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HEALTH ASPECTS OF POPULATION INCREASE

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GENERAL PERSPECTIVE: Health, Population Increase and Development

There is a growing awareness that the problems of development cannot be solved by concentrating on particular economic or social programmes to the exclusion of others. However, many developing countries have come to regard high rates of population growth as an especially serious problem, and have adopted specific population policies and programmes to restrain fertility. Other countries have endorsed family planning programmes as means of enhancing family health and well-being.

The World Health Organization has given much attention to the health aspects of family planning (Omran 1971; WHO 1970a), and has consistently affirmed its willingness to assist member governments in developing the health infrastructure for the provision of family planning within the context of integrated maternal and child health and other health services. (Resolution numbers WHA 18.49, WHA 19.43, WHA 20.41, WHA 21.43, WHA 22.32, WHA 22.55, WHA 26.49 in WHO 1971, pp.21-23, 457-468, and WHO 1973b, p.26).

In July, 1969, the Twenty-Second World Health Assembly requested the Director-General:

- “ (a) to continue to develop the programme of advisory services, training, research and reference in this field in the direction undertaken;
- (b) to evaluate various approaches to the introduction and development of services for family planning care specifically in the context of health services and generally in the context of community, economic, and national development; and
- (c) to continue to intensify the development of basic health services as the framework for meeting health needs, including family planning in those countries where this is necessary.” (WHO 1971, p.23)

The aim of this paper is to review the potential contributions of health to the process of general development, to analyze the interrelationships between health and population, and to consider in some detail the role of health services in accelerating fertility decline in countries which consider rapid population growth a serious problem.

A. Socio-Economic Development and Health

The interrelationships between socio-economic development and health have been of more concern to health workers than to economists. While there is much evidence from a long tradition of epidemiological research on ways in which socio-economic conditions influence health, only recently has there been any serious attention given to studies of contributions of health to socio-economic development. Health has been considered a general good that did not require justification. Recently, however, economic planners have begun to ask for evidence of the contribution of health to development. Even more specifically, economic analyses of alternative ways of improving health have been sought as an aid in making cost/benefit judgments about allocations to specific sectors. This has proved difficult because health has multiple ecological effects and its benefits are hard to define. Improved health directly affects the morbidity, mortality and fertility experience of a population and together these factors largely determine the size, age-sex structure, labor force components and productivity levels, factors that may either inhibit or facilitate economic progress. In the discussions that follow, health is understood to include nutrition even though many studies have attempted to separate the

nutritional effects.

A.1 Effects of Socio-Economic Development on Health

Evidence on the relation between socio-economic status and health is well established in epidemiological literature. There are few major health problems about which some epidemiological information on effects of socio-economic status is not available.

The increasing attention to the contributions of socio-economic variables to health improvement raises the question that perhaps health activities have been given more credit than they deserved for lowering mortality. During the long, slow process of development in most presently industrialized countries, economic development was probably more effective than public health and clinical medicine in reducing mortality. Even today, socio-economic development contributes significantly to the lowering of mortality in less developed countries. In rural areas, for instance, the present rapid decline in death rates cannot be attributed solely to organized health services because most village people do not have access to such services. Mass campaigns such as malaria control and vaccination programs have, of course, also contributed importantly but the precise balance in impact has not been defined.

On the other hand, it must be realized that industrialization may also lead to its own health problems if working conditions deteriorate and if there is an aggravation of environmental problems due to pollution and crowding.

A.2 Effects of Health on Socio-Economic Development

While health workers have always taken for granted that health contributes to socio-economic development, doubts have been raised largely because of concern about population growth. Recognition of the need to measure the strength of such relationships in comparison with the contributions of other developmental forces so that planners may have a better basis for allocating scarce resources has also led to increased attention to health by economists. Research is still rudimentary but there is indication that indirect effects are probably more important than direct effects. Data on the general relationships reported by Liebenstein (1970) and others indicated that health and education were the most evident among the large "residual" of factors that proved statistically more important than the usual economic indicators in explaining economic development.

a. Direct Effects

The most direct association between health and development is through increases in productivity. A recent annotated bibliography lists many references of varying quality of data (Williams et al, 1972). Some evidence can be cited of situations in which particular health measures, ranging from better nutrition to control of a disease such as malaria, caused a measurable increase in labor productivity. Two patterns of influence may be noted: (a) better personal health care and nutrition increases the productivity of the individual (Kraut and Muller 1946) and (b) large-scale health programmes can increase the pace of regional development as a whole (Bogatyrev and Rajtman 1969; Correa and Cummins 1970). However, much detailed research into the exact dimensions and specific magnitudes of such effects still needs to be carried out.

In addition to immediate effects of health on productivity, there is increasing evidence of potential delayed effects from malnutrition or illness occurring during the early development of children. It is clear that measurable deficiencies in several developmental indices, including intelligence, can be attributed to early malnutrition and to deprivation of mother care (Scrimshaw and Gordon 1968). It is not yet clear how much and under what conditions a catch-up effect can occur.

Health, then, is in the equivocal position of being both a means and an objective of development. The 1972 World Health Assembly Technical Discussion on the Contribution of Health Programmes to Socio-Economic Development (1972) arrived at

the following general agreement:

“ It was recognized as a basic principal that health programmes are rarely ever justified solely on economic grounds, but rather as the means of maintaining and improving health, which is perhaps the most important single factor in improving the quality of human life. It was accepted without question that health is an objective in its own right and represents one of the most important manifestations of social progress.”

(WHO 1972, A/25 Tech. Dis. 16 p.6.)

b. Indirect Effects

Potentially, the most important effects of health on socio-economic development are a set of indirect and difficult to measure attitudinal variables (Taylor 1965, 1968). Malenbaum argues that motivational changes are central to the process of economic development and the problem of reducing population growth, and that effective health measures can be important in the creation of new attitudes and motivations among the poor (Malenbaum 1973). The importance of people as the active agents who accumulate capital, exploit natural resources, and build social, economic and political organizations is recognized to be basic to all national development (Harbison 1971). There is agreement on the general principle that healthier people tend to show more enterprise than those chronically sick. Partly, this may be because sick and undernourished persons barely manage routine tasks, while it requires extra energy and working capacity to undertake new types of work and innovative effort. Perlman has also suggested that ill health contributes to the perpetuation of a high dependency ratio: parents wanting to insure themselves of life's minimum necessities are significantly motivated to have large families so that on any given day, despite ill health, a certain minimum number of family members are working. Therefore, improved health of those in or likely to join the labor force may well have an economic effect both in terms of increasing productivity and by increasing motivation to reduce family size (Perlman 1972). Underlying all such discussions is the increasing appreciation of the basic rationality of family decisions and the fact that in a subsistence economy children are viewed as introducing very small marginal increases in cost.

Perhaps the most important, but as yet unmeasured attitudinal change associated with better health, is the individual's view of the future. As prospects for survival improve, both for adults and children, the future becomes worth planning for. When health measures are made available in a traditional community and at early stages of development, the benefits are sometimes so dramatic that a change in basic and often fatalistic beliefs may occur which include a beginning understanding that natural phenomena can be rationally explained. Planning for the future becomes worth while when change is perceived as being possible (Taylor 1970).

