorb new entrants at 1975 participation rates. The starting demographic data used are those of Table 10: a 1975 Mexican population of 60 million, a life expectancy of 65 years, and a total fertility rate of 6.36 as estimated by the Mexican government.

Should the Mexican government's assumptions about future mortality and fertility trends prove correct, Mexico's total population would grow from 60 million to 142 million between 1975 and 2000. Linking the baseline demographic projection of Table 11 to the economic model results in the following economic changes between 1975 and 2000, as shown on table 12: total GNP grows from $65 billion to $288 billion, GNP per capita changes from $1,062 to $2,123, and the

size of the labor force jumps from 17 million to 40 million. As a result, by the end of the century, 1,274,000 new jobs--almost two and one-half times the number needed in 1975--are required annually to sustain current participations rates. Under the baseline assumptions, over one-half of Mexico's 6.1 per cent annual rate of overall economic growth would be used to maintain the country's growing population at the prevailing level of income instead of being applied to improvements in that level, indicating that population increase in Mexico will continue to exert pressure on the process of economic development.

If, as in the assumptions of variant 1, Mexico were successful in accelerating the now-anticipated rate of mortality decline by 50 per cent, the effect on economic indicators would be quite small. Total GNP would be slightly higher, but per capita GNP would be $23 or 1 per cent less than it would otherwise have been. The number of new jobs needed annually would be 32 thousand higher than the 1.274 million in the Baseline.

Variant 2 for Mexico projects a ten year gain in life expectancy--twice that now expected--with which would be associated a 37 point drop in infant mortality. This accelerated mortality decline produces a marginally larger total GNP in the year 2000; GNP per capita works out to be $2,079, only two per cent below the $2,123 of the baseline. The size of the labor force would be 40.6 million rather than 40.1 million.

Were mortality to fall as in variant 2, infant mortality would decline from 50 to 13 between 1975/80 and 1995/2000 instead of to 29 as currently anticipated. This fall of 37 points is 16 points more than the 21-point decline of the baseline assumption. The 1975-2000 increase in per capita income under this same rapid mortality decline scenario is $1,017, $44 or about 4 per cent less than the $1,061 1975-2000 increase under the baseline projection. A 16-point larger decrease in infant mortality than now anticipated by the end of the century, in

other words, would come at the "cost" of around 4 per cent of the $1,000 per capita income increments that would otherwise occur during that period.

The same economic-demographic model was used with data for Bangladesh, where the present levels of mortality and economic development are vastly different than those in Mexico. Bangladesh in 1975 had high mortality and a low level of economic development. As shown in Tables 13 and 14, 1975 GNP per capita in Bangladesh was $77, total GNP was $6.07 billion, and the population was 79 million.

Once again the RAPID model was run to the year 2000 under varying assumptions regarding mortality decline. Two sets of runs were prepared, one based on the relatively optimistic assumptions of the Bangladesh government concerning likely future mortality progress, the second based on the more pessimistic prognosis discussed in section III A and used as the basis for the "B" set of Bangladesh population projections. The demographic assumptions underlying the two sets of runs are those presented in Table 8; the results are given in tables 13 (optimistic mortality assumptions) and 14 (pessimistic mortality assumptions).

As the data of tables 13 and 14 indicate, variations in the rate of mortality decline would have a larger economic impact in Bangladesh than in Mexico. Even in Bangladesh, however, the impact is not overpowering, as can be illustrated by examining the most extreme of the alternate possibilities considered.

Should Bangladesh's life expectancy increase by 7-8 years during the remainder of the century (as assumed in the baseline projections of Table 13), and should the fertility and economic assumptions used be correct, per capita income would rise from $77 to $87 between 1975 and 2000. Doubling the amount of increase in life expectancy in this baseline projection, which would bring mortality conditions in 1995-2000 to where they are now in Latin America, would be consistent with a per capita income rise of $7 dollars, from the present $77 to $84. Even should such an extremely large improvement in mortality conditions somehow be brought

about, in other words, per capita income in Bangladesh would still increase, although the increase would be somewhat slower than under the baseline scenario which projected a $10 rise in per capita income between 1975 and 2000. In terms of income foregone, the "cost" of Bangladesh's achieving Latin America's mortality conditions by the end of the century would be on the order of $3 per capita per year at the end of that period, which is about 30 per cent of the currently-anticipated increment. Such a rise in life expectancy would increase the number of jobs required by approximately 15 per cent over what it would otherwise have been: 1.19 million new jobs would have to be created annually, instead of 1.03 million.

