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HEALTH EFFECTS OF URBANIZATION

Some health problems of rural migrants in terms of their socio-ecological adaptation to an urban environment

by

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I INTRODUCTION

Urbanization represents one of the great social movements and changes of world history. While as a phenomenon it has existed and grown slowly for centuries, now in the middle of the twentieth century and particularly in the "developing" nations it has begun to assume the proportions of a tidal wave. That urbanization has a long history does not necessarily mean that it is well understood. Thus while much is written generally on the problems of urbanization, there has been little specification as to the etiology of these problems. One of these unsolved as well as inadequately described problems is that of the relationship between health and urbanization, where a negative association has long been claimed but rather poorly documented and demonstrated. Part of this lack of clarity may be due to the lack of a consistent multi-disciplinary approach. For, while there is a voluminous literature on urbanization these socio-economic-historical investigations contain only the most rudimentary data and measures of health status. Similarly, the many extensive and detailed health and illness comparisons of rural and urban populations make reference to only the most rudimentary (usually demographic) social and cultural data.

One result of such "limited" approaches has been the view that the impact of rapid urbanization upon the health status of a nation - particularly in developing countries of Africa, Latin America and Asia that are ill-prepared for these rapid and massive shifts of population - creates increased risks of mortality and morbidity among the more densely concentrated populations settled in cities. Yet in a recent review Johnson (1,2) concluded that in the less developed countries of Africa, Asia and Latin America, indicators of health, specifically infant mortality and average life expectancy, do not vary systematically either according to rural-urban residence or to size and growth of place of residence. The conclusion emerges that the rapid urbanization situations of the present do not necessarily create (at least to the same extent) some of the unfavourable health conditions and mortality risks associated with cities of Europe and North America during the industrialization era of the 19th century. Thus, research attention needs to be directed to mechanisms which make up the urbanization process (rather than to the gross category of urbanization itself) and which may produce lesser or greater health hazards among a particular population undergoing the urbanization experience.

II WHAT COULD BE THE COMPONENTS OF A STUDY?

A comprehensive view of the health effects of urbanization might well include such diverse areas as genetic change, the spread of urbanism as a cultural phenomenon, environmental pollution, non-human populations, national economic development, etc. Initially one should perhaps limit one's attention to an important dimension of the problem, i.e. the changes either positive or negative brought about in the health of a migrant population as it moves from rural areas to a city and responds to its new social and physical environment.

A. Migrants

A number of reasons can be advanced for examining the health effects of urbanization through a focus on urbanward migrants. First, a substantial segment of the urban population consists of migrants. Second, migrants themselves are a group at a higher risk to certain pathological conditions because they are exposed to a different social and physical environment (3).

Third, the migrant can be regarded as an instrument in detecting health problems of a city. To watch the changes taking place in the health of newcomers is a convenient, if not the only possible way to understand health vices and virtues of a city in their wholistic setting. The migrants are a kind of tabula rasa on which health problems of a city leave distinct marks. The various categories of individuals making up a migrant population help to see a broad spectrum of health problems - more than one can hope to see watching other kinds of newcomers, e.g. infants born in a city. A further reason for limiting this initial research of the health effects of urbanization to a study of urbanward migrants is that many health and medical problems regardless of their specific etiology - become "problems" essentially because of a misperception of physiological states, unnecessary delays, and inappropriate use of medical and other facilities. It is felt that these three factors are more likely to be operative in a migrant group than in a presumably more sophisticated and better informed city-born population.

B. Adaptation

The accent on adaptation is explained partly by the definition René Dubos (The Mirage of Health, p. 33) gives of health: "... the expression of the manner in which the individual responds and adapts to the challenges he meets in everyday life" and partly by the nature of urbanization itself. Urban living usually implies some visible changes in demographic patterns as well as changes in ways of living, residence, physical and social movement, in social structures and relationships, and in cultural values and attitudes. It is a continuum of compromises between the original way of life and that of a city. The compromises are reflected in dress, housing, food habits, scale of values, etc.

As they experience the transition from rural life to their new urban setting, migrants have to face a particularly intense period of adaptation. It is probably the relationship between some selected health problems and the adaptation of new urban dwellers (migrants) to the phenomena of urban living which should be investigated.

One of the most important aspects of adaptation is the context in which it occurs. Adaptation to urban living is a process with both space and time dimensions. The former reflects differences in the level of health

hazards present in the cells of urban territory frequented by migrants. The latter reflects the gradual accumulation of urban influences upon migrants. The time dimension predetermines the need to consider the dynamics of the adaptation process. It may entail the partition of the migrants into sub-groups by the length of their stay in a city or in a particular cell of the urban territory.

Furthermore there are within cities a number of health related factors that explicitly reflect a spatial determinant. For example, certain types of health facilities (e.g. dispensaries, emergency clinics or maternal and child health clinics) are usually located to provide services on a residential neighbourhood basis; household densities and/or the rates of interhuman contacts, that may vary between one section of the city and another, can affect the incidence of certain communicable diseases in which transmission takes place by direct person to person contact; environmental hazards, such as inferior housing or polluted water supplies, are frequently concentrated within specific sectors of a city rather than being uniformly distributed over the entire urban area. It is therefore suggested that one analyzes the interrelationship which could exist between elements of urban morphology with an ordered spatial arrangement and the dynamic changes in health status measured among the study population of migrants.

The second major component of adaptation concerns the migrant himself and what he brings with him - his resources as well as his background. Urban living has often been characterized by a tendency towards change or breakdown of traditional close relationships with kin and others and by a corresponding increase in "secondary" relationships of a more transitory nature within the social networks of urban dwellers. It is particularly this change that may cause problems in dealing with troubles - medical, psychological or any other emergency situation. Urban living also implies an economic system in which goods, services and regular employment are exchanged on a cash basis, with a dependence on contractual-type work relationships, as opposed to the rural system of subsistence production activities where goods and services can be exchanged without necessarily a dependence on cash. Such changes may be of crucial importance in maintaining a steady diet and providing adequate child care. Also characteristic of the urbanization process are changes in cultural values and attitudes, with the

traditional and sacred values of their rural homes being replaced - or at least confronted and challenged - by the more modern "legal-rationalistic" values associated with life in the city, such as the whole idea of family planning. Thus, among various health-related behaviours which could be selected for a study in depth, attention could be focused on those associated with social networks, with work situations and income-wage patterns, and with variations in cultural perceptions.

C. Health Problems

Of the health problems which could be considered as paradigmatic of the adaptation of rural migrants to urban centres, those of mortality and morbidity, certain infectious diseases, nutritional status and the complex of behaviours and outcomes related to child birth and infance seems to be more relevant. The selection of health problems should be based on four principal considerations;

i) the problems to be studied are of reasonable importance to the total health situation of developing nations;

ii) they make possible an examination of the adaptation experience, in varying health spheres, of migrants to cities;

iii) they are not obviously atypical of a broader range of health problems, and

iv) in general they can be logically and empirically linked with one another.

1. Mortality and morbidity

Because of the finality of death and the all or nothing quality of this information it seems desirable to record mortality rates of the study population and attempt to correlate it to the various adaptation processes which will be considered in the study, including those associated with the spatial structure of urban places.

It is also felt that, through secondary analysis of available health statistics and some direct surveillance (e.g. through the recording of morbid episodes as reported by people themselves, self-treatment, etc.) of the study population, a picture of certain aspects of the health status of migrants to a particular city could be obtained. Such morbidity data could be

related to other data collected on the migrants (e.g. indicators of adaptation) and in particular they could be used to identify urban high risk areas on a residential or landscape basis.

2. Infectious diseases

Observations could be centered around infections representing different transmission patterns: vector-borne, direct person to person contact and food/water-borne. Diseases selected should fit certain criteria, i.e. they should be easily identifiable either directly or indirectly (serological evidence of infection), the methods of ascertainment should be such that the diseases are measurable in the same way and under the same conditions at repeated surveys, the infections should be of real public health importance e.g. highly prevalent and/or costly in terms of mortality, morbidity and economic loss, the diseases should allow plotting in a fashion which relates the migrant population to the urban setting and finally they should have some particular aspect which is relevant to the general aim of the study. As an illustration one could think of several diseases that fit these criteria: malaria and filariasis (vector-borne), syphilis and tuberculosis (person to person contact), typhoid fever and salmonellosis (food/water-borne). Malaria and filariasis could be expected to reflect a change in exposure, as a result of life in the city, to two mosquitoe vectors: the culex species whose domestic breeding habits bring them in close contact with urban dwellers and the anopheles species generally less prevalent in the urban environment because of mosquitoe control measures aimed at the destruction of larvae breeding places used by the species. There is already some evidence of differential prevalence rates of filariasis (4) between urban and rural populations. The case of malaria is less conclusive and it is hoped that the present investigations would help clarify the problem. Syphilis could be expected to be a good indicator of the problems faced by the new male urban dweller, who comes to live single at first in the city, and who has to adapt to the inavailability of a wife or of female companions of the "right" sort and to the availability of prostitutes. It could also be a good indicator of the tensions developing between married couples as a result of inadaptation to urban living. Tuberculosis could be linked to a number of detrimental social and ecological factors, while salmonellosis and typhoid fever will help

to focus attention on the dependence on public eating facilities that some migrants to a city may experience and the negative effect it may have on their health status.

3. Nutritional status

In his book entitled "Mirage of Health" (pages 46, 47) René Dubos wrote: "Any population long settled in a fairly constant environment develops likes and dislikes, which are the outcome of constant trials and errors. From this experience emerges a variety of customs, taboos, religious beliefs and practices which permit that population to survive under conditions that are often unacceptable or fatal to inexperienced newcomers. Among the countless examples that could be selected to illustrate this subconscious social wisdom, nutritional habits are particularly illustrative ..."

While Dubos' emphasis is on the accumulative "social wisdom" of urban dwellers, the problem for migrants is the obvious one of adjusting to or adapting to the nutritional habits of the city. While the health effects of this problem may not be as directly perceptible as others, there is nevertheless adequate basis for recognizing nutrition as a legitimate health concern for developing nations. This problem is especially "attractive" since it is a problem common to all migrants of whatever age, family status, and permanence of migration.

It is also important to note that rural migrants to a city, especially in the developing countries of Africa, Latin America and Asia, have to face in the majority of situations, but not in all of them, a different food distribution system. In the rural areas of many of these countires, food supply tends to be seasonal and food - including staple commodities - can get very scarce towards the end of the long dry spells which are a common climatic factor of many of these areas. Furthermore, food is brought in the city whereas it can be obtained on a barter basis in most rural places, particularly in the smaller villages. Again, because of the special conditions migrants face when moving into a city, they usually have to buy cheap food, prepared on a commerical basis (tea houses, restaurants, street vendors) and most of the time with very little attention being paid to elementary rules of hygiene. It should therefore be worthwhile to assess the nutritional status of a migrant population by use of carefully selected

indicators and relate these measurements to data of a socio-economic nature collected simultaneously.

4. Child birth and infancy

The complex of behaviours and outcomes related to child birth and infancy implies a set of health phenomena of unquestioned importance in developing countries but which has less obvious connection with the adaptation of rural migrants to an urban environment. In part, these phenomena are of interest because they are not unique to migrants. They represent an area of health-related problems in which a very "normal" series of events, i.e. pregnancy and child birth, initiate an array of behaviours - provision of prenatal care, assistance with the birth itself, postnatal and maternal care - which potentially provide a classic case for the study of the utilization of health services.

It is also an important area to study because the event which serves as a focus for investigation of the complex of behaviours is very likely to occur within the migrant population, due to the predominance of young people among migrants, and to occur within a reasonably short period of time, unlike other health problems which may occur infrequently or only at more advanced ages. Furthermore these phenomena provide a good standard of comparison since they will for many be a repeated event, i.e. one that has also occurred prior to migration to the city. The period of pregnancy, child birth and infancy is also one of the most critical in the life history of families when they are more vulnerable to a greater number of health hazards than at any other time. If to detect health hazards of a city one is looking for a sensitive indicator population among city-dwellers, then this is very likely to be migrant families burdened with child birth and child care.

Finally, the health problems associated with pregnancy and child birth are more likely to be influenced by the specific social and psychological adaptation processes which the study intends to investigate, namely: behaviours related to social networks, work situations and income-wage patterns, and variations in cultural perceptions. For example, mothers' employment, very often a necessity among urban dwellers, may have opposite effects on the health of the family: infants and young children may be

deprived of maternal care and attention when it is needed, whereas the portion of family budgets spent on food may be considerably increased by the contribution of mothers' earnings.

III HOW COULD IT BE IMPLEMENTED?

A. Objectives

A study on the topic suggested in this paper would contribute to the knowledge and understanding of the changes which are brought about in the health of a population undergoing the process of urbanization.

It would be aimed at measuring some of the changes, either positive or negative, which occur in the health of a population of rural migrants in terms of their adaptation to the social and physical environment they have to face in the urban area where they have settled. Given this general objective such a study could attempt to answer four questions:

i) What is the level of health factors (to be specified) of newly arrived rural migrants to a city?

ii) To what extent these health factors are affected by the process of adaptation both to the social and physical environment?

iii) Which of the selected factors of adaptation have the greatest effect, either singly or in combination, on the health factors of newly arrived migrants?

iv) To what extent these results can be used to predict changes in the health of new migrants and organize preventive (or corrective) measures in a more rational way?

This might be done by selecting indicators of the five health aspects considered relevant, i.e. mortality, morbidity, infectious diseases, nutritional level and child birth/infancy, as well as indicators of social and ecological adaptation, and analyzing the relationship existing between the former and the latter.

B. Study Design

In order to study the dynamics of the phenomena it would be necessary to consider a study design which would allow the investigators to assess

whether changes are taking place in the health of rural migrants adapting to their new urban environment and at what rate. The type of study design best suited to this purpose is probably a prospective longitudinal study in which the selected indicators of the three interacting components (health, social and ecological adaptation) are measured in a standardized manner in a population of recent rural migrants and the population is followed over time. The measurements are repeated at regular interevals and changes in the variables measured are noted. Such a design would have a number of advantages:

a) It would eliminate the complex problem of selecting ad hoc controls. In this particular case the right sort of controls might have been extremely difficult to identify in view of the fact that migrants are likely to differ from non migrants or from city-born dwellers. (In a dynamic society the state of non-migration may be only a temporary one);

b) As a result of (a) above, observations and measurements could be carried out in a single location as opposed to the multiple location of non-migrant rural controls;

c) The saving in time and personnel would allow for reduced intervals between two sets of measurements.