Despite its potential importance for health and development planning, many obstacles remain to the adequate quantification of the relationships between health and health programmes on the one hand and socio-economic development on the other. Among these WHO includes (1) the inadequacy of basic health and demographic statistics in many countries; (2) the lack of a single measure of national well-being comparable to but broader than the familiar Gross National Product; (3) a reliance upon input measures, due in part to a lack of well-defined output indicators, and especially a measure of health status; (4) the failure to develop appropriate analytical methods and models for a multi-disciplinary approach to socio-economic change; and (5) the failure to utilize such social and economic models as are presently available. (WHO 1973a, pp.17-20)

B. Health and Population Increase

Health interacts with both population growth and socio-economic development. In each case health may be regarded as a determinant as well as a consequence of the other. Health also may tend to be an intervening variable in the interactions between population growth and development. Health status in a population influences all of the components of population change: it directly affects levels of mortality and morbidity; directly and indirectly affects levels of fertility; and has considerable influence on migration. Our discussion here will focus primarily on the two way relationship between health and fertility.

B.1 Effects of Health on Fertility

Better health has multiple direct effects on population trends. The most obvious is the reduction of mortality which is the major force in population growth. Equally often noted is the proposition that better health may increase fertility in the absence of family planning. The contribution of this fertility effect to the growth of population should not be exaggerated, however. It may result in a slight and transient increase in fertility while mortality is falling to less than half its former level. The apparent increase in birth rates often observed as health services are introduced can usually be explained by better reporting of births.

Nevertheless, there are several ways in which improved health can increase fertility. The most obvious is elimination of diseases which reduce fecundity, such as tuberculosis salpingitis, endometritis and venereal diseases (Gray, 1972, p.9). Low fertility due to high prevalence of venereal disease has been noted in a few countries (Scragg, 1954, Romaniuk, 1966). Better health can also increase fertility by reducing diseases that interfere with completion of pregnancy, such as infectious hepatitis, smallpox, tuberculosis, malaria, syphilis, listeriosis, brucellosis, toxoplasmosis and rubella (WHO 1970b). Malnutrition may contribute to maternal mortality, foetal loss, low birth weight, and faulty lactation (WHO 1970b, p.16). The fertile time-span may be increased by better health and nutrition (Ridley 1965), whereas famine conditions may lead to widespread amenorrhoea and seriously affect fecundity (Baird 1965). The total time-span during which couples are exposed to marital fertility may also increase due to decline in mortality of adults, especially when high maternal mortality is reduced.

Conversely, health and nutritional factors may also serve to reduce fertility. For instance, prolonged lactation due to health improvement can prolong postpartum amenorrhoea.

It is worth noting that the provision of medical care does not invariably lead to better health, nor are successful health programmes the only means by which health improvement may be achieved. A full discussion of the role of health and population in development would need to deal with the contention of many that social-structural change is fundamental to the attainment of community health. Development efforts obviously need to be multifaceted; however, the focus of this paper is upon the contribution of the health sector.

B.2 The Influence of Health Services on Family Planning Utilization

Whereas health services resulting in reduced morbidity and mortality have often been considered a major cause of population growth, the point will now be made that they can also contribute to a more rapid fall in birth rates through increasing the practice of family planning. Three major groups of arguments will be presented in support of this position.

B.2.1 Programme Efficiency and Effectiveness

There are obvious organizational benefits to be obtained by combining health and family planning services. If integrated services are provided then the maximum and most efficient use can be made of available supplies, equipment, transportation facilities, personnel and organizational structure.

In addition, integrated services make more sense to families. When a health worker visits homes, parents like to have multiple problems cared for rather than being put off by classifications of personnel which they do not understand. In a clinic also, they would prefer to get their care from one person rather than a sequence. Many family planning services have had minimal impact because of their inability to provide adequate follow-up to acceptors. An effective and rational follow-up service can be most readily developed in conjunction with other health care services.

Perhaps most important is the consideration that there are major benefits to be achieved by relating activities for which the public demand is equivocal to care programs which are spontaneously and continuously in much demand. Even though some families are eager for family planning because they have more children than they can care for, in general the much larger number of low parity parents who are demographically most important will continue to be somewhat ambivalent in their motivation. For these parents, it seems important to have a convincing case made for early spacing by a health worker whom they have learned to trust because he or she has provided continuing help for day-to-day illnesses. Health workers are, however, not usually spontaneously interested in family planning and specific routines need to be established to ensure appropriate high priority and continuing attention.

B.2.2 Relation to Maternal Care

The international postpartum programs have clearly demonstrated that family planning acceptance is high during the postpartum period (Zatuchni 1970). Family planning is especially effective when provided as a routine part of postpartum care because of the high motivation. When a gradual process of education is started during the prenatal care period, the mother accepts as perfectly natural the proposition that family planning should be started after delivery both to protect her own health and the wellbeing of her child. Follow-up then is part of the routine. The reasons for high motivation at this time are not hard to identify. In addition to the health arguments, there are social, economic and time considerations relating to the difficulties parents would have in caring for the children they now have if another pregnancy supervened. In addition, there seems to be an important psychological consideration; having just passed through one pregnancy, mothers tend to want a period of respite before becoming pregnant again.

In some places, complications resulting from induced abortions may present a group of health problems strongly associated with the need for family planning. Abortion rates can reach equivalence with normal deliveries. Where they are performed under adequate professional control complications are minimal (Klinger 1966; Muramatsu 1966; Roht 1973). On the other hand, where abortions are carried out under unsafe hygienic conditions, surreptitiously, and by poorly qualified persons, the results can be disastrous. For instance, in one country it was estimated that 39% of maternal mortality was attributable to abortion, and in one city 42% of puerperal deaths were due to abortion. Under such circumstances, family planning programmes may be a major means of reducing the number of abortions (Requena 1965; Muramatsu 1965).

B.2.3. The Child Survival Hypothesis

In recent years, increasing attention has been given to the proposition that the experience and/or expectation of infant and child mortality may hinder significant movement toward lower fertility in much of the developing world. According to this view, as long as the proportion of children that die in childhood remains substantial, there is a major psychological obstacle to be overcome in promoting family limitation (Taylor 1965, 1968, 1970; Frederiksen, 1969; Omran, 1971). Thus significant reduction in child mortality may be an important although perhaps not essential means of encouraging an increased use of family planning in areas where both fertility and mortality are high. It would be expected then that efforts directed specifically toward the reduction of child loss and especially toward increasing the perception of greater child survival although not guaranteeing fertility decline, could shorten the demographically important lag between the decline of mortality and fertility rates. At the same time, a health infrastructure which is developed for infant and child care can be logically and readily combined with other important services including family planning.

If the child survival hypothesis is important, it is apparent that its effect will be seen mainly in transitional situations where mortality decline is occurring

while fertility decline lags behind. When conditions are so bad that high child mortality prevails, especially under famine conditions, then parents may practice family planning simply because they cannot afford or care for children. At the other end of the development spectrum, when conditions have improved so much that expectations of survival are generally high, then fluctuations of child mortality rates will have little effect on motivation for family planning. The fact is, of course, that the world's population problem is focussed in those situations where the child survival hypothesis may be most relevant.