Table 14 presents some less extreme estimates. As indicated earlier, its year 2000 baseline findings are founded on the assumption that life expectancy would increase more slowly, by 3.6 rather than by 7.6 years, between 1975-80 and 1995-2000. Should life expectancy increase by twice this much, by 7.2 years from 47.3 to 54.5 years as in variant 2, infant mortality would decline from 136 to 97 rather from 136 to 116: by 39 instead of by 20 points. Per capita income would rise by $11 under this scenario, from $77 to $88. This is about $1.50 less than the $12.50 rise under the baseline projection. The "cost" of the 19-point additional decline in infant mortality works out in this case to around 15 per cent of the presently-envisioned 1975-2000 increase in per capita income.

FOOTNOTES

1. John H. Knowles, "Health, Population and Development." Agenda and Discussion Papers: Health and Populationin Developing Countries. April 1979, Bellagio, Italy.

2. See Ansley J. Coale, "Increases in Expectation of Life and Population Growth." Paper presented at the International Population Conference, Vienna, 1959.

3. The Overseas Development Council appreciates the extremely helpful cooperation readily given by the Futures Group. The Future Group does not share any responsibility for the accuracy or interpretation of the results.

4. International migration is not taken into account for several reasons. For large geographic regions and the developing countries combined, migration will have a negligible effect on population size and growth rates. In specific countries for specific periods, migration could influence the results to some degree. But the influence would be slight; and given the difficulty in accurately estimating current and future migration rates and in light of the interest in focusing sharply on the influence of mortality changes, international migration was assumed to be zero in the specific regional and individual country studies as well.

5. United Nations, Department of International Social and Economic Affairs, Population Division, Demographic Estimates and Projections for the World, Regions and Countries as Assessed in 1978. Provisional Report, 20 January 1979, Mimeographed.

6. U.S. Department of Commerce, Bureau of the Census. Illustrative Projections of World Populations to the 21st Century. Current Population Reports, Special Studies Series P-23, No. 79.

7. The World Bank, World Development Report, 1978, Washington, D.C., August, 1978, notes to Table 16 and K. Zachariah, Revised Population Projections, 1975-2000. October 1977, Mimeographed.

8. Fertility can, of course, decline below replacement level. The government of the Peoples Republic of China now has a policy encouraging families to have one rather than two children. Were this to be achieved, fertility would fall below replacement level. But, fertility levels significantly below replacement level have not been experienced for long periods; and so for the sake of simplicity, the projections incorporate the assumption routinely used in work of this sort that fertility in the developing countries will not fall below that needed for full replacement.

9. Government of the People's Republic of Bangladesh, Bureau of Statistics, Statistics Division, Ministry of Planning. Monthly Bulletin of Bangladesh, Vol. VIII, No. 8, August 1978.

10. Government of Mexico, Direccion General de Estadistica, Subdireccion de Estadisticas Demografica y Sociales. Proyecciones de la Poblacion Mexicana, 1970-2000 (Nivel Nacional), Evaluation y Analisis, Series III.

11. U.S. Department of Commerce, Bureau of the Census. Mexico, Country Demographic profiles, ISP-DP-14. September 1979.

TABLE 1

ASSUMPTIONS UNDERLYING POPULATION PROJECTIONS
FOR LESS DEVELOPED REGIONS AS A WHOLE

	Assumptions for Fertility and Mortality			Change from Initial 1975/80 Values by	
	1975/ 1980	1995/ 2000	2025/ 2030	1995/ 2000	2025/ 2030
Less Developed Regions					
Total Fertility Rate	4.818	3.440	2.080	- 1.378	- 2.738
Life Expectancy (in yrs)					
Baseline	55.0	63.0	75.3	+8.0	+20.3
Variant 1	55.0	67.1	75.7	+12.1	+20.7
Variant 2	55.0	71.2	75.7	+16.2	+20.7
Infant Mortality Rates (Infant Deaths/1000 live births)					
Baseline	94	57	12	-37	-82
Variant 1	94	40	11	-54	-83
Variant 2	94	24	11	-70	-83

NOTE:

Infant mortality rates given are those corresponding to the life expectancies indicated according to the Coale-Demeny West family of model life tables.