On the other hand such a study design would not allow the investigators to detect differences which could exist between the characteristics of migrants and those of stayers in the place of origin, nor would it describe the extent to which migrants who have been involved in the adaptation process are similar to or different from city dwellers. Furthermore, if the proposed study design allowed one to identify which factor (or combination of factors) of adaptation has an effect, if any, on migrants' health, it is doubtful whether it could be used to describe the causative links whereby health is affected by the factors selected to measure adaptation to urban life. These disadvantages, however, are of relative importance since the defined objectives of the study do not necessarily require either a comparison of migrants with non-migrants or a detailed analysis of the mechanisms of adaptation. Each of these aspects could become the central themes of two separate studies to be undertaken in conjunction with or

following the type of investigation considered in this document.

In order to obtain a meaningful comparison, with the newly arrived migrants acting as their own control, one could divide initially all the sampled individuals into a number of categories, or strata, as homogeneous as possible, by taking into consideration the degree of their health problems as they first moved into the city, their economic and educational background, and the presence or absence of social factors which are presumed to influence in one way or another their adaptability. Comparisons in time between the initial set of measurements and each successive set of measurements would then be carried out within each stratum for the different patterns of adaptation detected in the course of the study.

C. Study Population

1. Unit of study

The first issue is whether the study unit should be individuals or households. Migration is a "family affair" - no matter what the culture, and to deny this is virtually to ignore all that is known about family dynamics and acculturation. How each family member will be influenced may well differ from culture to culture, but that they will be influenced seems a workable assumption. The fact of considering the migrant family as the study unit does not, of course, rule out the possibility of analyzing any portion of the data collected on an individual basis. There are two additional reasons why one should have a family study unit: (i) the family unit is probably best suited to the study of the health problems considered relevant, and (ii) it has the added advantage of simplifying considerably the task of data collection (interviews, physical examinations and collection of clinical specimens) and follow-up procedures - two major stumbling blocks in any population based study.

The next issue is whether the study should be restricted to a single type family unit. The answer is probably yes, because of the great range of variables involved and the difficulty they represent in analyzing fully or even describing the problem under study.

The size of the migrant family itself is probably irrelevant, but we believe that families recruited in the study should be as homogeneous as possible and should therefore fulfil a number of selection criteria such as:

a) Recent migration to the city, e.g. not later than three months before recruitment in the study;

b) Presence of husband and wife (with or without children);

c) Age of wife between 15 and 30 years;

d) Appertainance to one or two social classes only (presumably those to which the greatest number of migrants belong);

e) Similar ethnic and religious backgrounds;

f) Residence since birth prior to migration in rural areas.

One major excluding characteristic could be appertainance to an unrepresentative or atypical ethnic minority.

2. Sampling and sample size

Given the emphasis on assessing dynamic phenomena, i.e. the changes, either positive or negative, brought about in the health of rural migrants in terms of their socio-ecological adaptation to the urban environment, it is felt that a study of these phenomena should probably use a sample design in which the migrants themselves act as their own controls. It is the difference(s) between successive sets of measurements which matter here.

Furthermore it is also suggested that no probabilistic sample should be carried out and that instead the size of the study population should be determined on operational grounds rather than on statistical grounds. Instead of specifying a priori the degree of precision one would like to have for one's findings and establish subsequently a suitable sample size, one should decide which population size it might be feasible to handle and recruit enough families to make up the necessary total.

A number of considerations warrant this somewhat unorthodox approach:

a) The unequal rates of change likely to exist for the various selected health variables and the difficulty of choosing a sample size which would detect the smallest change and yet would not be wasteful of time and personnel;

b) The existence of a number of variables whose rate of occurrence (or incidence) would be almost unknown and for which only gross estimates would be available when initiating the study;

c) The difference in the rate of change of the same health event for two categories of migrants (each showing a different pattern of adaptation) could be so low as to require a very large sample size incompatible with available resources;

d) The loss (30-40% perhaps) which might occur on follow-up in any probabilistic sample as a result of the "fluidity" of migrants and the necessity (for the same reason) to work with "volunteer" families.

This approach does not rule out any kind of statistical comparison. In fact, it is suggested that the results of the first two or three sets of examinations could be used to estimate the rate of change of as many health variables as possible in terms of various patterns of adaptation and, if it were necessary, to increase the study population (within reasonable feasibility limits) in order to reach a degree of precision equal to the 0.05 or 0.01 percentage points limits.

If it were decided to let feasibility and operational considerations dictate the size of the study population, it would be necessary to have precise information about financial and man-power resources as well as availability of equipment and laboratory facilities, before any definite figure could be contemplated. Although such information is not available at the time of writing this document, it is probably reasonable to consider at this early stage of planning, a study population of 1,000-1,500 families. This figure could always be expanded if sufficient resources were made available to the investigators and if the initial observations warranted such an increase.

D. Site

Site selection is going to be one of the most difficult, earliest, and irreversible decisions. On what basis to decide? Perhaps the major thing to remember is that the type of migration studied should not be so atypical as to be irrelevant for either generalization or the development of future

study. Otherwise, the selection criteria should be those which are best suited to the objectives of the study and to the practical implementation of field procedures. Initially consideration should probably be given to a city where the following three conditions are present simultaneously;

i) the existence of a large number of accessible migrants of whom a high proportion (30-40%) are of the "familial" type;

ii) the availability of interested national co-investigators, in each of the three disciplines involved (ecology, medicine and sociology), who are willing to share with our group the responsibility of "doing" the study;

iii) the full support and co-operation of local and national authorities - both governmental, i.e. political, and medical.

Thus, any city with a large migrant population and presenting the above three conditions would do whether the migration was governmentally, economically, politically, i.e. war, or naturalistically, i.e. floods, earthquakes, induced or whether it was one-step or two-step.

E. Measurement of Indicators

Although it is clear that the methods of measurement will vary with each type of indicator considered (health, social or ecological), there are, however, a number of general principles which could apply to all data collection:

i) given the alternative between two equally satisfactory indicators, preference should always be given to the variable which can be best quantified;

ii) all qualitative indicators should be put on an ordinal scale when such a scale to describe them does not already exist;

iii) measurements should have a maximum possibility of repeatability and interfere as little as possible with life style.

1. Health indicators

The frequency of measurements for health indicators will depend very much on the availability of resources (finance, personnel and laboratory facilities). Given the interest in events associated with pregnancy, child birth and infancy, it is reasonable to envisage a bi-yearly frequency

for these measurements or even better a data collection spaced every four months. Information could be obtained by a variety of means: home and school visits, calls to dispensaries, health centres and hospitals attended by individuals recruited in the study. Measurements could include interviews with questionnaires, clinical examinations and the collection of clinical specimens (blood and urine). Exceptionally, one could consider continuous measurements for a number of selected variables, in particular: recording by means of very simple signs and symptoms over a period of one or two weeks all the "morbid" episodes of the family.

The frequency of these measurements and the resulting contacts with medical personnel could, and in all probability will, influence the attitudes and beliefs of the study population towards health in general, and the utilization of health services in particular. Such a bias however, would apply equally to all the study population (itself acting as its own control) and is thus unlikely to mask the effect which various patterns of adaptation may have on the health of migrants.

2. Social indicators

In general measurement of social indicators should coincide with those of clinical measurements. All information in this area could be obtained by conducting interviews with individuals, or respondents in the case of infants and pre-school children. Interviewers could use three methods to elicit information: direct questions about theoretical and actual events; projections and specific instruments, scales and tests. Whenever scales and/or tests are used, their broadness and complexity should be adjusted to the sophis tication and literacy level of migrants.

Certain indicators, e.g. social networks, may have to be investigated on a different time schedule (weekly intervals covering a 4-6 month period rather than once every 4-6 months) and could be measured by home visits and by observations at some central places (markets, shopping areas, etc.).

3. Ecological indicators

Measurement of ecological indicators should involve mostly direct observation, with some interviewing to establish place of work and the age and family status of people. Interviews should be combined with medical examinations.

Aerial photography could probably be a useful technique to apply when studying residential topography. Given the possibility of land use changing in the span of a year or a day, seasonal as well as daily rythms should be studied. Combining direct observation with aerial photographs repeated at hourly intervals one could try to establish how the functions of building changes in the course of a day from early morning, through morning, afternoon, late afternoon, early evening and night time. In the case of a major unexpected event, e.g. a medical epidemic, the building or destruction of the landscape - new streets, slums, any event likely to affect in a substantial way the "socio-ecological landscape" - new factories, new modes of transportation - or even the announcement of a forthcoming change which may not occur in the span of the study, it might be necessary to accelerate the rate of observation and increase the tempo of interviewing.

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Feedbacks in Economic and Demographic Transition

A neo-Malthusian and an alternative model of development are compared and tested against the real world.

Harald Frederiksen

Demographic transition and economic development are not independent phenomena. If there is such a thing as a "population problem," it cannot be understood and solved in isolation from the complex process of national development, of which economic development is but one aspect.

Needs and resources for health and family-planning programs evolve in the context of the successive stages of demographic transition and economic development. We have to agree on the nature and magnitude of the interactions between population and economic phenomena at the various stages of national development (called simply "development" hereafter) before we can agree on how much of what is most appropriate and effective in the circumstances in question.

Neo-Malthusian Model

A neo-Malthusian school believes that the process of development is impeded when the rate of population growth is high, and that this high rate of growth is the result of a rapid reduction in mortality, which in turn is the result of alien technology's increasing the effectiveness and efficiency of health services quite independently of levels of production and consumption. Let me quote from some writers who belong to this school.

> The death rate in less-developed areas is dropping very rapidly . . . and without regard to economic change . . .
>
> The less-developed areas have been able to import low-cost measures of controlling disease, measures developed for the most part in the highly industrialized societies. The use of residual insecticides to provide effective protection against malaria at a cost of no more than 25 cents per capita per annum is an outstanding example. . . .
>
> The death rate in Ceylon was cut in half in less than a decade and declines approaching this rapidity are almost commonplace. The result of a precipitous decline in mortality while birth rate remains essentially unchanged is, of course, a very rapid acceleration in population growth. . . .
>
> In the longer run, economic progress will eventually be stopped and reversed unless the birth rate declines *or the death rate increases* [1]

> The higher the population growth, the harder becomes the task of breaking through the Malthusian trap. A vicious spiral is set into operation. Because of a high rate of population growth, industrialization is difficult to attain. Because there is no industrialization, the birth rate and the rate of population growth remain high [2].

It may seem indecent to some to suggest that medical research first be concentrated on those diseases whose control

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will do most to improve the happiness and ability to work of people without reducing infant mortality . . . [3]

. . . Public health measures which can save millions of lives should not be practiced in China on a nationwide scale until the stage is set for a concurrent reduction in the birth rate [4]

Another 10 to 15 points of the initial death rate of 40 per thousand may be attributable to inadequate diet, clothing and shelter, with malnutrition the primary cause This is of direct concern to economic policy makers because it suggests that extra investments that do *not* increase the food supply, whether directly or indirectly through international trade, may temporarily be preferred to those that do [5].

Thus, a neo-Malthusian model of economic and demographic transition may seem quite plausible, at least when used to explain failure or to predict the probability of failure (Fig 1) But in order to explain successful development, we have to explain how countries proceed from low to high levels of production and consumption, and from high to low levels of mortality and fertility

A more humanitarian version of a neo-Malthusian model of successful development would allow some reduction in mortality, but not too rapid a reduction, so that a concurrent and commensurate reduction in fertility would keep population growth to a minimum and raise the formation of capital to a maximum (Fig. 2). Such a model of economic and demographic transition implies that high levels of production could be achieved when consumption, mortality, and fertility are, at best, still at intermediate levels.

Even if it were feasible to achieve high levels of production by some such shortcut, bypassing commensurate improvements in the levels of living and health and commensurate reductions in mortality and fertility, high levels of production alone would hardly meet the criteria for successful development. It remains to be seen, in the real world, whether the neo-Malthusian model is a shortcut to successful development. Yet, as a possible result of uncritical acceptance of the neo-Malthusian model, with its explanation of failure in development, "health programs," says Taylor (6), "which once represented a major effort in American technical assistance, are now being quietly downgraded or phased out in most [underdeveloped] countries except those that are obviously under-populated, such as Ethiopia."