Possible reasons for such attitudinal interrelationships are readily mobilized. Children, and especially sons, are seen as a source of support in old age. The status of woman in some cultures depends on whether she produces sons, and in almost all cultures many of the satisfactions of family life derive from having children around as long as possible. Ensuring a replacement number of children depends on the balance between reproduction and survival, and in terms of emotional investment there is probably more concern with the latter than the former.

Supporting evidence for the child survival hypothesis may be sought in two kinds of data: time series estimates of vital rates at national level to get a general feel for the probable direction and magnitude of quantitative and temporal association; and studies of couple experience which are undoubtedly of more value in trying to understand causal effects and the dynamics of interrelationships.

- a. Association between birth and infant mortality rates at the national level.

Little attention has here-to-fore been given to the pattern of relationship between infant mortality rates and fertility rates, despite earlier efforts, under the impetus of the theory of the demographic transition, to demonstrate such a relationship between general mortality and fertility rates. According to the child survival hypothesis, major declines in infant mortality should be followed after some lag by declines in fertility as couples perceive that their children are no longer dying in infancy. The levels of infant mortality and fertility over which the hypothesized effect occurs, the effect of the rapidity of the declines in infant mortality, and the duration of the lag in fertility response are all subjects for empirical investigation.

In gathering information on the child survival hypothesis it seemed worthwhile first to see what sort of an association can be defined in the timing of the two rates. Given all the limitations of currently available data, it was recognized that findings would be definitive only if inconsistent with the hypothesis and that even a strongly positive association would contribute mainly in suggesting what the magnitude and timing might be.

In a preliminary test of the relationships at the national level between fertility decline in the developing world since World War II and increased child survival, we have analyzed the association between crude birth rates and infant mortality rates as recorded in the United Nations Demographic Yearbook (United Nations 1959, 1960, 1965, 1966, 1969, 1970) for 53 countries in Asia, Africa and Latin America for each five-year period since 1945. Inclusion of a country depended solely on whether relevant time series data were recorded. It is recognized that these figures are suspect but their deficiencies are mainly in under-reporting and we were interested more in timing and relative rates of decline than in infant mortality levels.

From these data we have computed three parameters for each country:

- (i) the rate of fall infant mortality rate from its highest value since 1945-9;

- (ii) the rate of fall in crude birth rate from its highest value since 1945-9; and
- (iii) the interval between the onset of a decline in infant mortality or 1945-9, whichever was more recent, and the onset of decline in crude birth rate since 1945-9.

Because there are persuasive reasons for expecting the effects of rapidly declining infant mortality to be limited to those countries having high levels of infant mortality, and to vary by geo-cultural region, tests were also made separately for each of six regions, and for high and low mortality classes for each of the five-year periods since 1945.

As one corollary of the child survival hypothesis, the interval until the decline in fertility may be expected to be shorter where rapid declines in infant mortality are or have been underway. Table 1 reports the distribution of the mean rate of fall in infant mortality and crude birth rates by the interval between the onset in decline in infant mortality (or 1945-9, whichever is later), and the apparent onset of fertility decline for the 53 countries. Of these, in only one (Dominican Republic) was the post-World War II decline in infant mortality interrupted by a temporary rise after the onset of fertility decline, but the relative levels of the two rates (IMR 79.7, CBR 44/1000) suggested that infant mortality must have declined earlier. Among the other 52 countries the shorter the interval between infant mortality decline and onset of fertility decline, the greater has been the mean post-war rate of fall in infant mortality, with a Spearman rank correlation coefficient of -1 . For the 53 countries as a whole, the median interval to the onset of fertility decline, following 1945-9 or the subsequent onset of mortality decline, is only 11.4 years. The additional surviving births would, of course, tend to depress the crude birth rate by adding slightly to the denominator, but not enough to account for the changes observed. Only in three countries has the crude birth rate failed to decline during the post-war period. Limited though this test may be, it appears to support the hypothesis that the more rapid the fall in infant mortality, the sooner this will be followed by fertility decline. Of course, it is possible that the relationship is not causal; that it is not declining infant mortality that causes fertility decline but that both are caused by other factors.

We also tested the notion that the greater the rate of fall in infant mortality rate, the greater would be the rate of fall in the crude birth rate, but the results for this group of developing countries in the aggregate, or when controlling for mortality level and region, were inconclusive.

The ambiguity in defining causation from the results of such an analysis at the national level, especially since it is impossible to test all other relevant variables, emphasizes the importance of detailed small-scale studies of the sequential family building process. From the more complete data on small groups of persons, the effects of prior mortality upon subsequent fertility behavior can be better evaluated (Schultz, 1972).

b. Detailed studies of variables associated with fertility and family planning.

Six in-depth studies of the infant mortality-fertility relationship have been undertaken in six different geo-cultural regions (Hassan 1966; Adlakha 1970; Rutstein 1971; Harrington 1971; Khan 1973; Alam 1973). In addition, evidence bearing on this relationship can be found in several other fertility studies performed in association with action programs (Wyon and Gordon 1971; Schultz and DeVanzo, 1970; Schultz, 1971; Taylor and Takulia 1971). Although the studies are not strictly comparable because of differences in definition of variables, and in methods of data collection and analysis, the comparisons presented here are based mainly on the direction of differences.

The results of these studies are consistent in demonstrating a higher fertility associated with the experience and/or fear of child mortality, an association which is explained neither by socio-economic differentials nor in terms of the greater risks generally noted for higher parity children. Whether the dependent variable is desired-family-size, duration of birth intervals, contraceptive attitude or usage, parity progression, children-ever-born, etc. these studies show that the experience of child loss has a significant positive effect upon subsequent couple fertility. Table 2 summarizes the major findings of these studies.

Some investigators have attempted to eliminate that portion of the relationship attributable to increased exposure to child loss from age, marriage duration, and/or greater number of births, analyzing each parity separately or looking only at the effects of deaths in the first few parities.

That higher parity births are undertaken to replace early losses without changing the total number expected is supported by data on expected number of children reported by Adlakha (Table 3). Here, over a variety of stratifying control variables, statements about expectations of completed family size were virtually identical for couples with and without mortality experience, despite a larger number of births reported by those with child loss. Rutstein (1971) also found that the experience of child loss had little effect upon the number of additional births expected when the number of surviving children had been controlled.

All studies are quite clear that among the couples experiencing child loss, attitudes toward contraception are less favorable, current usage is depressed, and the timing of first use is delayed in comparison to couples without such loss. Table 4 taken from Rutstein's analysis is illustrative of the kinds of delay in initiating contraception which were associated with increasing mortality experience. It is not until the fifth or sixth parity that the percentage of women with losses who adopt contraception approaches that among women without loss. Moreover, data from the Rural Health Research Centre at Narangwal in the Punjab indicate that the perception of increased child survival is associated with a rate of use of the more effective methods of contraception which is nearly twice that of women who do not share such a view (Taylor and Takulia 1970).

c. Studies based on service programmes.