TABLE 2

ASSUMPTIONS UNDERLYING POPULATION PROJECTIONS FOR AFRICA

	Assumptions for Fertility and Mortality			Change from Initial 1975/80 Values by -	
	1975/ 1980	1995/ 2000	2025/ 2030	1975/ 2000	2025/ 2030
AFRICA					
Total Fertility Rate	6.313	4.913	2.161	-1.400	-4.152
LIFE EXPECTANCY					
Baseline	48.8	57.9	71.7	+9.1	+22.9
Variant 1	48.8	62.5	75.7	+13.7	+26.9
Variant 2	48.8	67.1	75.7	+18.3	+26.9
INFANT MORTALITY RATE					
Baseline	128	80	23	-48	-105
Variant 1	128	59	11	-69	-117
Variant 2	128	40	11	-88	-117

NOTE:

Infant mortality rates given are those corresponding to the life expectancies indicated according to the Coale-Demeny West family of model life tables.

TABLE 3

ASSUMPTIONS UNDERLYING POPULATION PROJECTIONS FOR EAST ASIA

	Assumptions for Fertility and Mortality			Changes from Initial 1975/1980 Value by -	
	1975/ 1980	1995/ 2000	2025/ 2030	1995/ 2000	2025/ 2030
EAST ASIA					
Total Fertility Rate	3.014	2.080	2.080	-0.934	-0.934
LIFE EXPECTANCY					
Baseline	64.8	70.7	75.7	5.9	10.9
Variant 1	64.8	73.7	75.7	8.9	10.9
Variant 2	74.8	75.7	75.7	10.9	10.9
INFANT MORTALITY RATE					
Baseline	50	26	11	-24	-39
Variant 1	50	17	11	-33	-39
Variant 2	50	11	11	-39	-39

NOTE:

Infant mortality rates given are those corresponding to the life expectancies indicated according to the Coale-Demeny West family of model life tables.

TABLE 4

ASSUMPTIONS UNDERLYING POPULATION PROJECTIONS FOR LATIN AMERICA

	Assumptions for Fertility and Mortality			Changes from Initial 1975/1980 Value	
	1975/ 1980	1995/ 2000	2025/ 2030	1995/ 2000	2025/ 2030
LATIN AMERICA					
Total Fertility Rate	4.941	3.875	2.276	-1.066	-2.665
LIFE EXPECTANCY					
Baseline	63.5	69.7	75.7	+6.2	+12.2
Variant 1	63.5	72.9	75.7	+9.4	+12.2
Variant 2	63.5	75.7	75.7	+ .2	+12.2
INFANT MORTALITY RATE					
Baseline	55	30	11	-25	-44
Variant 1	55	11	11	-44	-44
Variant 2	55	11	11	-44	-44

NOTE:

Infant mortality rates given are those corresponding to the life expectancies indicated according to the Coale-Demeny West family of model life tables.

TABLE 5

ASSUMPTIONS UNDERLYING POPULATION PROJECTIONS FOR SOUTH ASIA

	Assumptions for Fertility and Mortality			Changes from Initial 1975/1980 Value by -	
	1975/ 1980	1995/ 2000	2025/ 2030	1995/ 2000	2025/ 2030
SOUTH ASIA					
Total Fertility Rate	5.535	3.567	2.080	-1.968	-3.455
LIFE EXPECTANCY					
Baseline	51.6	60.8	74.8	+9.2	+23.2
Variant 1	51.6	65.5	75.7	+13.9	+24.1
Variant 2	51.6	70.1	75.7	+18.5	+24.1
INFANT MORTALITY RATE					
Baseline	112	66	14	-46	-98
Variant 1	112	46	11	-66	-101
Variant 2	112	28	11	-84	-101

NOTE:

Infant mortality rates given are those corresponding to the life expectancies indicated according to the Coale-Demeny West family of model life tables.

TABLE 6

POPULATION PROJECTIONS AND ESTIMATED ADDITIONAL GROWTH IN POPULATION SIZE INCURRED BY ACCELERATING THE PACE OF MORTALITY DECLINE, LESS DEVELOPED REGIONS AS A WHOLE

(Population in Millions)

	1975 Population	2000 Population	Percent Difference Over Yr. 2000 Baseline Population	2100 Population	Percent Difference Over yr. 21 Baseline Population
Baseline	2,894	4,804	-	8,437	-
Variant 1	2,894	4,902	+ 2.0	8,939	+ 5.7
Variant 2	2,894	4,996	+ 4.0	9,162	+ 8.3

NOTES:

A. The 1975 population total is taken from the United Nations Population Division's provisional report, Demographic Estimates and Projections for the World, Regions and Countries as Assessed in 1975. (Mimeo., January 25, 1979).

B. For a detailed discussion of the single set of fertility assumptions and three sets of mortality assumptions see the text and Table 1.