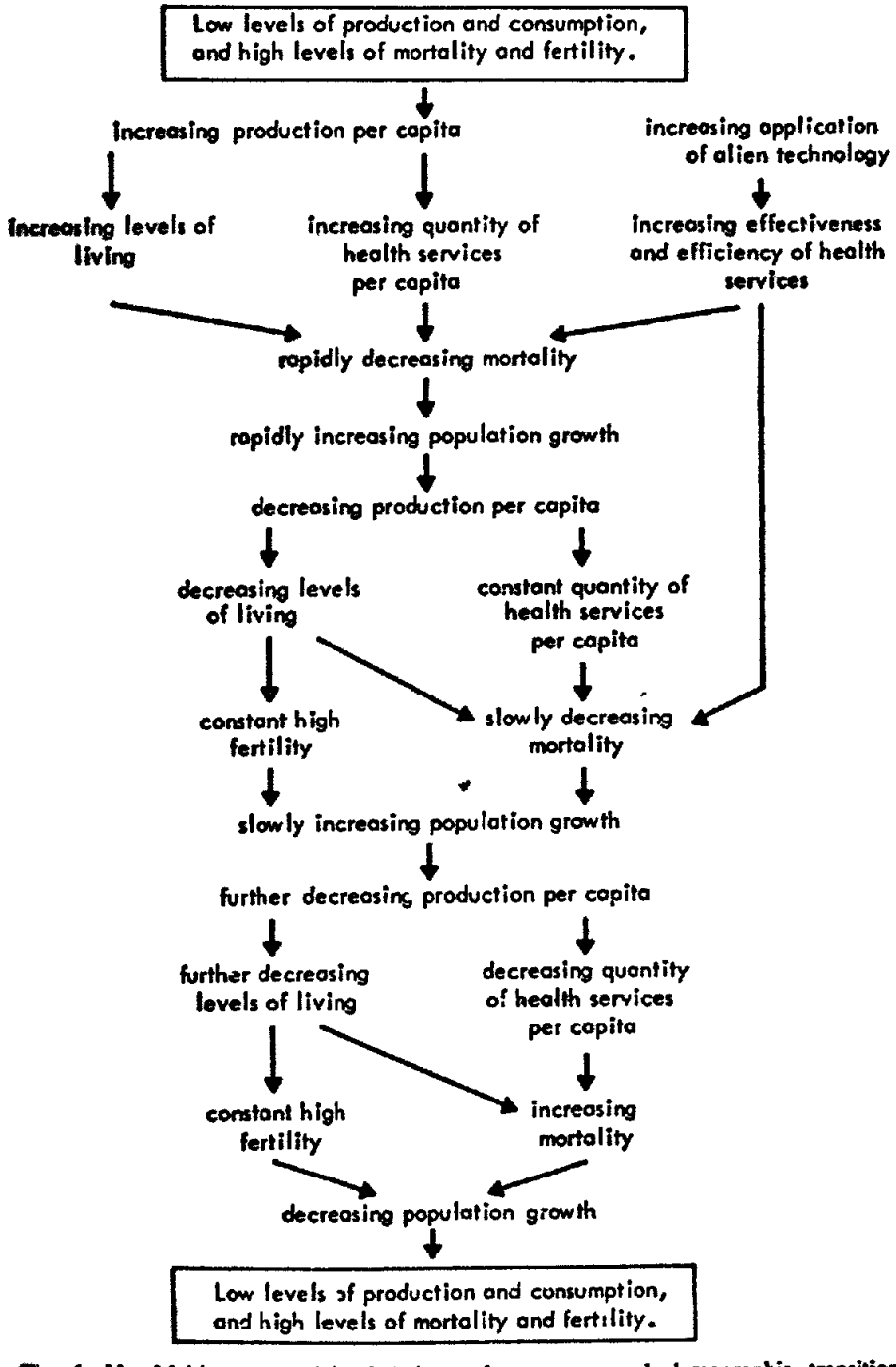

Fig. 1. Neo-Malthusian model of failure of economic and demographic transition.

Alternative Model

An alternative model of successful economic and demographic transition would seem to explain more readily the transition from low to high levels of production and consumption, and from high to low levels of mortality and fertility (Fig 3)

This alternative model assumes that improvements in the standard of living and decreases in the mortality and fertility rates are linked in a process of "concurrent, circular, and cumulative causation" (to use the language of Gunnar Myrdal) This model stresses the human factor in development and views a drop in the mortality rate as part of the solution of the population problem, not as a cause.

A reduction in mortality is considered a necessary, although insufficient, condition for a reduction in fertility Mortality trends may influence fertility trends by way of two mechanisms: (i) with reductions in mortality, compensatory reductions in fertility are required if the desired family size is to be achieved; (ii) when there is less uncertainty about survival, as well as a higher probability of survival, the desired family size may be reduced.

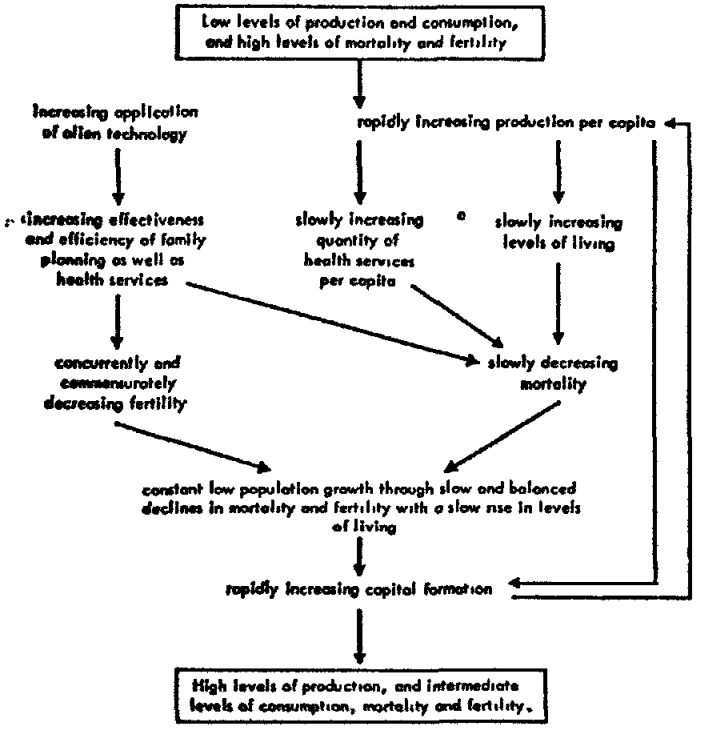

Fig. 2 (above) Neo-Malthusian model of successful takeoff in economic and demographic transition

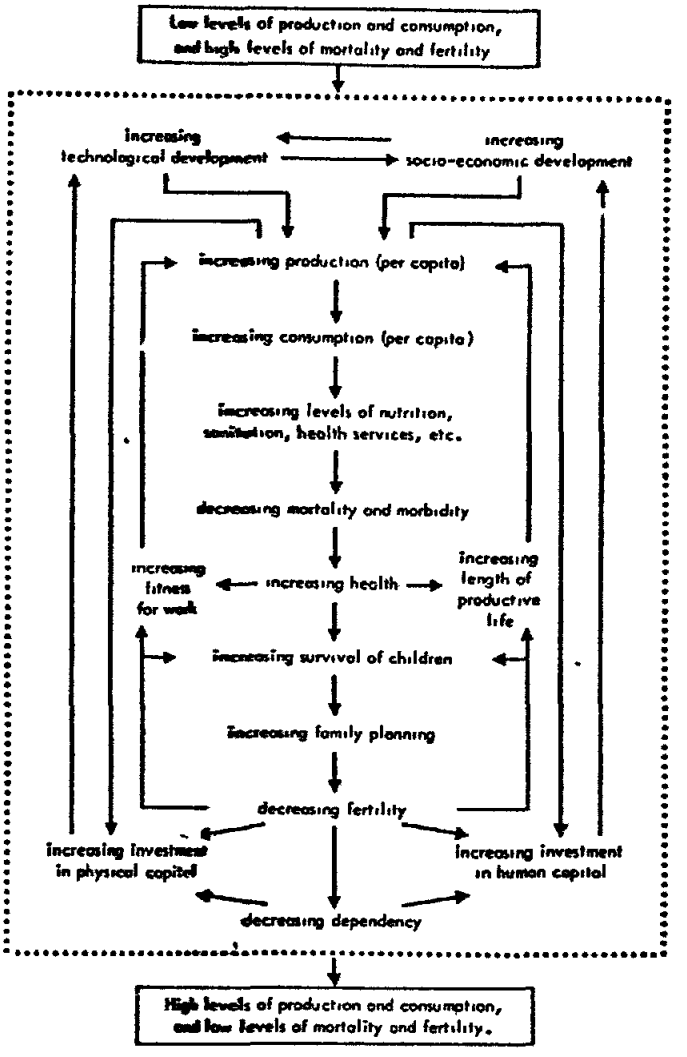

Fig. 3 (right) Alternative model of successful economic and demographic transition from low to high levels of production and consumption, and from high to low levels of mortality and fertility.

In regions where there had been considerable variation in the number of child deaths from family to family, a reduction in overall mortality might result in a reduction in fertility larger than that required to offset the reduced probability of child loss Thus, a reduction, at the family level, in uncertainty concerning the survival of children might tend to make people want smaller families

Let me quote from some of the writers who have arrived at similar conclusions.

. . . The removal of any of the particular causes of mortality can have no further effect upon population than the means of subsistence will allow Of its operation in tending to prevent marriage, by diminishing the demand for fresh supplies of children, I have no doubt [7]

To some extent the birth rate is influenced by the death rates in the lower age groups A reduction in child mortality would probably reduce birth rates after a lag of several decades [5]

Low death rates, or conditions underlying low death rates, merit consideration as contributory factors, if not as prerequisites, for low birth rates [8].

No efforts of social-economic development can be successful in a disease-ridden population, or will a desire for small families be likely to emerge [9].

Mortality varies inversely with economic indicators of the levels of living In a balancing movement, fertility tends toward approximate equilibrium with mortality. . . . a deliberate reduction in fertility is a sequel to a reduction in mortality which develops individual and collective motivation as well as the need for a commensurate restraint of fertility [10].

High fertility has been an adjustment to high and unpredictable mortality . . . Availability of birth control is largely irrelevant until the desired number of living children is secured [11]

The frequency of births in a population can be understood in terms of three groups of factors that influence parents' desires for births First there is a family size goal or a number of surviving children that parents want. This goal is determined by a host of environmental factors that modify the relative attractiveness of many versus few children Second is the incidence of death, mainly among offspring, which necessitates a compensating adjustment in birth rates to achieve any specific family size goal Third is the effect of uncertainty in the family formation process where births, deaths, and remarriage are unpredictable [12].

In nations with traditionally high child mortality, this desire of fathers to have sons who will outlive them acts as a deterrent to restriction of family size [13].

It was generally agreed that in high mortality countries, the thing *not* to do is blanket the country with a massive family planning program. . . . programs will usually not emerge in countries where the population perceives that the high rate of infant mortality is either high by their standards or is not declining [14]

Although the world-wide population explosion has been created by a decline in death rates paradoxically a further decline in mortality in the less developed nations may be an invaluable aid for curbing the current rate of population growth [15]

The authors quoted above seem to support one or other of the basic assumptions (concerning the interactions between mortality, fertility, and levels of living) which underlie the alternative model of successful development. But those authors may or may not support the alternative model, which puts these basic interactions together in a concurrent, circular, and cumulative process of transition from low to high levels of production and consumption, and from high to low levels of mortality and fertility (Fig. 3).

Comparison of the Models

Comparison (Fig 4) of the neo-Malthusian model (Fig 2) and the alternative model (Fig 3) indicates three essential differences

The neo-Malthusian model views a reduction in mortality as an increase in population growth, whereas the alternative model notes the transitory nature of the "population explosion" and emphasizes the improvement in health, productivity, and longevity

The neo-Malthusian model explicitly or implicitly assumes that levels of mortality are now *quite independent* of levels of living, whereas the alternative model assumes that levels of mortality are still *quite dependent* on levels of living, although the relative effectiveness of health services increases with increasing levels of living

The neo-Malthusian model ignores any dependence of fertility trends on mortality trends, whereas the alternative model assumes that reductions in mortality develop the need and desire for family planning

Empirical Test of the Models

At any given point of development, the economic growth rate per capita approximates the economic growth rate minus the population growth rate This may have led some to equate the population problem with excessive population growth. But it does not follow that a decrease in the population growth rate would be associated with a commensurate increase i.. the economic growth rate per capita

Cross-sectional comparison of nonlinear regression lines for population growth rates, economic growth rates, and economic growth rates per capita, for 67 countries, plotted by gross national product per capita, indicates no obvious correlation between population growth rates and economic growth rates per capita (Fig 5).

The *linear* correlation of the rate of population growth with the rate of economic growth *per capita* for the 67 countries was only weakly negative ($r = -0.32$), even though the population growth rate serves as denominator for the dependent variable In contrast, the linear correlation of the rate of economic growth with the rate of economic growth per capita was strongly positive ($r = 0.88$) The linear correlation of the rate of population growth with the rate of economic growth was only slightly positive ($r = 0.15$).

A statistical significance test was performed only for the latter correlation—that between the rates of population growth and of economic growth —since only these two variables are not algebraically related to each other The correlation ($r = 0.15$) was not significant even at the 5 percent level of probability

Actually, the rate of *per capita* economic growth is a poor indicator of development A low rate of economic growth per capita can be the result of a balance between high or low rates of economic and population growth and thus may be found in countries with *any* rate of economic growth, and with any rate, and at any level, of development.

Moreover, the rate of population growth is a poor indicator of the "population problem," or of its solution, since this rate tends first to rise and then to fall in the course of the modernization process.

Rather than rely exclusively or primarily on the population growth rate as a basis for understanding, measuring, and influencing the demographic transition, it would be better to rely on the birth rates and death rates from which the population growth rates are derived

Thus, in the real world, successful development is associated with increasing levels of consumption and of capital formation and with decreasing levels of mortality and fertility—first mortality, then fertility (Fig 6).

Incidentally, the rise in the crude death rates toward the higher values for gross national product per capita is a result of the aging of the populations, which in turn is a result of the declining birth rates If the death rates could have been adjusted for the differences in age distributions, there would not have been such an apparent rise in the death rates at the higher values for gross national product per capita. Unfortunately, not enough comparable detailed data were available to permit adjustment of the death rates for differences in the age distributions

The objection might be raised that these comparisons are cross-sectional, and that these relationships that existed at a point in time would not hold true in longitudinal comparisons over a period of time

The historical tendency for mortality trends to vary inversely with the standard of living and for fertility trends to maintain or restore approximate balance between mortality and fertility is indicated by the economic and demographic transition that has occurred in France over the past two centuries (Fig. 7)

A similar tendency toward approximate balance between mortality and fertility has been observed in Japan (Fig. 8), where the demographic transition began much later than it did in France Whereas France was the first country to enter into the process of demographic transition, Japan was one of the latest countries to complete it.