As an incidental observation, it has been possible to extract from various sets of service statistics information which also related to the child survival hypothesis.

The Pathfinder Fund conducted a long-term comparative evaluation of IUD usage. Among the questions asked of mothers coming to clinics, two were introduced relating to additional births desired and to previous child loss. These provide us with comparative information on additional births desired according to prior child loss in women attending IUD clinics in Hongkong, Philippines and Israel by parity. It must be appreciated that all of these women had come to the family planning clinics deliberately to defer births so that expressions of desire for additional births must be taken to have more meaning than in the usual household survey, even though the number of observations in some cases is very small. The major difference among them appears in the percent desiring another child at parity 4. With child loss the percentage desiring more children was almost double in Hongkong and Israel; and in the Philippines it was more than five times greater than for parents without child loss (Table 5).

Similarly, two studies in Africa can be cited. In rural Nigeria at Ilesha, Cunningham (1969) was able to observe the five-year impact of the original Under-Fives Clinic started by Morley (1966). Despite the fact that the study village was in general a somewhat poorer village than the control village (Table 6), a major reduction in infant and child mortality had been achieved (Table 7), and the mean number of babies born and surviving was approximately one child greater than in the control village (Table 8). It is of interest that five years after the initiation of the program but before an active family

planning program had been undertaken, a dramatic difference in additional births desired was recorded (Table 8). In the study village only four additional births were desired with a calculated desired completed family size of over nine. In the control, more than eight additional births were desired for a calculated completed family size of over twelve. The important question then is whether family planning practice will follow these statements about desired family size.

The beginning of a similar trend may have been underway in urban Lagos, where after only one year of operation of the Gbaja Clinic, some of the same differences were observed. A comparison between the mothers attending the under-five clinics and a control group found a greater percentage of the Gbaja mothers expressing awareness of increased child survival and approval of contraception (Wellman 1971).

In a tea plantation in Bangladesh, MacKay (personal communication) showed over a period of 10 years in a population of almost 40,000 that the infant mortality rate was brought down from over 60/1000 live births to 40, and maternal mortality from over seven to less than 2/1000 births. Without any deliberate family planning program except for access to the national program, the birth rate also dropped from 40 to 30/1000 population. A possible explanation is that the birth rate fall was indirectly influenced by the maternal and child health program.

d. Discussion

Despite the close agreement of the findings from these studies, the effects in many cases are not very large. It remains difficult to evaluate the long run demographic effect of reductions in infant and child mortality. To the extent that couples are either over-compensating for child loss or having additional "insurance" births, increased child survival would tend to reduce couple fertility and population growth rates. The argument has been made by some demographers that, to the extent that couples fail to fully replace losses, increased child survival would tend to increase population growth, assuming no change in family size norms and desires. This argument is irrelevant to the practical situation because it would be impossible in any case to achieve a one-to-one replacement. In the first place, continuing child loss itself introduces a compound interest type of geometric progression, with any replacement itself experiencing further loss. Secondly, it would be unreasonable to claim that replacement desires would override all other considerations as a motivational force. It is only one force in a complex matrix with an equally important force being the relative degrees of unwantedness of children. There is undoubtedly, then, a spectrum ranging from lower parity children who are lost even though wanted and are therefore partially replaced, on to children at higher parities whose births go beyond family expectations and here the tendency to replace would be minimal. The important issue is where on this spectrum does practical decision-making lead to the practice of family planning. At a developmental level where 8-9 children are born and only 3-4 survive, as in many African villages, replacement desires may be adding 2-3 births. Where an average of 4 children are born and 3 survive, the potential replacement desire would undoubtedly be less. As child mortality declines, the sub-conscious expectation of death would also decline but after a lag period.

The ambiguity of the purely demographic impact is reflected in some of the modelling exercises which simulate population growth under various assumptions regarding fecundity, vital rates and birth intervals (Ridley et al, 1967; Kennedy, 1970). In this type of model no specific behavioral assumptions are made, and the effect of mortality decline may be to increase or decrease growth rates depending upon the set of values chosen for the demographic parameters. Simulation models incorporating assumptions about son-survivorship represent an effort to go beyond demographic considerations, to evaluate the influence of mortality decline upon a motivational concern common to many cultural areas (Heer, 1966; Heer and Smith, 1968; May and Heer, 1968; Immerwahr, 1967; O'Hara, 1972).

The effects of increased child survival upon family size norms and contraceptive usage are potentially of great importance; it will be from a prospective evaluation of the magnitude of these effects and their consequences for fertility reduction that the case for investment in an attack upon infant and child mortality will be most persuasive. Field studies to quantify these effects for populations at different levels of mortality and fertility, and in different geo-cultural regions, could make a significant contribution to our understanding of the rationale for integrating health and family planning services.

Finally, it should be noted that the argument presented here in support of the child survival hypothesis has focused upon the behavior of the parents whose children are newly surviving; it may be, however, that the lag in perception is such (and/or the marginal cost of children so low) that it is not the parental generation but rather the larger cohort of surviving children which will respond with reduced fertility as it experiences a greater pressure for employment, housing, etc.. This intergenerational effect of major changes in the size of cohorts reaching adulthood has not as yet been fully explored.

B.3 Effects of High Fertility on Health

A high rate of population increase may contribute to the aggravation of health problems by pressure on the basic necessities of life. We review below the growing body of evidence that patterns of high fertility are associated with health hazards to individuals, families and communities, leading to the strong conclusion that family planning is one of the most important health measures available.

a. Influence of large family and rapid child bearing on the health of children.

Abundant evidence has been accumulated showing that high parity directly affects the health of children. These subjects have been extensively reviewed recently by Kessler and Kessler (1970); Omran (1971); and a WHO TRS (WHO 1970a). The risks of stillbirth, infant mortality and child mortality are high with first births; they decline and then increase with parity after the fourth birth (Yerushalmy 1945, 1956; Morris and Heady 1955; Shah and Abbey 1971). These effects are seen most dramatically in less developed countries where all rates are high (Bajpai, et al, 1966; Mehdi, et al, 1961; Radovic 1966; Roberts and Tanner 1963; Wyon and Gordon 1962), but studies from Britain show that the differential rates persisted even after a significant mortality decline (Butler and Bonham 1963; Butler and Alberman 1969; Spicer and Lipworth 1966). Perinatal and infant mortality were also related inversely to social class but within each social class the relationship to family size persisted (Morris and Heady 1955).

Similarly, rapid childbearing has an adverse effect on child health. When the interval between deliveries is short (less than one year), foetal, infant and childhood mortality are increased (Yerushalmy 1956; Douglas 1950). Useful evidence on this subject from a developing country comes from the Khanna Study in the Punjab (Wyon and Gordon 1962). Neonatal, infant and second year mortality were highest when the birth interval was less than one year and tended to decline progressively with longer intervals up to four years. A major part of this effect was found in Africa to be mediated by weaning changes (Cantrelle 1970).