TABLE 7

POPULATION PROJECTIONS AND ESTIMATED ADDITIONAL GROWTH IN POPULATION SIZE INCURRED BY ACCELERATING THE PACE OF IMPROVEMENT IN LIFE EXPECTANCY: AFRICA, EAST ASIA, SOUTH ASIA, AND LATIN AMERICA

(Population in Millions)

Region/Mortality Scenario	Year 1975 Population	Year 2000 Population	Year 2000 Percent Increase over Yr. 2000 Baseline pop.	Year 2100 Population	Year 2100 Percent Increase over Yr. 2100 Baseline pop.
AFRICA					
Baseline	404.8	849.5	-	2,267.1	-
Variant 1	404.8	872.7	2.7	2,474.9	9.2
Variant 2	404.8	894.6	5.3	2,586.1	14.1
EAST ASIA					
Baseline	1,063.4	1,406.4	-	1,749.4	-
Variant 1	1,063.4	1,426.1	1.4	1,776.9	1.6
Variant 2	1,063.4	1,442.4	2.6	1,795.5	2.6
SOUTH ASIA					
Baseline	1,210.5	2,094.0	-	3,570.0	-
Variant 1	1,210.5	2,145.7	2.5	3,823.0	7.1
Variant 2	1,210.5	2,193.6	4.8	3,960.8	10.9
LATIN AMERICA					
Baseline	322.7	606.8	-	1,408.4	-
Variant 1	322.7	614.1	1.2	1,433.5	1.8
Variant 2	322.7	621.3	2.4	1,445.4	2.6

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TABLE 8.

ASSUMPTIONS UNDERLYING POPULATION PROJECTIONS FOR BANGLADESH UNDER ALTERNATE MORTALITY DECLINE SCENARIOS

	Assumptions for Fertility and Mortality			Changes from Initial 1975/1980 Value by -	
	1975/ 1980	1995/ 2000	2025/ 2030	1995/ 2000	2025/ 2030
Total Fertility Rate	5.207	3.435	2.482	-1.772	-2.725
Life Expectancy					
Baseline A	47.3	54.9	68.6	7.6	21.3
Variant 1A	47.3	58.7	75.7	11.4	28.4
Variant 2A	47.3	62.5	75.7	15.2	28.4
Baseline B	47.3	50.9	56.5	3.6	9.2
Variant 1B	47.3	52.7	58.2	5.4	10.9
Variant 2B	47.3	54.5	60.3	7.2	13.0
Infant Mortality Rate					
Baseline A	136	97	54	-39	-82
Variant 1A	136	76	11	-60	-125
Variant 2A	136	59	11	-77	-125
Baseline B	136	116	87	-20	-49
Variant 1B	136	106	78	-3	-58
Variant 2B	136	97	54	-39	-82

NOTES: Assumptions developed from information in Government of the People's Republic of Bangladesh, Bureau of Statistics, Statistics Division, Ministry of Planning. Monthly Statistical Bulletin of Bangladesh, Vol. VII, No. 8, August, 1978.

Infant mortality rates given are those corresponding to the life expectancies indicated according to the Coale-Demeny West family of model life tables.

TABLE 9

POPULATION PROJECTIONS AND ESTIMATED ADDITIONAL GROWTH IN POPULATION SIZE INCURRED BY ACCELERATING THE PACE OF IMPROVEMENTS IN LIFE EXPECTANCY IN BANGLADESH
(Population in Millions)

Country/Mortality Scenario	Year 1975 Population	Year 2000 Population	Year 2000 Percent Increase Over Year 2000 Baseline Population	Year 2100 Population	Year 2100 Percent Increase Over Year 2100 Baseline Population
BANGLADESH MORTALITY ASSUMPTIONS					
Baseline A	79.0	124.7	-	233.8	-
Variant 1A	79.0	127.5	2.3	273.4	17.0
Variant 2A	79.0	130.1	4.4	289.5	23.8
ALTERNATE MORTALITY ASSUMPTIONS					
Baseline B	79.0	121.8	-	201.6	-
Variant 1B	79.0	123.2	1.1	215.4	6.8
Variant 2B	79.0	124.7	2.4	227.3	12.7

TABLE 10.