When one compares the experience of France and of Japan, it seems that the process of transition has been accelerated Whereas improvements in the standard of living and reductions in mortality have accelerated, the lag

Neo-Malthusian Model

Dependent Variables	Independent Variables		
	Levels of living	Mortality	Fertility
Levels of Living		⊕	−
Mortality	○		+
Fertility	−	○	

Alternative Model

Dependent Variables	Independent Variables		
	Levels of living	Mortality	Fertility
Levels of living		⊖	−
Mortality	⊖		+
Fertility	−	⊕	

Fig. 4. Neo-Malthusian and alternative models of demographic and economic interaction. The circles focus attention on those interactions which are essentially different in the two models Plus or minus signs indicate a positive or negative association

between mortality and fertility may have remained more or less constant. Thus, we are observing more violent, but transitory, "population explosions" Once the fertility trend turns downward, the reductions in fertility are also accelerated

Japan, it might be argued, was a rapidly developing country at the time of its demographic transition, and it was for this reason that the transition could take place in Japan as late as it did, but modern medicine has since changed the course of demographic transition and the prospects for development in the less developed world

Kirk has noted (*16*) that the later phases of the demographic transition (that is, definitive declines in birth rates to low or moderate fertility) have now reached almost all people of European ethnic background, but that Costa Rica and, until recently, Chile have been exceptions Kirk made his statement in 1967, information subsequently made available indicates that Costa Rica and Chile are beginning to complete the historic process of demographic transition first observed in Europe. Thus, in the 5 years between 1962 and 1967, Costa Rica experienced about a 10 percent reduction, and Chile about a 20 percent reduction, in fertility

It might be objected that Costa Rica and Chile, while they may be developing countries, are of European ethnic background, and that their experience may differ from that of countries of non-European background. It is for this reason that the case histories of Ceylon and of Mauritius are cited here, since these countries were first selected by the neo-Malthusian school to bolster their views

Many writers—too many to be cited here—have attributed the dramatic postwar decline in mortality in Ceylon solely or largely to the eradication of malaria Newman (*17*), who has studied the case history of Ceylon more than most, has concluded that eradication of malaria has accounted for 42 percent of the postwar decline in the death rate of Ceylon Titmuss and Abel-Smith (*18*) have attributed most of the dramatic decline in mortality between 1946 and 1947 in Mauritius to eradication of malaria.

If the sequence of events in Ceylon and Mauritius had demonstrated that economic development is no longer a prerequisite for a decline in the death rate, it might have seemed plausible to

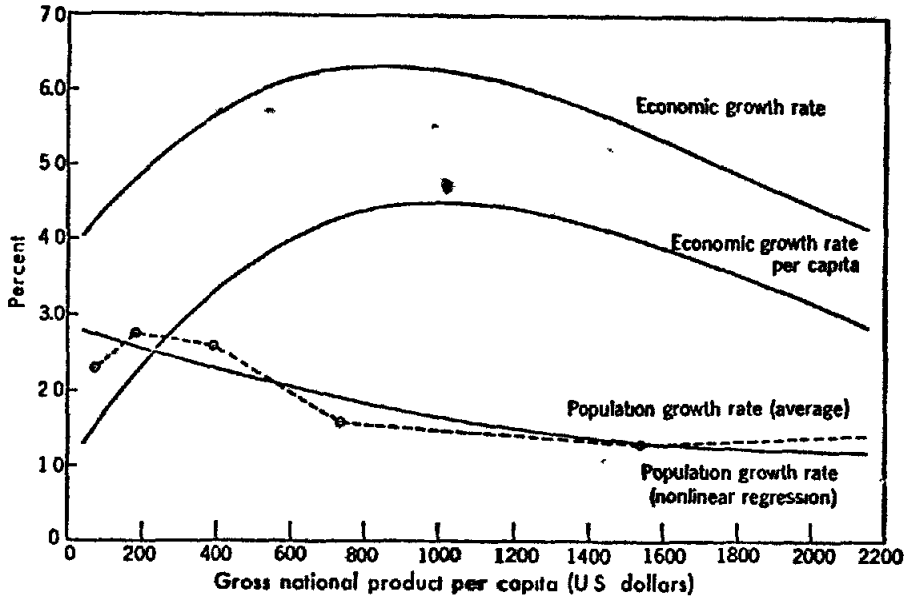

Fig 5 Nonlinear regression lines (third degree) for population growth rates (1958–1966), economic growth rates (1960–1965), and economic growth rates per capita (1960–1965), by gross national product per capita (1965), for 67 countries. [Sources of basic data, United Nations and World Bank]

postulate that modern public health measures would tend to reduce per capita income as well as mortality, should economic development lag; it might have seemed plausible to infer that per capita income would rise with a rise in mortality But the postulation of such determinants and consequences of mortality trends is not confirmed by the experiences of Ceylon and Mauritius (*10*)

Although the postwar decline in the death rate in Ceylon, from 20 to 14 per 1000 in the single year from 1946 to 1947, approximately coincided with a campaign of spraying with insecticides, the spectacular decline in mortality was about the same for the area without malaria, not protected by insecticides, as for the area with malaria, protected by insecticides (*19*). It has also been shown (*8*) that the decline in mortality was associated with a commensurate development of the econ-

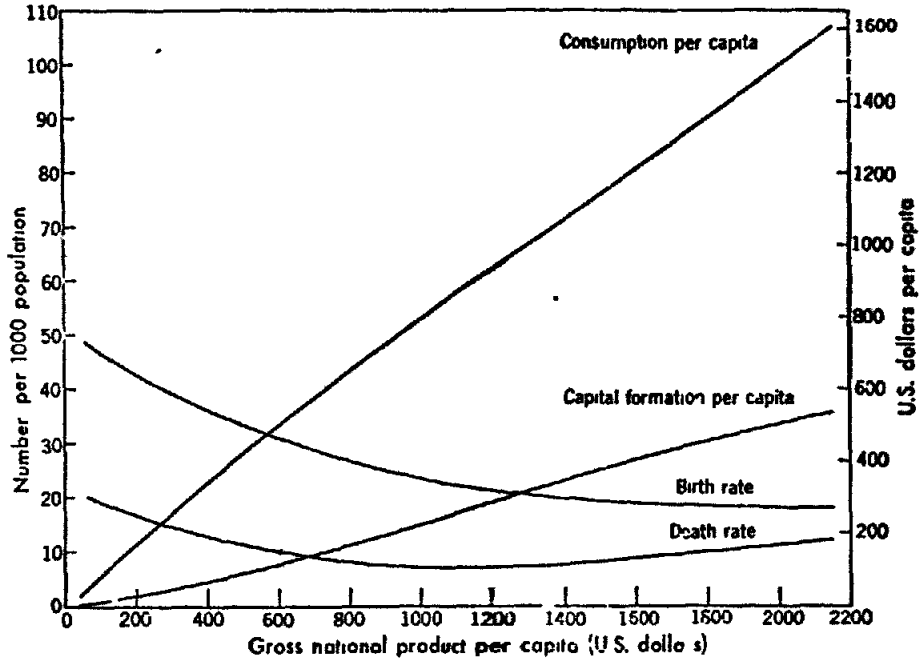

Fig 6 Nonlinear regression lines (third degree) for economic and demographic variables by gross national product per capita (1965), for 67 countries [Sources of basic data, United Nations and World Bank]

omy and rise in the standard of living.

Moreover, the birth rate declined from a postwar peak of 39 8 per 1000 in 1951 to 31 6 in 1967 In the 5 years between 1962 and 1967, Ceylon has experienced a greater than 10 percent decline in birth rate

The postwar drop in the death rate in Mauritius, from 30 to 20 per 1000 in the single year from 1946 to 1947, was also attributed mainly to the use of insecticides But the spraying campaign was started in 1949, 2 years after the dramatic 1947 decline in the death rate Moreover, the per capita production of sugar, virtually the sole export of the island, rose sharply as mortality declined

Mauritius may follow the pattern of demographic transition displayed in the course of history in the West

First, the inverse relationship between (i) the mortality rate and (ii) the standard of living indicated by the per capita proceeds (in 1939 rupees) from sale of the principal cash crop suggests that reductions in mortality are still dependent on commensurate improvements in the standard of living Improvements in health services may be involved, but only as a part of general improvements in living standards (Fig 9).

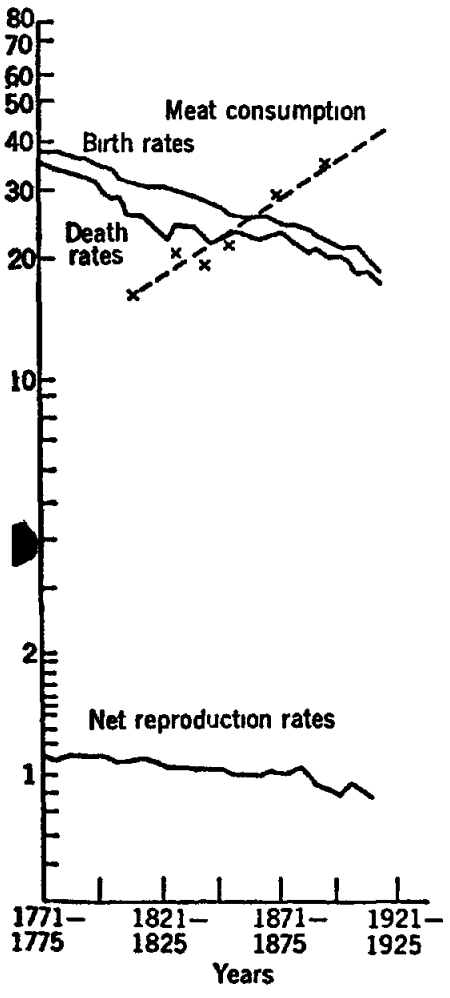

Fig. 7. Average annual number of births per 1000, number of deaths per 1000, and net reproduction rates in the 5-year periods 1771 to 1775 and 1906 to 1910, and annual consumption of meat and animal fat (in kilograms per capita) between 1812 and 1910, in France [For sources of basic data, see (22)]

Second, the fertility trend has now turned downward, decisively so, about 20 years after the dramatic downturn in the death rate From a postwar peak of 49 7 per thousand in 1950, the birth rate declined to 30 4 in 1967 In the 5 years between 1962 and 1967, Mauritius experienced about a 20 percent decline in the birth rate This seems to confirm the experience of other countries a reduction in mortality is a precursor of, and perhaps a prerequisite for, a reduction in fertility in the course of demographic transition (Fig 10)

Thus, Mauritius experienced a population explosion As the word implies, an explosion is a transitory phenomenon. The sharp increase in the rate of population growth calls for individual and collective decision making With lower mortality, the traditional and practical family size can be achieved with lower fertility Moreover, the lessening of uncertainty about whether one's childre will survive, and the greater overall probability that they will, may induce parents to want fewer children than they have wanted in the past Thus, reduction in mortality, by influencing the decision concerning family size as well as facilitating its realization, may operate by way of two mechanisms to develop motivation toward a reduction in fertility.

In the course of economic and demographic transition, a reduction in mortality induces a population explosion which may, in turn, induce a commensurate reduction in fertility, thereby restoring approximate balance between mortality and fertility

The qualitative nature and directions of the feedbacks in the alternative model (Figs 3 and 4) seem to be consistent with the relationships observed in the real world, as indicated by longitudinal as well as cross-sectional observations, and by historical as well as contemporary case histories (Figs 5 and 10) Let me say again that case histories of Ceylon and Mauritius were first cited by those who wanted to bolster their neo-Malthusian views. But the actual events in these countries seem to refute the neo-Malthusian model and to support the alternative model of economic and demographic transition

Additional empirical evidence for the alternative model has been presented elsewhere (*10*, *20*)

Dynamics of Transition

The dynamic equilibrium of economic and demographic transition in the postwar era may be indicated by empirical equations describing the quantitative and qualitative relationships between changes in mortality, fertility, and living standards in 21 countries, for which comparable data were available

The equations imply that the prospective rate of natural increase can be estimated on the basis of the rates of fertility and mortality in the base year and the relative change in per capita product at constant prices

The relative change in natality n in year t can be expressed in terms of natality n and mortality m in the base year o

$$\frac{n_t}{n_o} = \left[\frac{a}{(n_o - m_o)^b}\right]^{t-o}$$

(a and b are constants)

The relative change in mortality m in year t can be expressed in terms of the relative change in per capita product (at constant prices) p in year t:

$$\frac{m_t}{m_o} = \left[\frac{c}{\left(\frac{p_t}{p_o}\right)^d}\right]^{t-o}$$

(c and d are constants)

When the equations for relative changes in natality and mortality are combined, the rate of natural increase, $n - m$, in year t can be expressed in terms of natality n and mortality m in the base year o and the relative change in per capita product (at constant prices) p in year t.

$$n_t - m_t = n_o\left[\frac{a}{(n_o - m_o)^b}\right]^{t-o} - m_o\left[\frac{c}{\left(\frac{p_t}{p_o}\right)^d}\right]^{t-o}$$

The empirical derivation of the equations and of the constants a(= 1.028), b(= 0.016), c(= 1 085), and d (= 0 018) are described elsewhere

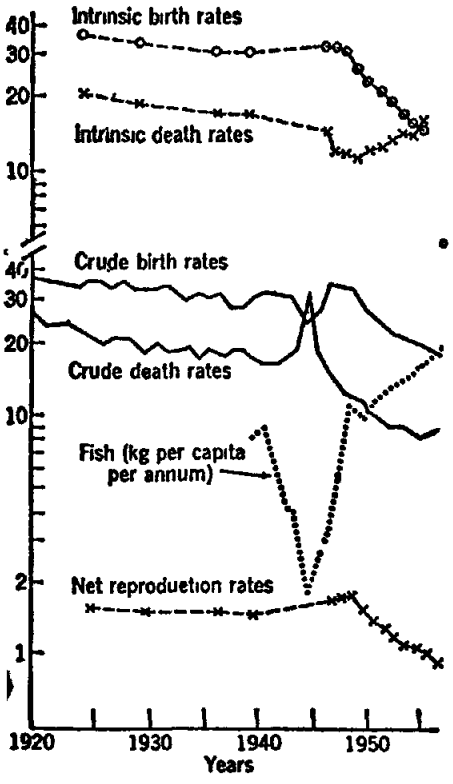

Fig. 8. Processed fishery products (in kilograms per capita per annum), crude and intrinsic birth rates and death rates (in number of births or deaths per 1000), and net reproduction rates, for Japan, for the period 1920 to 1957. [For sources, see (*23*)]

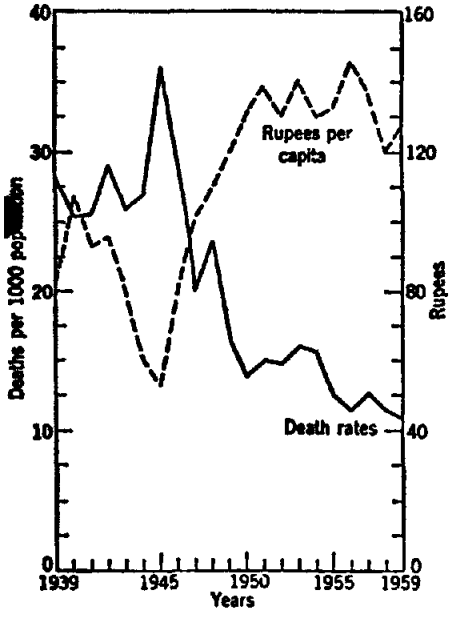

Fig. 9. Levels of mortality and levels of living, as indicated by the sales proceeds from sugar production (in constant rupees per capita) for Mauritius, for the period 1939 to 1959 (Constant rupees at 1939 prices were computed from the consumer price index for manual workers.) [Source of basic data, *Yearbook of Statistics* (Central Statistical Office Colony of Mauritius, 1946–1959)]

(*20*) The parameters can hardly be expected to predict the trends in vital events in all countries at all times, at least with any great degree of accuracy. For one thing, the values of the constants were derived from data uncorrected for differences in the age distributions. Second, the process of economic and demographic transition is constantly accelerating, as indicated by comparisons of the tempo of transition in developing countries with the tempo of the historical process in Europe.