Studies of rapid childbearing have yet to clearly establish the distribution of adverse health effects among siblings at risk. There are three separate paths of influence that may be noted. one, increased burden on all the children due to additional costs to the family budget; two, an additional selective burden to the "dispossessed" next older sibling, especially to one who has not yet been weaned at the time of the subsequent conception; finally, an increased burden to the new-born infant itself.

For national development, the effect of parity and spacing on child health and growth may also be an important consideration. It must be reiterated that these manifestations are linked with multiple causal relationships and that unobserved mediating variables may be more important than those being observed. The height and weight of children has been shown to be inversely associated with family size (Grant, 1964; Scott, 1961). In France (Heuyer, et al, 1950), India (Sukhendra, 1966), U.K. (Scottish Council for Research in Education, 1949; Record, et al, 1969), and the U.S.A. (Reed, W. & Reed, S., 1965), studies with a variety of intelligence tests all showed that mean IQ scores decreased with increases in family size and that this effect persisted with social class. Similarly, a controlled study of children with manifest mental deficiency showed a positive relationship with increasing birth order (Pasamanick and Lilienfeld, 1955).

More specifically, malnutrition has been shown to be more common in large families (Wray and Aguirre, 1969). The money spent per week on food decreased with increase in family size. Similarly, careful longitudinal studies have shown increasing incidence of common respiratory infections and gastroenteritis with larger family size presumably because of greater exposure (Dingle, et al, 1964; Spence, et al, 1954; Douglas and Blomfield, 1958). Finally, Spence's classic studies in Newcastle upon Tyne (U.K.) showed a clear association between the quality of maternal care and family size (Spence, et al, 1954; Douglas and Blomfield, 1958).

b. Influence of parity and spacing on the health of mothers.

Parity directly affects maternal mortality, with a steady and sharp increase in risk after the third birth (Eastman, 1940; Jaffe and Polgar, 1964). These differentials are most marked where obstetrical care is minimal. But higher morbidity due to toxæmia, placental disorders, malpresentations and haemorrhage continue to occur with grand multiparity even after improved obstetrical care has reduced mortality (Oxorn, 1955).

In relation to specific diseases, there are two studies which demonstrate an increasing prevalence of diabetes in association with increasing parity (Pyle, 1956; Middleton and Caird, 1968). It has also been observed that cancer of the cervix is associated with parity but perhaps the cause is more directly related to maternal age at first pregnancy (Wynder, et al, 1954; Wahi, et al, 1969; Lundin, et al, 1964).

c. Influence of population pressure on community health

Tracing relationships between high fertility and health within families has proved difficult enough because of the large number of associated variables. When attempts are made to study whole communities the evidence becomes even more controversial and judgements based on observational impressions tend to be substituted for data. A recent review (Cassel, 1971) balances the evidence and concludes that the deleterious effects of crowding are mostly related to associated environmental considerations. The greatest risk seems to be to those newly entering the crowded conditions. More important than straightforward issues relating to the spread of infections is the social environment as a determinant of adaptation. Within a particular social environment the quality of social interactions and the position within the group seem to be the most important influences on the adaptive process.

Many studies have shown relationships among crowding, housing and specific diseases (Benjamin, 1965; Tayback, 1965), especially tuberculosis (Cairnes and Stewart, 1951). Others have attempted to relate crowding to social pathology, controlling for those social-structural variables which are highly correlated with population density (Schmitt, 1957 and 1966; Winsborough, 1965; Galle, et al, 1972). Results are ambiguous however, and suggest that more detailed causal studies need to be undertaken to clarify the nature of the relationships among density, social class variables, and social pathology. Even though a relationship has been found between large family size and Schizophrenia (Stevens, 1964), in at least one other study (Galle, et al, 1972) admissions to mental hospitals were found to be highly correlated ($r=0.72$) with the percentage of persons living alone. Little can be said firmly about the mental health effects of crowding except for the gratuitous comment that human beings are remarkably adaptive.

In sum, the health hazards of high fertility to the individual, the family, and the community are fairly large, and it appears reasonable to assume that if fertility can be reduced, for example through family planning, then these health hazards would be lessened. It bears repetition that successful development must be multi-faceted and family planning should be part of the process.

C. Population and Socio-Economic Development

In various countries and situations differing motivations have stimulated programs to modify population growth; in general the program direction has been determined by some combination of underlying concerns relating to health, social justice and economic development. This document is focussed mainly on the interactions with health. Historically, the social justice arguments have been and continue to be powerful, especially as they relate to women's rights. Of most immediate interest to demographers and population experts are issues related to the interactions between population growth and socio-economic development. Increasing awareness of the effects of rapidly increasing population growth upon development has also led some governments to consider or adopt policies whose objective is to reduce birth rates through the promotion of social and economic changes affecting family size norms. To guide policy formulation and to evaluate the success of policy alternatives, a generally accepted theory of the determinants of fertility is required, one which will permit the quantitative estimation of fertility change induced by each policy.

Although such a comprehensive theory has not yet been developed, consumer choice models have been increasingly used in fertility analysis by economists over the decade since this approach was proposed by Becker (1960; 1965). Generally ignoring supply questions, the focus is on household demand for children as determined by a balancing of social and cultural tastes, prices, and household resources of money and time (Mincer 1963; Easterlin 1969). Since it is surviving children who are wanted, births must be related to prevailing infant and child mortality. In several important studies Schultz (1969; 1971; 1972) used this model of fertility to measure constrained consumer choice; in a recent paper (1973) he has reviewed studies testing the model (Schultz and DeVanzo, 1970; Harmon, 1970; Maurer, et al, 1972; Ben-Porath 1970) and concluded that the three most important variables, in the sense that they can be modified, are child mortality, parent education and employment opportunities for women.

The most comprehensive model is that of Easterlin (1974). Following Tabbarah (1971), who pointed out the limitations of the usual demand models in explaining fertility in those nations where high rates of infant and child mortality make the supply uncertain, Easterlin has drawn on sociological models (Davis and Blake, 1956; Freedman, 1961-2; Petersen 1969) which are concerned primarily with the supply side of the equation. Easterlin further advances the concept of "natural supply", i.e., that the number of surviving children, in the absence of deliberate fertility control, is dependent upon both natural fertility (Eourgeois-Pichat 1965) and infant and child mortality in a particular society. Biological, social and cultural factors are responsible for differences in natural fertility; economic factors operate indirectly. So long as demand for children exceeds the natural supply, the theory of consumer choice does not come into play. When supply exceeds demand (usually with economic development and as a result of some combination of increased fecundity, child survival and a change in desired family size), economic factors become more important and the consumer choice model becomes operative. Since, however, there are costs to fertility control, supply factors may continue to determine fertility for a period after demand is exceeded, until the cost of that excess fertility is greater than the cost of control; fertility then becomes more directly responsive to constrained demand process.

The Easterlin formulation encompasses findings from economics, anthropology, sociology, and demography. A research paradigm rather than an operating model, it will call for careful and imaginative model specification and empirical testing if it is to become a tool for policy makers and planners.

D. Interactions Between Health, Population and Development

Having described broadly the ways in which health is both a determinant and a consequence of population increase, it is important now to attempt a balancing of the relative strength of the interactions in the development process.