ASSUMPTIONS UNDERLYING POPULATION PROJECTIONS FOR MEXICO
UNDER ALTERNATE MORTALITY DECLINE SCENARIOS

MEXICO	Assumptions for Fertility and Mortality 1975/1980	1995/2000	2025/2030	Changes from Initial 1975/1980 Value by - 1995/2000	2025/2030
Total Fertility Rate					
Mexican Government's Assumptions	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Alternate Fertility	3.180	2.180	2.080	-3.00	-0.1[illegible]
Life Expectancy					
Baseline	64.7	70.4	74.8	+5.3	+10.1
Variant 1	64.7	72.6	75.7	+7.9	+11.0
Variant 2	64.7	75.3	75.7	+10.6	+11.0
Infant Mortality Rate					
Baseline	50	29	14	-21	-3[illegible]
Variant 1	50	20	11	-30	-39
Variant 2	50	13	11	-37	-3[illegible]

NOTES: Mexican Fertility Assumptions: Government of Mexico, Direccion General de Estadistica, Subdireccion de Estadisticas Demograficas y Sociales. Proyecciones de la Poblacion Mexicana, 1970-2000 (Nivel Nacional), Evaluation y Analisis, Serie III, No. 8.

Alternate Fertility Assumptions: Developed from information in U.S. Department of Commerce, Bureau of the Census. Mexico, Country Demographic Profile, 15P-DP-14. September, 1979.

Infant mortality rates are those corresponding to the life expectancies indicated according to the Coale-Demeny West family of model life tables.

TABLE II

POPULATION PROJECTIONS AND ESTIMATED ADDITIONAL GROWTH IN POPULATION SIZE INCURRED BY ACCELERATING THE PACE OF IMPROVEMENTS IN LIFE EXPECTANCY IN MEXICO:
(Population in Millions)

Country/Mortality Scenario	Year 1975 Population	Year 2000 Population	Year 2000 Percent Increase Over Year 2000 Baseline Population	Year 2100 Population	Year 2100 Percent Increase Over Year 2100 Baseline Population
MEXICAN FERTILITY ASSUMPTIONS					
Baseline	60.0	141.6	-	455.8	-
Variant 1	60.0	142.9	1.1	468.4	2.1
Variant 2	60.0	144.1	2.0	469.8	3.1
ALTERNATE FERTILITY ASSUMPTIONS					
Baseline	60.0	99.5	-	148.1	-
Variant 1	60.0	100.2	0.7	148.6	0.3
Variant 2	60.0	101.0	1.5	149.3	0.8

Table 12. Economic Consequences of Alternate Mortality Scenarios, Mexico, 1975 - 2000

Economic Indicator	1975 Initial Values	Year 2000 Baseline	Year 2000 Variant 1	Year 2000 Variant 2
1. Total GNP (in billions)	$ 65.46	$ 287.93	$ 289.22	$ 290.08
2. GNP/Per Capita	$1,862.00	$2,124.00	$2,100.00	$2,079.00
3. Size of Labor Force (Pop. 15-64 in millions)	16.99	40.10	40.40	40.60
4. New Jobs Needed Annually (in thousands)	521.0	1,274.00	1,307.00	1,328.00

Table 11. Economic Consequences of Alternate Mortality Scenarios Using Baseline Population Projection A, Bangladesh, 1975 - 2000

Economic Indicator	1975 Initial Values	Year 2000 Baseline	Year 2000 Variant 1	Year 2000 Variant 2
1. Total GNP (in billions)	$ 6.07	$ 11.14	$ 11.20	$ 11.25
2. GNP/Per Capita	$ 76.64	$ 87.25	$ 85.47	$ 84.06
3. Size of Labor Force (Pop. 15-64 in millions)	27.86	51.57	52.01	53.30
4. New Jobs Needed Annually (in thousands)	661.14	1,011.14	1,118.00	1,190.25

NOTE: The Baseline projection in Series A assumes a 7.6 year increase in life expectancy during the 1975-2000 period.

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TABLE 14. ECONOMIC CONSEQUENCES OF ALTERNATE MORTALITY SCENARIOS USING BASELINE POPULATION PROJECTION B, BANGLADESH, 1975-2000

Economic Indicator	1975 Initial Values	Year 2000 Baseline	Year 2000 Variant 1	Year 2000 Variant 2
1. Total GNP (in billions)	$ 6.07	$ 11.10	$ 11.12	$ 11.14
2. GNP/Per Capita	76.64	89.20	88.36	87.52
3. Size of Labor Force (Pop. 15-64 in millions)	27.86	50.70	51.11	51.53
4. New Jobs Needed Annually (in thousands)	661.14	951.30	989.42	1027.90

NOTE: The Baseline projection in series B assumes a 3.6 year increase in life expectancy during the 1975-2000 period.