But the equations were remarkably accurate in predicting or explaining the recent changes in the levels of fertility, mortality, and natural increase in Chile and Costa Rica. The recent dramatic turn in the trends of vital events in Chile and Costa Rica would have been missed had it simply been assumed "that current trends continue."

The population projections for Costa Rica, published by the United Nations in 1966 but based on data available in 1963, implied a rate of population growth of 3.9 percent in 1965 (an average annual rate of 4.0 percent between 1960 and 1965 and 3.8 percent between 1965 and 1970). The United Nations has since reported that the actual rate of population growth in 1965 was 3.1 percent. By substituting, in the foregoing equations, the birth rate and the death rate in 1960 and the relative change in per capita gross national product at constant prices between 1960 and 1965, we would estimate the 1965 population growth rate to be 3.3 percent in 1965.

Of course, the estimate of the death rate, and the rate of population growth derived therefrom, require economic data first available sometime after 1965, and for this reason this part of the equation is explanatory rather than predictive. But the estimate of the birth rate (number of births per 1000 population) obtained by means of this equation can be based solely on demographic data available in the base year. Such an estimate, for Costa Rica, based on the 1960 birth rate of 48.4 per 1000 and the 1960 death rate of 8.6, yields an estimated birth rate of 41.3 in 1965 which quite closely approximates the actual birth rate of 40.5 for that year.

Of course, no one factor in the equation can be successfully manipulated independently of the other factors, in the expectation that the other factors will automatically respond, as if this were simply a matter of arithmetic.

Demographic Policy for Demographic Transition

The solution of the "population problem" is not simply the achievement of a low rate of population growth, which could be the result of a balance between either high or low birth rates and death rates. All humanitarian considerations aside, only low death rates matched by low birth rates will provide maximum returns from investment in human resources and keep to a minimum the burdens of child dependency.

Of course, the desired demographic changes are no more automatic than the desired economic changes. The systematic extension of information and facilities favoring the use of efficient, effective, and acceptable methods of regulating family size is the appropriate response to spontaneous motivation to limit family size—motivation which increases as rates of survival increase.

Thus, improvements in the standard of living, as well as desired changes in mortality and fertility rates, will result from an interplay of effort in both the demographic and the economic aspects of economic and demographic transition.

Health measures and family plan-

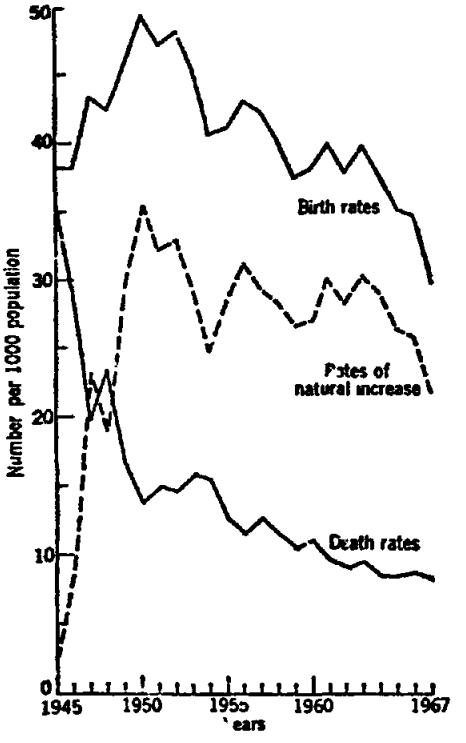

Fig. 10. Rates of birth, death, and natural increase for Mauritius, for the period 1945 to 1967. [Source of basic data, *Demographic Yearbook* (United Nations, New York, 1954–1967)]

ning, by their effects on morbidity, mortality, and fertility, can accelerate the economic transition from low to high levels of production and consumption They can also accelerate the demographic transition from high to low levels of mortality and fertility by restoring the balance between mortality and fertility at the lowest level of mortality attainable with the available resources With such understanding, the allocations for health services would be limited by the availability of resources rather than by a fear that health services might be too effective

The availability of resources for competing sectors of development would be decided by empirical review of the combinations of allocations to determine which combination had achieved a given level of development in the past and seemed to be necessary and feasible for achieving the next level.

Relative Costs and Benefits

The question remains, How should we or can we plan optimum efforts in view of the unlimited needs competing for the limited resources available? If we are to set realistic health targets, we must consider political, social, economic, and demographic, as well as administrative, factors We must consider noneconomic as well as economic costs and benefits, and we must start with the given set of circumstances, not with rarefied abstractions.

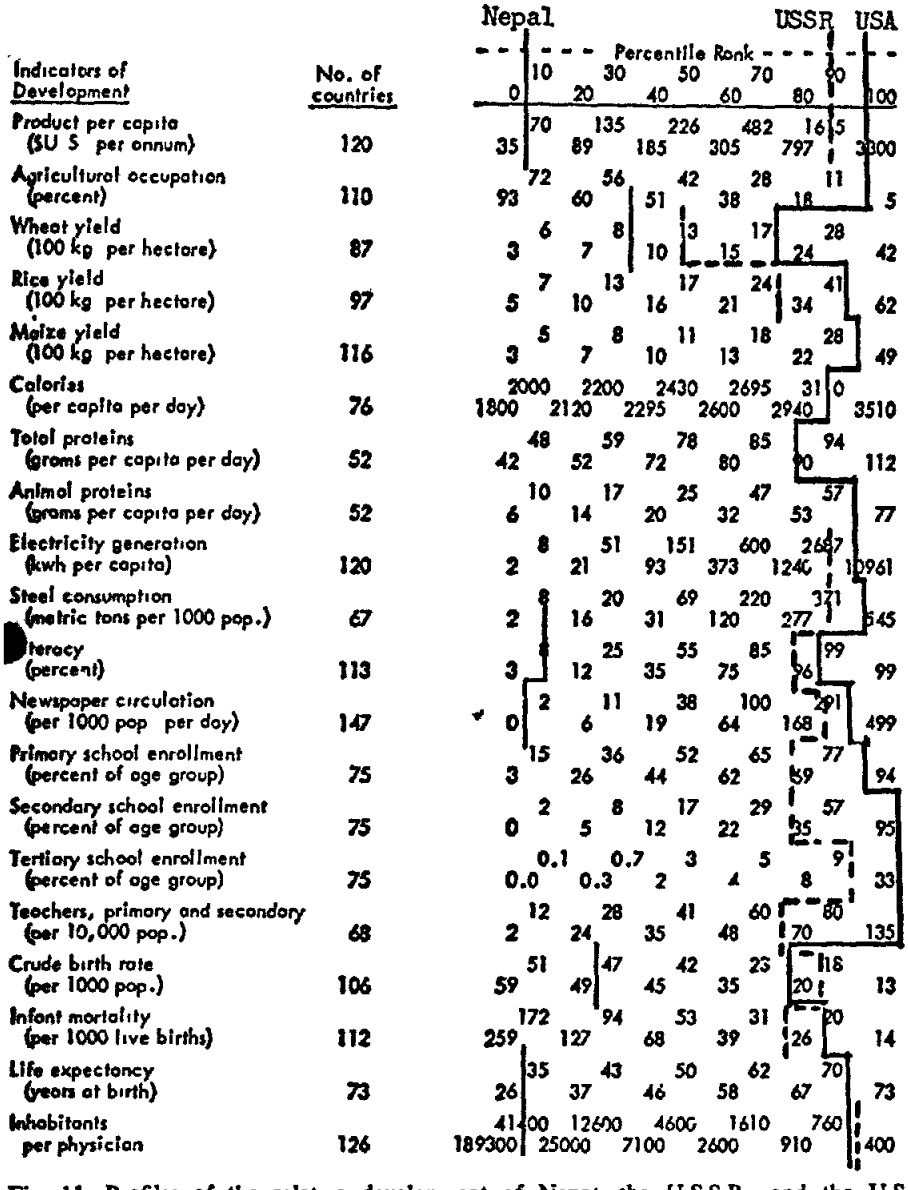

Fig. 11 Profiles of the relative development of Nepal the USSR, and the US. (indicated by the histogram) in comparison with ten levels in the global grid of sectoral development, indicated by the deciles in the rankings of indicators from the latest year, and the maximum number of countries, for which comparable data are available. [For sources, see (*24*)]

Health planners can dream of comprehensive and integrated health services, both curative and preventive, for achieving the ideal state of health as defined by the World Health Organization But in the real world, available resources are limited Moreover, it is in the less developed parts of the world that the needs are greatest, and the resources least.

In planning health services as integral parts of national development, it would be necessary or desirable to compare the costs and benefits of alternative programs, having different objectives, in different sectors of the economy, as well as the costs and benefits of alternative programs, having the same objectives, within the health sector. We must determine the optimum allocations for all sectors in the context of multiple needs competing for inadequate resources.

But, in practice, cost-benefit analysis may be neither a practical nor a valid method of deciding whether a more efficient and more effective program is an appropriate alternative for a less efficient and less effective program when the two do not have the same objective

For one thing, we may lack a common unit of measurement for comparing the costs and benefits of programs in the health sector with those of programs having different objectives, in other sectors In theory it may seem possible to quantify the various benefits in dollars, but what seems possible in theory may not prove feasible in practice

Moreover, we lack understanding of, or agreement on, the innumerable interactions of the multiple factors in the complex process of development For example, death control and birth control programs may be placed in competition for limited funds In such a predicament, the dilemma can be resolved neither by moral arguments nor by cost-benefit analysis Simple comparisons of the ratios of the costs and benefits of these arbitrary alternatives would be meaningless and misleading.

On the basis of simple arithmetic, we find that either more deaths or fewer births would lower the rate of population growth But a low rate of population growth may be the result of a balance between either high or low birth rates and death rates Only a balance between low birth and death rates will give the highest possible ratio between producers and dependents. And, as discussed above, only a prior

:duction of mortality will develop the iotivation needed for limiting family ize.

Thus it is clear that cost-benefit nalyses must be based on valid alter-atives and not on simple assumptions nd speculations which tend to ignore ie dynamic nature and sequence of ie interactions between economic and emographic factors We might feel ssured that a good analyst would take econd- and third-order benefits into ccount Yet, again, what seems po-ible in theory may not prove feasible i practice

Again (to cite a comparison of the osts and benefits of another popular air of specious choices), it has been ariously calculated that the expendi-ire on a program of birth control of ither $1 or $5 from each $100 spent n development can double the rate of capita economic growth achieved the whole expenditure But could e really double economic growth merely by increasing our investment in contraception? If that were possible, we might concentrate on contraception and eliminate investments in all other sectors of development Although the popular notion that an ounce of contraception is worth a pound of development has some validity, this does not mean that birth-control programs could or should invariably be substituted for programs that have a less favorable cost-benefit ratio The setting of priorities is not simply a mathematical problem

Of course, within a given sector, a more effective and efficient program may be substituted for one that has the same objective but a less favorable cost-benefit ratio, provided the proposed alternative is otherwise appropriate and acceptable

Actually, there is little need for complex and controversial economic and demographic arguments to justify appropriate action in response to spontaneous motivation to restore the balance between mortality and fertility We all know the absurd consequences projected by extrapolations of imbalances between current mortality and fertility trends

Although intersectoral cost-benefit analyses may not be particularly feasible, such analyses may be undertaken intrasectorally in conjunction with an empirical method, described next, for intersectoral linking of targeting and budgeting in a multisectoral system of development

Profiles of Relative Development

So far, no comprehensive model of development for obtaining the best possible allocations among the innumerable needs competing for limited resources has been generally accepted and successfully applied In the absence of such a model, analysis of national

able 1 Evolution of environmental health problems, predominant patterns of disease, mortality, and fertility, goals, type and scope of ealth services, and the state of nutrition

tate of ociety	Environmental health problems	Predominant patterns of disease, mortality, and fertility	Goals, type and scope of health services	State of nutrition
radi-tional	Largely rural environment with contamination of water and food, proliferation of insects and rodents, periodic food scarcities.	Endemic infections, parasitisms, infestations, nutritional deficiencies High death rate and high birth rate.	Indigenous systems of medicine based on traditional practices and beliefs	Undernutrition as a result of food scarcities in a subsistence economy with practices and preferences of food production and consumption of a traditional, but youthful, society
arly transi-tional	Largely rural environment with contamination of water and food, proliferation of insects and rodents, adulteration of foods and drugs, food scarcities	Endemic infections, parasitisms infestations, nutritional deficiencies Intermediate death rate and high birth rate	Medical relief and family planning in key centers, control of endemic diseases and environmental sanitation in selected areas, nationwide extension of categorical health services (malaria and smallpox eradication) requiring only minimal cooperation from the public and only minimal judgment from auxiliary staff with stereotype duties (residual spraying and vaccination)	Potential improvements in nutrition in areas of the monetary economy through possible modification of social, economic, and agricultural policies favoring the consumption of a variety of nutritious foods, facilitation of the extension of modern practices of agriculture, food technology and marketing, nutrition education, child-feeding and school lunch programs to the minority of the population within the scope of the nutrition programs of the health, education, and agricultural services
ate transi-tional	Rural environment still resembles that of traditional society, whereas the urban environment resembles that of modern society	Endemic diseases prevail at reduced levels in rural areas, whereas the disease patterns of urban areas resemble those of modern society Low death rate and intermediate birth rate	Comprehensive and integrated systems of preventive and curative health and medical services in key centers, with nationwide extension of medical relief, family planning, nutrition, basic sanitation, health education and communicable disease control	Continuing improvement of nutrition as a by-product of economic growth and as the result of progressive extension of nutrition programs nationwide, including the production of protein-rich foods and the fortification of staples.
lodern	Largely urban environment with pollution of air, water, and food, plus hazards from use of cigarettes, alcohol, food additives, new drugs, and narcotics	Bronchopulmonary and cardiovascular diseases, malignant neoplasias, mental illness, accidents, obesity Low death rate and low birth rate	Nationwide extension of complex systems of comprehensive and integrated preventive and curative health and medical services, requiring a prosperous society and an enlightened public, as well as ample health manpower, qualified to exercise independent judgment.	Overnutrition as a result of an abundance of foods in an industrial economy of an affluent, sedentary, and aging society.