D.1 Balance of Forces Influencing Population Trends

The following generalizations must be applied with appropriate flexibility to local situations. A tentative sequence is traced representing stages at which particular forces become most evident, but it must be reiterated that these are overlapping and variable in their impact.

a. In many developing countries there is a considerable latent demand for family planning. Some parents already have more children than their personal or financial resources can provide for and they are eager for better means of family planning. It is postulated that merely by providing family planning services birth rates can be brought down to the mid-30's, with a family planning utilization level by eligible couples of about 15% which can be raised to over 20% with an intensive program.

b. In the countries experiencing fertility decline most recently it appears that the lag between falling mortality and fertility is being shortened. So that whereas a general decline in birth rates followed declining death-rates (especially child mortality rates) by a period of over 50 years among most countries of the developed world, the lag recently appears to have been reduced to less than 25 years (Kirk, 1971). It is postulated that to the extent that improved health services contribute to further declines in infant and child mortality, they will also accelerate declines in fertility, although there is probably a threshold when birth-rates reach the low 20's, beyond which the effects of maternal and child health and survival as forces influencing fertility will be superseded by other forces. From the limited evidence now available from field research, the indirect attitudinal effects of improved health on family decisions may be more potent than the direct physical effects. Expectations of child survival seem to be part of a subconscious orientation toward the future based partly on the mortality experience of siblings and friends during each individual's own childhood as supplemented by more recent family and community experiences. Field trials combining child care and family planning programmes are under way to see if awareness of survival can be made a conscious decision variable as parents see that their children are being provided continuing care. In a study in the Punjab, about 40% of eligible couples are actively using family planning with the curves still rising (Taylor, 1970; 1974).

c. In the past, demographic shifts occurred slowly and spontaneously as an indirect result of socio-economic development and better nutrition. It is likely that the first effect of economic development is merely to permit parents to have the greater number of children that their pronatalist traditions would encourage. The eventual close association between better economic status and low fertility seems mainly to have been mediated through secondary attitudinal changes associated with modernization and the increasing ability of parents to plan ahead for their families. Such an orientation is clearly influenced by education, social and political stability, availability of resources, and better health.

As general socio-economic and political stability improves and spontaneous family aspirations rise, a society comes to accept the idea of family planning in response to felt needs for health; direct use of economic incentives to influence family planning motivations could then become a realistic possibility (Wang and Chen, 1973; Ridker and Muscat, 1973). In any case, through the spontaneous action of socio-economic forces the birth-rate will eventually move on down to some kind of balance with a stabilized death-rate level of 10-15, as has been the experience of countries which have already achieved economic modernization.

d. Finally, there are potent demographic and socio-economic forces which must be recognized and allowed for in planning, but which can be less readily changed or used in family planning programmes. For instance, there are strong taboos and belief patterns which persist as underlying forces influencing behavior and psychological responses. It is of some interest that most demographic and social science research has focussed on this kind of underlying variable which cannot be readily changed. Certainly population education should start now to promote awareness of demographic trends because the effects will probably be long range.

D.2 Balance of Forces Influencing Health

Health improved historically mostly as an indirect effect of socio-economic development. Health services have become increasingly effective but their application is still often linked to socio-economic development. Demographically, the most significant mortality changes in developing countries still result from improved maternal and child survival, the latter by reducing common infections such as diarrhea and respiratory infections in synergistic combination with malnutrition (Scrimshaw, et al, 1968). These improvements depend on personal health care rather than mass environmental measures. However, it has to be borne in mind that declining mortality should not be considered the main criterion of improved health. The almost complete lack of reliable information on morbidity, however, makes it difficult to define this relationship with any precision.

Most countries face difficult choices in balancing the investment of money and manpower that is to be applied to the economic as compared with the social welfare components of overall development. There is increasing recognition that the maldistribution of income, which is so evident when purely economic development occurs, must be compensated for by investments in minimum services which are increasingly considered basic human rights. High on any such grouping of rights are a basic level of health services and nutrition.

An integrated service package of simple and increasingly effective health care and family planning provided by auxiliaries in a regionalized network can facilitate demographic adjustments while directly contributing to the social components of general development. Such a combined program can be practical, constructive, immediately applied, relatively inexpensive, and will probably have particular appeal to political leaders who have become suspicious of programs concentrating solely on family planning.

D.3 Generalizations Relating to Development of Health and Family Planning Programmes

A series of simple broad generalizations will be presented to crystallize some issues important to policy and planning. They deal both with causal interactions and programme implications.

a. The momentum of change has today become the greatest force for change in most countries. The expectations of all peoples have risen to the point that demand for a better quality of life represents a dominant force both within nations and in international relations.

b. International programmes will have to be adjusted to the aspirations and special circumstances of recipient countries. Specifically, the balance of emphasis between three main groups of justifications for family planning — demographic, social justice, and health — will have to respond to a mosaic of country-specific planning. Population policy must be determined by individual governments.

c. The following stages in programme development based on the forces described above provide a basis for programme planning (Taylor, 1968):

- (i) Meeting existing demand for family planning in situations where no such services have been available.

Every society has parents who are eager for help in limiting family size because of economic, health and social reasons. They use abortion or any other method available. Obviously, programmes must start by providing modern methods of family planning to this group. When modern methods are made available the first wave of acceptance is usually due to substitution for traditional methods.

- (ii) Integrating health and family planning services

For the long hard process of building effective services, more and more countries are integrating health and family planning services. Great efficiencies can be achieved by the integrated use of facilities and manpower. Help with health problems produces confidence in health workers which leads to acceptance of advice on family planning and provides for follow-up. In addition, the need for family planning is most evident to parents in conjunction with events in the reproductive and child care cycles. A two-way interaction has been defined — family planning is a potent way of improving maternal and child health and conversely MCH will facilitate family planning utilization.

- (iii) Utilizing changing economic influences in family planning programmes

To influence the acceptance and continuing utilization of family planning there have been imaginative efforts to use economic incentives and constraints. These work best with procedures that have the finality of sterilization; they have not worked thus far with other family planning methods. Some experimental programmes probably will end up being as expensive as integrated family planning and health services. Economic choices in daily living become a more significant force as economic conditions improve and more planning options open. A pattern of planning ahead in daily living may represent an increasingly critical factor in fertility decline especially as birth-rates reach low levels.

- (iv) Utilizing changing socio-cultural influences in family planning programmes

Consistent use of family planning in most cultures requires major adjustments of long-standing values and practices. Long-term education to a new fertility pattern should be started early. For the short-term it is probably simpler to concentrate on changing practices rather than values. Changes in the role of women, especially their education and employment opportunities outside the home, obviously become important as social conditions improve. In general, however, such value change is more likely to be a resultant rather than initiating cause of social change.

E. Conclusions

The interactions among population increase, health status, and socio-economic development are complex. Although the effects are difficult to measure, there is no question that improved health status for individuals and communities both facilitates socio-economic development and is itself one of the goals of that process. Moreover, there appears to be little doubt that socio-economic development has been accompanied by a slowing down of the rate of natural increase, although the influence of population growth upon the development process is by no means clear-cut, and depends upon the socio-geographic and temporal context.

In those situations in which the effect of rapid population increase is considered harmful to development, investment in the health sector, despite its obvious desirability, has come in for serious questioning, because of the role of health services in decreasing mortality and thereby accelerating population growth. The child survival hypothesis, however, suggests that infant mortality decline may be a necessary step toward increased family planning motivation and consequent fertility decline.

It has been the thesis of this paper that basic health services, including family planning, are an important component of socio-economic development in so far as they result in improved health status, and that where early fertility decline is considered crucial for development, family planning services are most effective when integrated with maternal and child health programmes.

TABLE 1. MEAN RATES OF DECLINE IN INFANT MORTALITY RATE AND CRUDE BIRTH RATE SINCE 1945-49 BY INTERVAL BETWEEN DECLINE IN INFANT MORTALITY AND ONSET OF DECLINE IN CRUDE BIRTH RATE

Interval between decline in IMR and CBR	Number of countries	Rates of change since 1945-49 in:	
		Infant mortality rate	Crude birth rate
< 0 years	1 ^a	-.0361	-.0178
< 5 years	6	-.0496	-.0219
5-9	16	-.0373	-.0165
10-14	14	-.0353	-.0238
15-19	13	-.0327	-.0146
≥ 20	3	-.0238	-.0000
Total	53	-.0367	-.0178

^a Dominican Republic experienced a temporary rise in infant mortality after 1950-54, since reversed; crude birth rate has been declining since 1950-54, so that the birth rate fall appeared to precede the death rate fall even though in 1950-54 the CBR was 44.0 and the IMR was 79.7. Data from U.N. Demographic Yearbook. (1959, 1960, 1965, 1966, 1969, 1970).

TABLE 2
SUMMARY OF SELECTED RESULTS REPORTED FOR MICRO-LEVEL STUDIES ^a
OF CHILD SURVIVAL AND FERTILITY

Fertility Measures	Mortality Measures	Controls ^b	Results.	Investigators
1. Ideal number of children (total and by sex)	Child loss; number of child deaths to early parities (1-3); fear of child loss (index); perception of increased child survival; mortality a consideration in family size decisions.	Parity Fear Index	Ideal number is larger for couples with mortality experience and/or fear of child loss. Relatively more of those who fail to perceive increased child survival, have an ideal number of sons in excess of the model number (2-3 sons), than do those perceiving increased child survival. As the number of sons considered ideal increased women were less likely to have considered child mortality in decisions about family size.	Hassan Rutstein Taylor & Takulia Alam
2. Expected surviving births	Child loss among early parities (1-4).		No effect of child loss upon expected number of surviving births	Adlakha
3. Additional births expected	Child loss.	Number of surviving children; sex of dead child.	No effect of child loss per se upon expected number of additional births, controlling for number of surviving children; slight increase in expectation if dead child was male.	Rutstein
4. Expected births	Child loss among early parities (1-4).	Age of mothers; achieved parity.	Higher fertility expectations among couples with early loss.	Adlakha Alam
5. Opinion about change in number of births	Perception of change in child survival		Compared to those who perceive an increase in child survival, a greater percentage of those who do not perceive such an increase tend to think more children are being born now.	Taylor & Takulia
6. Family size decisions influenced by child mortality considerations	Perception of change in child survival		Few explicitly report considering child mortality making family size decisions; relatively more of those perceiving increased child survival state that mortality was not a factor, while those who thought child mortality was greater report not having considered it.	Taylor & Takulia
7. Index of fatalism	Perception of increased child survival		As an index of fatalism, a count was made of the total number of times "God's Will" was given as a response in open ended questions. Those who mentioned God's Will were twice as likely to say that more children die now.	Takulia & Takulia

continued...

TABLE 2: SUMMARY OF SELECTED RESULTS REPORTED FOR MICRO-LEVEL STUDIES OF CHILD SURVIVAL AND FERTILITY
(Continued)

Fertility Measures	Mortality Measures	Control ^b	Results	Investigators
8. Parity progression ratio and parity continuation ratio	Number of child deaths; death of previous child; death before next birth; death before index parity death between index parity and next birth	Parity; number of surviving children sex of dead child; age of child at birth	PPR increases with the number of deaths at all parities; decreases with the number of surviving children. PPR is higher at each parity if previous child died; the effect is greater at nearly all parities family sizes if dead child is male. PCR lower for those with child death, for next 2-5 years, for all parities. Median duration in index parity longer (10-15%) for those without child death.	Rutstein Harrington Khan
9. Number of live births	Proportion dying in early parities (1-3); child loss among early parities (1-4); fear of loss (index); child loss; number of children lost (parities 1-6)	Parity; number of surviving children; number of surviving sons; maternal age; marriage cohort	Child loss, especially among the early parities, associated with larger number of live births. Number of births at each parity level increases with fear of loss. Births exceed desired number of children by a greater extent when early loss has occurred	Adlakha Hassan Rutstein Wyon & Gordon Alam Khan
10. Number of surviving	Child loss among early parities (1-3); number of children lost (parities 1-6).	Age; parity	Very little difference in surviving births by mortality experience at each parity if age is controlled	Adlakha Wyon & Gordon
11. Conditional probability of birth in current year	Child loss during preceding 5 years	Birth in previous year.	Direct relationship between death of child and subsequent probability of birth; fertility response to loss of older child not due to cessation of lactation. The response is slightly greater if the child lost is male, but less than expected.	Schultz (Bangladesh)
12. Age-normalized crude birth rates	Child death adjustment ratio (reciprocal of child survival rate to age 15).	Age	Age normalized crude birth rate increases with child death adjustment ratio. (Linear regression coefficients from 1-4). Effects are similar for linear, non-linear and log linear regression models.	Schultz China: Province of Taiwan only
13. Birth intervals	Number of child deaths; child loss among early parities (1-4); fear of child loss (index); loss of birth preceding, following interval	Parity; number of surviving children; lactation; socio-economic status	At all parities, birth intervals are shorter when the preceding birth dies, and decreases with the number of child deaths. Est. 40% of decrease in interval due to cessation of lactation. Differences are reduced when number of surviving children is controlled. Fear of child death is associated with a slight increase in interval. Short interval may also result in loss of previous child.	Adlakha Rutstein Harrington Alam

continued

TABLE 2 SUMMARY OF SELECTED RESULTS REPORTED FOR MICRO-LEVEL STUDIES OF CHILD SURVIVAL AND FERTILITY
(Continued)