and sectoral "profiles of the relative development" of human and natural resources provides an objective and practical method for setting realistic, although tentative, targets and budgets (*21*). Such profiles facilitate comparison between countries or regions with respect to a number of variables, each of which can serve as an indicator of the level of development (Fig 11)

Profiles of individual countries are entered on global grids of development, which are constructed by ranking any number of variables from all countries for which comparable data are available; the deciles thus obtained are used to construct the grids

For example, the first indicator in the global grid is the product per capita Data for this variable from 120 countries are ranked in the first two horizontal rows of Fig 11, from left to right. The top entry in the first vertical column (the 0-percentile column) indicates that none of the 120 countries had a per capita product of less than $35 in 1965 The top entry in the second vertical column (the 10-percentile column) indicates that 12 countries (10 percent of 120) had a per capita product of no more than $70 And the top entry in the last vertical column (the 100-percentile column) indicates that all 120 countries had a per capita product lower than $3300 The profile of the relative development of a particular country (Nepal, the U S S R., and the United States) is indicated by the histogram in the grid For example, Nepal had a product per capita of less than $70

Variables have been included in the grid without regard to any hierarchy or classification The variables or indicators are simply a diverse collection of characteristics of a society or economy, some of which might be considered costs or benefits, inputs or outputs, causes or effects, needs or resources, means or ends The preparation of development profiles requires neither classification of the variables nor understanding of the nature and extent of their interactions—neither explicit nor implicit assumptions other than recognition of a tendency toward balance or complementarity in the development of human and natural resources. Whether progress is the inevitable result of free enterprise or the intended result of a planned economy if and when a system or policy or fortuitous combination of factors results in development, the balance in the development of human and of natural resources is remarkable

For different countries, paths of development are usually and essentially the same, but the path may be followed with greater or lesser speed Harmonizing the objectives and choosing the best possible targets may accelerate the passage from traditional to modern stages of society and economy.

Since grids such as Fig 11 have no time scale, it is not possible to schedule the achievement of individual targets within fixed periods Rather, the profiles suggest, for example, that it might be realistic to choose as a target reductions in infant mortality from 127 to 68 per 1000 live births coincidentally with an increase in the product per capita from $89 to $185 a year

The observed balance in the development of human and natural resources permits us to decide what is necessary or desirable and feasible at the various stages of development, even though we lack a comprehensive mathematical model of development. In effect, the open-ended nature of the grid permits approximation of a comprehensive model of development, albeit associatively rather than structurally

The method of analysis is discussed more fully elsewhere (*21*).

Evolution of Goals and Services

Integration of planning, programming, and budgeting of health services into a system for accelerating development may confirm the belief that differences between a sound economic point of view and a bona fide humanitarian point of view are more apparent than real Of course, there are situations where the two are irreconcilable. In such situations, the deliberate political decision may be to choose a humanitarian policy rather than the most economic alternative However, in the long run it may not be politically opportune or economically feasible to consistently ignore either humanitarian or economic considerations

Fortunately what is necessary or desirable from the economic and the humanitarian points of view may, and usually does, turn out to be essentially the same, when analyses of the relative costs and benefits are based on targets or budgets for programs that are possible and feasible, valid and appropriate in the context of the evolving needs and resources And what is necessary or desirable and feasible from the economic and humanitarian point of view may, in the long run, be a safe and sound position from the political point of view as well.

Thus, the best or only way to obviate or resolve conflicts, apparent or real, between independently derived economic and health plans would be to devise and adopt a method of planning health services and investments as integral parts of a multisectoral system for accelerating the development of an economy and a society Such planning must be based on an understanding of the quantitative and qualitative evolution of feasible goals and optimum programs in the context of evolving needs and resources at successive stages of development

Disease and reproduction tend to occur in definable patterns that closely reflect the degree of modernization of the society (Table 1) Where the patterns are not compatible with the process of modernization, we can attempt to modify the patterns and make them compatible

The ideal health policy would be one of short-term and long-term planning such that the manpower and organization of the health services, designed to attack the most prevalent diseases that are amenable to attack, would evolve along with the needs and resources in the complex process of economic, social, and demographic transition

There are various alternative strategies and tactics that might be pursued by the health services Before we try to determine the relative cost effectiveness of alternatives we must decide which of the many alternative programs are valid paths to the agreed-upon objectives, this decision, in turn, must be based on consideration of what alternatives are both possible and feasible

This requires, first, consideration of the nature of the problem, which may call for epidemiologic study Then the possibilities of prevention must be determined; this involves determination of the link in the chain of transmission or causation that is most readily broken by the possible means of prevention.

But what is possible may not be feasible The feasibility of goals and services evolves with the needs and the resources (Fig 11 and Table 1) And once we decide which alternative is feasible, we still must set tentative targets or budgets for the alternative pro-

ars before we can analyze the rela-
e costs and benefits

The profiles of relative development
rmit the setting of tentative but realis-
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inimum and to achieve maximum
nefits, by permitting cost-effectiveness
alyses to be based on the empirically
rived targets as well as budgets

mmary and Conclusions

The feedbacks in a neo-Malthusian
d in an alternative model of eco-
mic and demographic transition are
mpared with each other and tested
ainst the real world On the basis of
empirical evidence, it is postulated
the population problem is not sim-
y a high rate of growth Nor is its
lution simply a low rate of growth
hich could be the result of a balance
tween either high or low rates of
ortality and fertility

Reductions in the mortality rate are
rt of the solution, rather than the
use, of the problem Mortality rates
nd to vary inversely with levels of
nsumption and production More-
er, reductions in mortality seem to
prerequisites for compensating re-
ictions in fertility to achieve the de-
ed family size

Of course, the desired demographic
anges are no more automatic than
e desired economic changes The sys-
matic extension of information and
facilities favoring the use of ac-
ble methods of regulating family
e is the appropriate response to spon-
taneous motivation to limit family size

Successful development results in, and from, a balance between mortality and fertility at the lowest mortality rate attainable with the resources available With improved health and greater longevity increasing the returns from human resources, and with decreasing fertility decreasing the burdens of dependency, the maximum improvements in the standard of living and the desired changes in mortality and fertility will result from interplay of efforts in both the demographic and the economic areas

Strategy and tactics for national development evolve with the needs and resources "Profiles of relative development" in the multiple sectors of national development may indicate what targets and budgets are necessary or desirable and feasible at successive stages

Paths of development may be usually and essentially the same for different countries, but the path may be followed with greater or lesser speed Harmonization of the objectives and wise choice of targets may accelerate the passage from traditional to modern stages of society and economy

Health measures and family planning, as integral parts of the complex process of modernization, can accelerate and must complete the economic and demographic transition from low to high levels of production and consumption, and from high to low levels of mortality and fertility

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TOWARD A NON-MALTHUSIAN POPULATION POLICY

JEAN MAYER

One theme of this essay is that food is only one of the elements in the population problem Admittedly, at present, it is a major factor in some parts of the world, but there are large areas where the national food supply is a minor factor and others where it is not a factor at all Furthermore, considering the world as a whole, there is no evidence that the food situation is worsening and there is at least a likelihood that food may at some time (20 or 30 years from now) be removed altogether as a limiting factor to population Yet, to deny that the population problem is basically one of food for survival is not to deny that there is a population problem, it is in fact to remove the appearance of a safety valve and also to reveal the problem in its generality For were we really to starve when the population reache. a certain magic number, this in turn would cause a drastic increase in child and infant mortality, decreased fertility, and a shortening of the average life span In other words, it would cause the increase in population to be self-limiting If the world can continue to feed—however badly—an ever-increasing number of people, this safety valve (however unpalatable, it *would* be a safety valve) is missing And if lack of food is not a component of the definition of overpopulation, rich countries as well as poor ones become candidates for overpopulation—now

Another theme is that there is a strong case to be made for a stringent population policy on exactly the reverse of the basis Malthus expounded Malthus was concerned with the steadily more widespread poverty that indefinite population growth would inevitably create I am concerned about the areas of the globe where people are rapidly becoming richer For rich people occupy much more space, consume more of each natural resource, disturb the ecology more, and create more land, air, water, chemical, thermal, and radioactive pollution than poor people So it can be argued that from many viewpoints it is even more urgent to control the numbers of the rich than it is to control the numbers of the poor

The population problem is not new, although it has recently acquired new and dangerous dimensions In all early treatments of the subject, considerations of population policy were not closely linked to economic concerns or the availability of food Plato, who undertook nothing less than the projection of an ideal city-state in estimating the numbers needed for the various functions of citizenship, arrived at the figure of 5,040 citizens as the desirable size, adequate to "furnish numbers for war and peace, for all contracts and dealings, including taxes and divisions of the land." In *The Republic* he described his well-known eugenics proposal for public hymeneals of licensed breeders His preoccupation was with the quality of man and of the state, not with the availability of food and other resources Aristotle, who was concerned with certain of the economic consequences of overpopulation, though not specifically with food, warned in *Politics* that "a neglect of an effective birth control policy is a never-failing source of poverty, which is in turn the parent of revolution and crime," and advised couples with an excessive number of children to abort succeeding pregnancies "before sense and life have begun "

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Plato and Aristotle did not go unchallenged The Pythagoreans, in particular Hippocrates, opposed abortion The Hippocratic oath contains the pledge "I will not give a woman an abortive remedy" Of greater subsequent importance, the Romans, particularly Cicero, disapproved of the Greek views on population They were not so much concerned with the quality of man as with the excellence of the Empire Rome taxed celibacy and rewarded large families Roman ideas, incidentally, were very similar to those of Confucius and his followers, also citizens of a large and expanding empire, and equally convinced that a numerous and expanding population should be promoted by wise rulers The economic consequences of large populations were essentially ignored by the Romans, Confucius dealt with them by enunciating the rather intriguing formula "Let the producers be many and the consumers few"

The Hebrews and the Fathers of the Church were similarly uninterested in the economic implications of population growth Biblical and early Christian writers can, indeed, hardly be considered to have had a population policy, though their concepts of family life and of the dignity of man are as basic now as they were milleniums ago Children were repeatedly designated as the gifts of God, with large families particularly blessed The prescriptions of Saint Paul were somewhat more complex while he stated that women could merit eternal salvation through bearing children if they continued to be faithful, holy, and modest, he praised virginity as more blessed than marriage, and dedicated widowhood as preferred above remarriage Following Saint Paul, the position of Christians in sexual relations became variegated from strict antinomianism, believers in all possible experiences, to fanatical ascetics who believed in self-castration to remove all possibility of temptation, with the center of gravity of Christian opinion somewhere between the traditional Roman double standard (strict virtue expected from the woman, somewhat more permissive rules for the man) and the more puritanical ideal of the Stoics

In this ethical Babel, the absence of strict theological canons made it possible for intelligent citizens of a crowded and decaying empire to discuss the possible economic and political consequences of overpopulation In *De Anima* Tertullian wrote "The scourges of pestilence, famine, wars, and earthquakes have come to be regarded as a blessing to crowded nations, since they served to prune away the luxuriant growth of the human race" The position of the Church against abortion hardened in the third century, when Saint Hippolytus opposed Pope Calixtus I for showing too much leniency toward the abortionists, and reiterated the Christian position that the fetus is a person and not, as in Roman law, a part of the mother. Saint Augustine, rising from a Manichaean background and a personally unhappy sexual history, defined the purpose of Christian marriage as procreation, with abstinence permissible by mutual consent. This basis of the Christian marriage, unmodified by Thomas Aquinas or the medieval theologians, unmodified by Luther (an Augustinian, very much attached to the pattern of the order) was to survive far into the twentieth century

In spite of theologians, Tertullian was echoed 1,300 years later in Botero, a sixteenth-century Italian writer, who held that man's productive powers are inferior to his reproductive powers, which do not diminish automatically when population increases The population of the world, then, must be constantly checked by war and epidemics, the earth already holding as many people as it can feed. From Botero onward, concepts of optimum population size became indissolubly linked to economic considerations, but to economic considerations of the lowest order. Population limitation was advocated by writers, Malthus foremost among them, who felt they could demonstrate that population will inevitably rise to the very margin of food production capacity, with misery and vice the only consequences. The examples chosen were often unfortunate in the light of hindsight Malthus based his prediction on an examination of the United States of the late eighteenth century On the other side, mercantilist writers and rulers once again saw an increase in population as a guarantee of ample manpower for production and for war, and as a test of good government Through the nineteenth century the debate continued Malthusians saw the solution of economic problems due to overpopulation in continence and in more poverty—specifically, the repeal of the poor laws The belief in the inevitability of starvation and the desirability of a *laissez faire* policy was in no small measure responsible for governmental inaction during the Irish famine At the other end of the spectrum, Marx and Engels opposed Malthus as a peculiarly vicious and obsolete defender of capitalism "Overpopulation" was a bourgeois invention designed to justify the poverty of the working classes. Im-

proved production and distribution, not restriction of births, was the answer A socialistic economy could thrive under all conditions of population growth, while an economy based on scarcity and high prices required birth control to mitigate its glaring deficiencies Oddly enough, a number of modern Catholic philosophers have held a viewpoint not very different from that of Karl Marx

The position of many Chinese leaders at present is a combination of orthodox Marxist anti-Malthusianism and traditional Chinese predilection for large families Others, echoing Francis Place and the liberal socialists, advocate the availability of the means of birth control so as to permit the liberation of women and their participation in the edification of socialism (being careful meanwhile to avoid any Malthusian implication)

Since the mid-nineteenth century, three profound revolutions have been taking place a technological revolution, which promises to accelerate food production still faster, a demographic explosion, which is also accelerating and places the problem of population in an even more dramatic context, and changes in human attitudes, for which Harlan Cleveland has coined the felicitous expression, "the revolution of rising expectations" It is the contention of this writer that nothing is more dangerous for the cause of formulating a sound population policy than to approach the problem in nineteenth-century terms By continuing to link the need for population control to the likelihood that food supply will be increasingly limited, the elaboration of birth control programs of sufficient magnitude will be held up for many years, perhaps many generations In contemporary terms, it may well be that the controversy between Plato and Cicero makes more sense than that between the neo-Malthusians and the neo-Marxists

That the magnitude of the population problem has increased dramatically in recent years is well publicized Scholars have estimated that after hundreds of thousands of years of slow growth, the population of the world reached the quarter billion mark some time around the beginning of this era It doubled to 500 million by 1650 Two centuries later it reached the billion mark The next doubling took 80 years, with a population of 2 billion in 1930 It would appear that the world is on its way to the next doubling, to 4 billion in 45 years, by 1975, and a population of 8 billion may well be reached within the following 30 or 35 years unless rates of growth are drastically decreased. The present growth rate would lead to a population of 500 billion by the year 2200, and give the surface of all continents a population density equal to that of Washington, D C at present!

This increase has been due not to an increase in birth rates, but to a decrease in death rates. Around 1700, life expectancy at birth of European populations was about 33 years, and had increased little in the previous three to four hundred years By 1950, life expectancy in Western and Central Europe and in the United States had increased to 66-69 years, an increase of over 100 per cent This decrease in mortality rates is no longer confined to populations of European stocks In 1946, the death rate of the Moslem population of Algeria was higher than that of Sweden in 1775 In 1954, in spite of generalized guerilla war on its territory, the death rate of this population was lower than that of Sweden in 1875 A similar telescoping of the drop in death rates is going on all over the world

From a demographic point of view it must be noted that a drop in the death rate, with birth rate unchanged, not only results in an increase in the rate of population growth, but also produces an acceleration in the rate of growth itself a decline in age-specific mortality rates in ages prior to the end of the childbearing age has the same demographic effect as an increase in the birth rate In the United States, 97 out of every 100 newborn white females reach the age of 20, 91 reach the age of 50 In Guatemala, only 70 reach the age of 20, 49 that of 50 If the death rate in Guatemala fell within the next decade to somewhere near the 1950 United States level, a not unlikely development, this alone would increase the number of women reaching the beginning of the childbearing period by 85 per cent Because of the high proportion of young people in underdeveloped countries generally—a country like Costa Rica has twice the proportion of people under 15 that Sweden has—this drop in the death rate in the pre-childbearing period has now and will have in the next few years a gigantic effect on the birth rate Brazil had 52 million people in 1950, 71 million in 1960, and 83 million in 1966 If present rates prevail it should have 240 million by the year 2000, or 14 times the 1900 population With a drop in mortality in the young age groups, the increase could be even more spectacular

The significance of the demographic trends

within this country is not generally appreciated The United States, with a population of 200 million, has at present one-sixteenth of the earth's population on one-sixteenth of the land area Though a number of underdeveloped areas are piling up population faster, we are accumulating about 2 2 million people per year, more than any increase before 1946 The rate of growth seems unimpressive, 1 1 for the year 1967 (the highest rate reached was 1 8 in 1946 to 1957) If the rate prevailing over the past five years persists, the population of the United States will reach 300 million by the year 1990 What most of us have tended to ignore is that the so-called baby boom of the postwar era followed a period of depression and very low birth rates from 1920 to 1933 the birth rate had fallen steadily from 27 7 per 1,000 in 1920 to 18 4 in 1933 The absolute decline in births was less steep, because the numerical base of women of childbearing age was still growing When the birth rate started rising in the early forties, the increase was applied to the still large number of women born between 1916 and 1924 Since 1945, the baby boom that has been so well publicized had actually been taking place on the basis of the shrinking group of women of childbearing age born since 1924 As of 1963, the last of the undersize groups had entered the reproducing age From 1964 (when the first girls born in the big postwar years reached the age of 18), the number of women in the childbearing age has started increasing rapidly While in 1940 there were 32 million women 15 to 44 years of age, in 1950 34 million and in 1960 36 million (a very slow increase), there will be 43 million in 1970 and 54 million in 1980 While the birth rate is declining (and while a better index, the age-standardized general fertility rate based upon women of childbearing age only is also declining), the sheer existence of the number of women and girls alive now means that even in the unlikely event that the fertility rate fell to the historical lows of the depression years and never departed from it, the population of the United States would still more than double in the next century The reader will, I trust, give me credit for not minimizing the problem of total population either at home or for the world at large

With this picture of ever-increasing numbers of people, the first reaction among a portion of the public is that we are running out of space, that the "population density" is becoming dangerously high This concept of "population density"—number of people per unit surface—has underlain the concept of "overpopulation" in the past It is not very useful except where the primary resources are extractive (mining) and where the most primitive types of agriculture (independent of industry for fertilizers, machines, etc , and hence essentially dependent on area) and forestry prevail It also presupposes that there is no industry to absorb surplus manpower It is a concept of dubious value where non-extractive industries are dominant and where trade is possible The high density band from Boston to Washington has an area of 14,000 square miles, an aggregate population of over 30 million (or over 2,000 persons per square mile), and very limited natural resources The median family income is $1,000 more than for the United States as a whole Can this area be said to be overpopulated from a material standpoint? To those who object that this area is part of a larger and less densely populated whole, one might point to prosperous Holland, or Belgium, or even Hong Kong, which, although trade with its hinterland is very meagre (imports from mainland China represent only 17 per cent of total imports), not only houses 3 1 million people on 398 square miles (12,700 per square mile), but has shown an unexcelled increase in national product of 7 to 10 per cent per year —a doubling of real output within 10 years Once one argues that a certain population density should be preserved, such as density with respect to capital for example, one is dealing with a much more complex concept From it follows the idea that some sparsely settled countries need rapid increases in population, preferably through immigration, for optimal use of resources The mental image of population density entertained by most people is, in any case, complicated by esthetic and social considerations, and "high density" is more likely to be ascribed to Calcutta than to Paris, to Costa Rica than to Denmark

This leads us to the second and more popular concept, that overpopulation can best be appraised with respect to food resources and that the present rate of increase in the world's population is rapidly carrying us to the brink of or to actual starvation. It is my contention that this is not happening. Furthermore, I do not consider that my belief, which I shall now endeavor to justify, makes me an "optimist" as compared to the legions of conservationists, social scientists, etc , who have embraced a Malthusian "pessimism " If anything, this view

makes me even more pessimistic about our chances of limiting the world's population at an early date famine or the threat of famine is perhaps the worst method of limitation, but it would work

World War II was not a Malthusian check In spite of the horrendous numbers of soldiers and civilians killed, in spite of the massive genocide perpetrated by the Nazis, food production decreased much more than population By 1945, intake per capita was 16 per cent lower than the 1934-38 average The creation of the Food and Agriculture Organization, a specialized United Nations Agency that was endowed during its first years with particularly articulate spokesmen, dramatized the worldwide concern over the food situation The difficulties inherent in getting agriculture going while industry and the means of communication were not yet rebuilt, led to a generalized feeling of pessimism Cereals, oils, meat, dairy herds were, in succession, the objects of great attention, the conclusion being in each case that pre-war levels of production and consumption were not going to be reached for years The chaotic state of international trade accentuated shortages, which UNRRA and various emergency agreements attempted to cope with on an *ad hoc* basis And yet very quickly the situation improved The oil shortage vanished first, while the gigantic ground nut scheme of the British government, which was supposed to mitigate it, was taking off to a very slow start, the reappearance in the channels of trade of adequate amounts of fats and oils eliminated the motivation for the scheme itself United States production of cereals and animal products, which had grown during the war in spite of the lack of abundant manpower and the diversion of the chemical industry to military purposes, had to be slowed down as surpluses started accumulating, and, with their appearance, the threat of a collapse of agricultural prices loomed By 1952-53, the worldwide rate of per capita production of food had overtaken pre-war rates. Since then, the average rate of increase in the production of food for the world at large has been 3 per cent per year, while the population has increased on the average 1 7 per cent In document No. 8148, the Department of State estimates that if individual consumption levels remained at the 1955-57 level, the world at large would show by 1975 an annual surplus of 40 million tons of wheat and 70 million tons of rice (This estimate is based on the postulate that there will be no increase in rice production in Europe and North America, and no increase in wheat production in North America.) Actually, this slight but steady gain of food production over population is part of a secular trend E S and W S Woytinski, in their monumental *World Population and Production,* estimate that since 1850 the increase in output has been more rapid than the increase in population

As chairman of the National Council on Hunger and Malnutrition in the United States I have been talking of these evils at home for years I have done extensive work in malnutrition in Asia and in Africa and have just returned from a trip to Nigeria and to Biafra, where I went to study the famine and the means to alleviate it I am, therefore, as well aware of the widespread character of malnutrition as anyone in the world Caloric undernutrition is still found in many parts of the world, and not always as a result of war or civil disorder, earthquakes or floods, invasions of insects and other parasites, or abnormally prolonged droughts Protein deficiency —kwashiorkor where it occurs without accompanying caloric deprivation, marasmus when both caloric and protein intakes are inadequate—is encountered in varying degrees of prevalence among the young children of most countries of Asia and Africa and in many of Central and South America Vitamin A deficiency is perhaps underestimated as a threat to the life, and the sight, of children of most of the same areas where protein deficiency is also seen Riboflavin deficiency, thiamine deficiency (beriberi in its various forms), and a number of other deficiencies are still very much with us Still, there is no evidence that the situation is getting worse. The food balance sheets on which postwar pessimism was based are imperfect instruments As an officer of FAO, I spent considerable time attempting to gauge such unknowns as figures for waste at the retail level and within families, and that portion of the food supply that does not move within the channels of trade (food grown by the farmer for his family is very inaccurately known, particularly as regards fruits and vegetables which tend to be underestimated) The nutritional standards against which available supplies are gauged are themselves being refined As the results of additional experimental and clinical work become available, it is realized that a number of such standards—those for protein and calcium among others—were probably unnecessarily high Even without such reevaluation, the evolution of food balance sheets, the only instruments we have to judge the race between

food and population, make it apparent that most regions do show the same slow increase of per capita supplies exhibited by the world at large It must be recognized, of course, that many of the worst nutritional scourges of mankind have been historically due as much to ignorance and to callousness as to lack of nutrients as such Thousands of children die of protein deficiency in areas where the proteins which would save them do in fact exist and are often consumed in sufficient amounts in the very households where infants and toddlers die for lack of them A faulty understanding of a child's needs may be the main reason he is denied some of the food consumed by his father and older siblings As for man's inhumanity to man and its contribution to starvation, it could be illustrated by thousands of examples cereals being shipped from Ireland under the protection of naval guns during the famine, stocks being withheld during the Congo famine to keep prices up, crop destruction policies in South Vietnam, the food blockade of Biafra

Certainly as far as food is concerned ours is not one world The United States government rents 20 million acres from our farmers so that they will not grow food on them. A study made at Iowa State University a few years ago suggests that sixty-two and a half million acres ought to be similarly retired so that surpluses will not continue to be created in relation to the present market Australia, Canada, New Zealand, Argentina, and France have been, or are at present, involved in similar efforts to restrict production

Nor is this idling of food production restricted to highly developed countries A recent study estimates that Ghanaian farmers work only an average of two hours a day in the cocoa area, the wealthiest agricultural area of the country

It is fair to say that in most areas of the world the race between food and population would be more favorable to the development of adequate nutrition if the rate of population growth was decreased But I believe that there are no grounds for saying in 1969 that the nutritional state of the world is getting worse It is not And I believe that improvement in communication, availability of surpluses in certain countries, the existence of solid international organizations, and the gradual improvement in international morality make large-scale famines, such as the Irish or the Bengali famine, less likely to occur in this era—except perhaps in Red China because of its alienation from the two richest blocs of countries (It appears, moreover, that the food situation in China has improved considerably in the past two years, making the recurrence of famine there, as in India, more remote)

Bad as it is, the present is no worse than the past and probably somewhat better But what of the future? In absolute numbers, the increase in population is likely to accelerate for some time. Can the food supply be kept up? My contention is that for better or for worse it can and will.