Fertility Measures	Mortality Measures	Control ^b	Results	Investigators
14. Approval of contraception	Child loss; perception of increased child survival; fear of child loss (index); approval of "insurance" birth	Parity; sex of dead child; child loss; fear index.	At each parity approval of contraception decreases with number of child deaths, controlling for fear of loss; the decrease is slightly greater with male deaths. Approval also decreases with the level of fear, controlling for child loss. A higher proportion of couples not requiring an "insurance" birth, and of those perceiving an increase in child survival, tended to approve contraception.	Rutstein Taylor & Takulia
15. Approval of contraception before the first birth	Child loss.	Parity; sex of dead	No trend and little difference by sex of dead child	Rutstein
16. Contraceptive attitude index	Child loss; fear of child loss (index).	Sex of dead child	Contraceptive attitude index decreased with both child loss and fear of child loss; the effect is slightly greater if dead child is male.	Rutstein
17. Timing of adoption of contraception	Number of losses (parities 1-3); number of losses; fear of child loss (index).	Parity	The number adopting contraception increases with parity; the adoption is postponed 1-4 parities for women with mortality experience, and for women with fear of child loss.	Hassan Rutstein
18. Current use of contraception	Child loss to early parities (1-4); child loss; number of losses; fear of child loss; perception of child survival.	Sex of dead child; surviving sons.	Per cent using contraception currently is somewhat lower among those with child loss, especially with a male loss. Fear of loss is associated with a smaller per cent using contraception; perception of increased survival with a higher per cent.	Adlakha Rutstein Taylor & Takulia Wyon & Gordon
19. Effectiveness of method used	Perception of child survival		Per cent using more effective methods nearly twice as great among those perceiving an increase in child survival.	Taylor & Takulia
20. Preferred method of contraception used.	Perception of child survival.		A greater proportion expressing a preference for sterilization was found among those who perceived increased child survival, than among those who did not think more children survive.	Taylor & Takulia

^a Results compiled from the following studies: Alam (1973); Adlakha (1970); Harrington (1971); Hassan (1966); Khan (1973); Rutstein (1971); Schultz (1970,1971); Taylor & Takulia (1970); Wyon & Gordon (1971).

^b Controls: Each of the investigators has also controlled for relevant socio-economic and demographic characteristics.

TABLE 3
AVERAGE NUMBER OF LIVE BIRTHS AND EXPECTED SURVIVING BIRTHS
FOR WOMEN UNDER 45 YEARS OF AGE WITH AT LEAST TWO LIVE BIRTHS,
BY EXPERIENCE OF INFANT MORALITY AMONG THE FIRST FOUR LIVE BIRTHS,
CONTROLLING FOR SELECTED SOCIO-ECONOMIC CHARACTERISTICS

Socio-economic characteristics	Number of live births		Number of expected surviving live births *	
	With experience of infant deaths	Without experience of infant deaths	With experience of infant deaths	Without experience of infant deaths
<u>Birthplace of parents</u>				
Both urban	4.4	3.0	4.2	3.6
Mixed	4.4	3.2	4.2	4.1
Both village	5.6	4.4	5.0	5.4
<u>Education of parents</u>				
Both without school	5.8	4.5	5.2	5.3
One without and one with school; or both primary school only	5.0	3.7	4.7	4.8
One primary or above and one more than primary	3.7	2.8	3.2	3.1
<u>Husband's monthly income</u>				
< \$ 70	5.3	3.9	4.8	4.8
70-139	4.8	3.3	4.3	3.9
≥ \$ 140	3.9	2.6	3.1	3.0
<u>Media exposure</u>				
Low	5.6	4.2	5.0	5.1
Medium	4.8	3.4	4.2	3.9
High	3.7	2.7	3.1	3.1
<u>Duration of marriage</u>				
< 10 years	3.3	2.5	4.0	3.8
10-19	5.4	3.6	4.4	4.4
≥ 20	6.2	5.1	4.8	5.0

* Expected surviving births = surviving live births + additional expected live births

Adapted from Adlakha, A.L. (1970), pp. 173-175.

TABLE 4
 PERCENTAGE OF NON-CONTRACEPTORS INITIATING CONTRACEPTION *
 BY NUMBER OF CHILD DEATHS, BY PARITY LEVEL

Number of child deaths	Parity Level				
	2	3	4	5	6
0	6.6%	14.0%	25.7%	28.3%	34.3%
1	4.4%	6.1%	13.1%	19.3%	31.6%
2	—	6.1%	8.0%	21.2%	36.5%
Total	6.4%	12.7%	22.4%	25.2%	33.7%

* Adjusted for date of birth of attained parity level, wife's education, income pre-adult, mass media exposure, quality of housing, husband's occupation.

Adapted from Rutstein, S.O. (1971), pp.183-184.

TABLE 5
 COMPARISON OF ADDITIONAL BIRTHS DESIRED ACCORDING TO
 PRIOR CHILD LOSS IN WOMEN ATTENDING IUD CLINICS BY PARITY AND
 LOCATION (INTERNATIONAL IUD PROGRAM)

Location + parity	Prior child loss			
	Women without loss		Women with loss	
	No.	% Desiring another child	No.	% Desiring another child
<u>Hong Kong</u>				
0-2	475	66	2	50.
3	400	22.8	13	46.2
4	324	7.7	28	14.3
5+	334	1.5	71	0
<u>Philippines</u>				
3	148	29.7	13	30.8
4	168	6.3	22	36.4
5	146	3.4	41	4.9
<u>Israel</u>				
1-2	461	80.	6	66.6
3	508	52	14	50.
4	283	25	31	45.2
5+	306	23.2	53	32.

From Bernard, R. (1971).

TABLE 6. VILLAGE PROFILES: IMESI-ILE + OKE-MESSI 1967

	Imesi-Ile	Oke-Messi
Population	6,200	7,200
Person/house ratio	7.9	7.9
% of houses cemented	57	56
Water Supply	Streams	Piped (since Dec. 1966)
Water coliform count	180/100 ml	90/100 ml
Staple Foods	Yams, gari, eko, beans, rice	Yams, gari, amala, rice, eko
Cash crops	Yams, cocoa, kola, cotton	Rice, yams, cocoa, tabacco
School Students	1,568	1,352
Seamstresses	24	47
Tailors	19	26
Palm wineries	16	29

From Cunningham, N., as cited in Taylor, C. (1971)

TABLE 7. 1966-67 CHILD MORTALITY AT IMESI-ILE AND OKE-MESSI

	Imesi-Ile	Oke-Messi
Live births	262	368
Infant deaths	14	27
Infant mortality rate/1000 L.B.	53	73
Child 1-5 population	905	1023
Child 1-5 deaths	16	47
Child 1-5 mortality rate/1000	18	46

From Cunningham, N., as cited in Taylor, C., (1971).

TABLE 8. BIRTH EXPERIENCE AND DESIRE OF IMESI-ILE AND OKE-MESSI
MOTHERS BY WEIGHT-FOR-AGE STATUS OF THEIR CHILDREN

SAMPLE SIZE 250 — 1967.

	Child weight- for-age	Imesi-Ile	Oke-Messi
(a) Mean number of babies born:	"Highs"	5.5	4.2
	"Lows"	5.1	4.2
(b) Mean number of live births:	"Highs"	5.0	4.1
	"Lows"	4.3	4.0
(c) Mean number of surviving children:	"Highs"	3.8	2.8
	"Lows"	3.7	2.8
(d) Mean number of additional births desired:	"Highs"	4.1	7.9
	"Lows"	4.2	9.7
(e) Calculated mean total births desired (a + D):	"Highs"	9.6	12.1
	"Lows"	9.4	13.9

From Cunningham, N., as cited in Taylor, C., (1971).

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