First, let us consider conventional agriculture FAO's figure indicate that 3 4 billion acres are at present under cultivation This represents less than 11 per cent of the total land area of the world Some experts—Prasolov, Shantz, Zimmermann—estimate the area that can eventually be made arable at from 13 to 17 billion acres Colin Clark, director of the Agricultural Economics Research Institute of Oxford, uses the figure of 19 billion acres, but counts double-cropped tropical lands twice (He considers, incidentally, that if the land were farmed as well as the Dutch farmers work their acres today, it would support 28 billion people on a Dutch diet, if Japanese standards of farming and nutrition were used, this area would support 95 billion people)

The biggest potential increase of food production does not, however, come from the extension of the area under cultivation, but from the increase in the use of fertilizers The phenomenal increase in food production in this country has actually been performed with a reduction in acreage farmed By pre-World War I standards of cultivation, it took one-and-one-half acres to support an American If such standards prevailed today, we would need to add at least 40 million acres to our farm area every ten years, or the equivalent of an additional Iowa every decade In fact, we use fertilizers instead One ton of nitrogen is the equivalent of 14 acres of good farmland The use of between two and three hundred thousand tons of nitrogen (and corresponding amounts of other necessary elements) per decade has obviated the need to discover another Iowa And our use of fertilizer is less intensive than it is in Japan, where it is well over twice ours, or in Western Europe (Incidentally, in spite of its already high standards of cultivation, Japan is still increasing its agricultural production at a rate of 3 per cent per year) India, Africa, and most of Latin America use only an infinitesimal fraction of Japanese or Western amounts of fertilizer, or none at all Garst has estimated that an

expenditure of ten dollars an acre per year for fertilizers would alone add 50 to 100 per cent to the low yields in underdeveloped countries Applying this investment to an area of 1 5 billion acres would be the equivalent to adding at least 750 million acres to the crop areas of these countries, the equivalent of a continent bigger than North America. It is interesting to note that this primacy of fertilizers was recognized relatively late In this country, the recognition dates back only to World War II, and has accelerated since the Korean conflict In Japan, it dates back to 1950 or thereabout And the leaders of the U S S R only recently realized that a large-scale increase in fertilizer output would be easier and more rewarding than the extension of cultivation to the "virgin lands "

There are many other advances in agriculture that have yet to be applied on a large scale The identification of necessary trace elements and their incorporation into fertilizers and feeds have opened vast areas to cultivation and husbandry in Australia and elsewhere Selective breeding of plants and animals has permitted the development of species with superior hardiness and increased yields. In the greater part of the world such work has hardly begun Advances in animal health and nutrition have permitted the mass production of milk and eggs in indoor conditioners on a scale that was unimaginable a few years ago The city of Los Angeles, for instance, is now an important and efficient dairy area In some large installations, computers programmed to calculate the cheapest method of providing a diet of known energy and known content in ten essential amino acids, total protein, and other nutrients, automatically set the controls that will mix basic staples providing the cheapest adequate poultry diet as they are informed of the latest commodity prices Herbicides increase yields, pesticides prevent losses from rodents, insects, and fungi In many underdeveloped countries one quarter of the crop is lost before it reaches the consumer Certain methods of preservation of foods by radiation have just been approved by the Food and Drug Administration The control of weather by seeding clouds for rain, speeding cloud formation by heating lakes by atomic energy, the desalinization of brackish water by various methods, are entering the realm of practical feasibility

Powerful though these methods of "classical" agriculture are, I believe that they will, within the lifetime of most present inhabitants of this planet, be left far behind as methods of food production The general public is still unaware of some new developments, their promise, and the extent of the means likely to be expended in the next decade in bringing the results of research to practical application Large-scale manufacture of food from petro-chemicals started during World War II, when the Germans manufactured synthetic fats to feed forced labor groups These fats did not conform to desirable standards of taste or safety (they contained a high proportion of branched-chain fatty acids not normally found in nature and probably not fully metabolized, and retained a petroleum-like odor) After the war, interest in "synthetic" fats persisted for a while during the years when it appeared that a shortage of natural fats was likely to be protracted During the fifties, little or no work was done in this field, but recently some of the larger international oil companies have again become actively interested, and pilot plants are now in operation Fatty acids, triglycerides (the constituents of our common oils and fats), and fully metabolizable simpler compounds, such as 1,3-butanediol, may soon be manufactured at very low cost for human food and animal feeds While the promise of abundant and cheap atomic power, widely heralded for the morrow in the more immediate postwar period, has shown itself slow to be realized, it is coming, and it may well be that oil will be increasingly a raw material for food and plastics rather than a fuel

As a potential source of food production, photosynthesis can be used much more efficiently in algae than in higher plants With proper mineral fertilization and with the proper rate of removal of the finished products, one square meter may serve to support algae production sufficient to feed one man And a large proportion of the calories produced—as much as one half—are derived from protein, vitamins are also produced into the bargain. Several universities are working with a number of species, chlorella in particular, and large industrial firms are yearly becoming more interested. The problems entailed in passing from the theoretically feasible to the economically feasible are formidable, but their solution is likely to be hastened for an unexpected reason Interplanetary travel of long duration and the organization of distant stations require not only recycling of oxygen and waste water, they necessitate the fabrication of food and its integration into the recycling of oxygen, water, and excreta Over the next two decades, an increasing fraction of the several billion dollars that

the United States and the Soviet Union will spend every year for space travel is going to be channeled into life support systems. The money spent in the aggregate on new methods of food production will probably, during that period, dwarf the cost of the Manhattan Project In many ways, we may have in space exploration what William James called "the moral equivalent of war" We will probably also have in it the technological equivalent of war, without the corresponding losses in men and in resources The usable "fall-out" of such research is likely to be enormous Certainly if economical harnessing of photosynthesis, through biological units or directly, can be realized under the hostile interplanetary, lunar, or martial conditions, it should become relatively easy to put it into effect on earth All this is no longer science fiction It is as much of a reality as the federal income tax Obviously, a breakthrough in this field could for centuries altogether remove food as a limiting factor to population growth

I hope I have said enough to show how dangerous it may turn out to link the population problem so closely to food, as so many writers have done These have generally been conservationists and social scientists rather than agricultural or nutritional scientists, concerned—rightly—with the effects of crowding which they had observed At the same time, not sure that the public and governments would agree with them that there was cause for concern, and action, based on these grounds, they have turned to the threat of a worldwide shortage of food as an easily understood, imperative reason for a large-scale limitation of births Had they consulted nutritionists, agriculturists, and chemists, they might have chosen a more appropriate battleground For if we can feed an ever-increasing number of people—even if we feed them as badly as many of our contemporaries are fed—their argument fails And yet there is a need for the establishment as soon as possible of a sound population policy for the world at large

There is, of course, another good reason for not tying population control to food this tie eliminates from contention rich countries, and in particular surplus countries such as ours Our population is increasing faster than it ever has; our major nutrition problem is overweight, our major agricultural problem is our ever-mounting excess production. Does anyone seriously believe this means that we have no population problem? Our housing problems; our traffic problem; the insufficiency of the number of our hospitals, of community recreation facilities, our pollution problems, are all facets of our population problem I may add that in this country we compound the population problem by the migratory habits of our people from rural farm areas to urban areas and especially to "metropolitan" areas (212 such areas now have 84 per cent of our population), from low income areas to high income areas, from the East and Midwest to the South and Southwest; from all areas to the Pacific Coast, from the centers of cities to suburbs, which soon form gigantic conurbations, with circumstances everywhere pushing our Negroes into the deteriorating centers of large cities All this has occurred without any master plan, and with public services continually lagging behind both growth and migrations.

Let us conclude with one specific example 4 million students were enrolled in U.S colleges and graduate schools in 1960, 6 million in 1965 The Bureau of the Census estimates that 8 million will seek admission or continued enrollment in 1970; 10 in 1975; 12 in 1980 No one questions our ability to feed these youngsters But are we as a nation at all prepared for a near doubling of the size of our colleges and universities in 11 years?

Let us now examine the other argument, that in certain ways the rich countries are more immediately threatened by overpopulation A corollary of this is that the earth as an economic system has more to fear from the rich than from the poor, even if one forgets for a moment the threat of atomic or chemical warfare.

Consider some data from our own country We have already said that "crowding" is certainly one of the pictures we have in mind when we think of overpopulation The increased crowding of our cities and our conurbations has been referred to, but what of the great outdoors? In 1930 the number of visitor-days at our national parks was of the order of 3 million (for a population of 122 million), by 1950 it was 33 million (for a population of 151 million), by 1960 it was 79 million (for a population of 179 million), by 1967, 140 million (for a population of 200 million). State parks tell the same story a rise in visitor-days from 114 million in 1950 to 179 million in 1960, an increase in attendance of over 125 per cent for a rise in population of less than 20 per cent! Clearly, the increase in disposable income (and hence in means of

transportation and in leisure) becomes a much more important factor in crowding and lack of privacy than the rise in population

Not only does the countryside become more rapidly crowded when its inhabitants are rich, it also becomes rapidly uglier With increasing income, people stop drinking water as much as a result we spread 48 billion (rust proof) cans and 26 billion (nondegradable) bottles over our landscape every year We produce 800 million pounds of trash a day, a great deal of which ends up in our fields, our parks, and our forests. Only one third of the billion pounds of paper we use every year is reclaimed Nine million cars, trucks, and buses are abandoned every year, and while many of them are used as scrap, a large though undetermined number are left to disintegrate slowly in backyards, in fields and woods, and on the sides of highways The eight billion pounds of plastics we use every year are nondegradable materials And many of our states are threatened with an even more pressing shortage of water, not because of an increased consumption of drinking fluid by the increasing population, but because people are getting richer and using more water for air-conditioning, swimming pools, and vastly expanded metal and chemical industries

That the air is getting crowded much more rapidly than the population is increasing is again an illustration that increase in the disposable income is perhaps more closely related to our own view of "overpopulation" than is the population itself. From 1940 to 1967 the number of miles flown has gone from 264 million to 3,334 billion (and the fuel consumed from 22 to 512 million gallons) The very air waves are crowded the increase in citizen-licensees from 126 thousand to 848 thousand in the brief 1960-67 interval is again an excellent demonstration of the very secondary role of the population increase in the new overpopulation I believe that as the disposable income rises throughout the world in general, the population pressure due to riches will become as apparent as that due to poverty

I trust that I have demonstrated how dangerous it is to link constantly in the mind of the public the concept of overpopulation with that of undernutrition I believe that it is dangerous to link it necessarily with poverty It is absurd on the basis of any criterion of history, economics, or esthetics. Some countries are poor and densely populated A few countries are poor and so sparsely populated that economic development (e g road-building, creation of markets) becomes very difficult It is easy to demonstrate that a couple with many children will be unable to save and invest It is perhaps also true that, as the comparison to nineteenth-century France, England, and Germany suggests, at a certain stage of development, too low a birth rate (as in France then) decreases the ambition and labor of part of the population so that the savings expected from the decreased birth rate never materialize (Losing wars because of a smaller population and having to pay a heavy tribute, as happened to the French at the conclusion of 1870-71 war, also nullified this advantage). The fact is that we are not yet in one world and that while in general it is true that population increases make improvement in nutrition and in delivery of social services more difficult, the relation of changes in wealth to changes in population has to be examined in each area on its own merits.

We have seen, furthermore, that there is more to the problem of population than the decrease in income consequent to overpopulation We have seen that the increase in disposable income creates a population problem that is becoming every day more acute. The ecology of the earth—its streams, woods, animals—can accommodate itself better to a rising *poor* population than to a rising *rich* population. Indeed, to save the ecology the population will have to decrease as the disposable income increases If we believe, like Plato and Aristotle, in trying for excellence rather than in rejoicing in numbers, we need a population policy now, for the rich as well as the poor. Excellent human beings will not be produced without abundance of cultural as well as material resources and, I believe, without sufficient space We are likely to run out of certain metals before we run out of food, of paper before we run out of metals And we are running out of clear streams, pure air, and the familiar sights of Nature while we still have the so-called "essentials" of life. Shall we continue to base the need for a population policy on a nutritional disaster to occur at some hypothetical date, when it is clear that the problem is here, now, for us as well as for others? Shall we continue to hide the fact that a rational policy may entail in many countries not only a plateauing of the population to permit an increase in disposable income, but a decrease of the population as the disposable income rises?

between two states having the same isotopic spin. In fact, the giant resonance in a non-self-conjugate nucleus should split into two parts—one with the isotopic spin of the ground state (written $T_<$), the other with one unit more of isotopic spin ($T_>$). The part with $T_<$ can be fed by alpha capture, and thus the selection rules of isotopic spin permit observation of the giant resonance. However, as shown in Fig. 9, the yield from the $Si^{30}(\gamma,\alpha_0)Mg^{26}$ reaction, the inverse of the $Mg^{26}(\alpha,\gamma)$, is even less than for the isotopic-spin-forbidden $Si^{28}(\gamma,\alpha_0)Mg^{24}$ reaction. This fact shows that it is not the selection rules of isotopic spin that inhibit alpha capture through the giant resonance.

Summary and Conclusions

The data on radiative capture through the giant resonance have led to a model in which the capture is pictured as proceeding through a single broad (and therefore short-lived) state that can be called the giant-resonance state. This state is the one formed directly upon capture of a proton, and hence most of the capture radiation is emitted quickly in the direct-interaction mode. Some of the energy that is contained in the giant-resonance state is shared with the more-complicated states of the compound nucleus (that is, with states having many excited nucleons). This sharing, in turn, gives rise to the fine structure that is observed within the giant-resonance envelope. The constant angular distributions that are observed throughout the giant-resonance region support the single-state picture of the giant resonance.

The simple model appears to account for the main features of the data, and at least qualitatively accounts for the variation in yield for proton capture through various giant resonances. Further information about the giant-resonance state is obtained from the alpha-capture data and from the characteristic angular distributions of the various gamma rays. However, there remains the difficulty that the shell-model picture predicts a varying angular distribution—contradicting the experimental result. Work in this field is being continued in the hope of resolving this difficulty, and of extending the model to provide a more complete picture of this important nuclear phenomenon.

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Population Policy: Will Current Programs Succeed?

Grounds for skepticism concerning the demographic effectiveness of family planning are considered.

Kingsley Davis

Throughout history the growth of population has been identified with prosperity and strength. If today an increasing number of nations are seeking to curb rapid population growth by reducing their birth rates, they must be driven to do so by an urgent crisis. My purpose here is not to discuss the crisis itself but rather to assess the present and prospective measures used to meet it. Most observers are surprised by the swiftness with which concern over the population problem has turned from intellectual analysis and debate to policy and action. Such action is a welcome relief from the long opposition, or timidity, which seemed to block forever any governmental attempt to restrain population growth, but relief that "at last something is being done" is no guarantee that what is being done is adequate. On the face of it, one could hardly expect such a fundamental reorientation to be quickly and successfully implemented. I therefore propose to review the nature and (as I see them) limitations of the present policies and to suggest lines of possible improvement.

The Nature of Current Policies

With more than 30 nations now trying or planning to reduce population growth and with numerous private and international organizations helping, the degree of unanimity as to the kind of measures needed is impressive. The consensus can be summed up in the phrase "family planning." President Johnson declared in 1965 that the United States will "assist family planning programs in nations which request such help." The Prime Minister of India

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said a year later, "We must press forward with family planning This is a programme of the highest importance" The Republic of Singapore created in 1966 the Singapore Family Planning and Population Board "to initiate and undertake population control programmes" (*1*).

As is well known "family planning" is a euphemism for contraception The family-planning approach to population limitation, therefore, concentrates on providing new and efficient contraceptives on a national basis through mass programs under public health auspices The nature of these programs is shown by the following enthusiastic report from the Population Council (*2*)

> No single year has seen so many forward steps in population control as 1965 Effective national programs have at last emerged, international organizations have decided to become engaged, a new contraceptive has proved its value in mass application, . . . and surveys have confirmed a popular desire for family limitation.
>
> An accounting of notable events must begin with Korea and Taiwan Taiwan's program is not yet two years old, and already it has inserted one IUD [intrauterine device] for every 4-6 target women (those who are not pregnant, lactating, already sterile, already using contraceptives effectively, or desirous of more children). Korea has done almost as well . . has put 2,200 full-time workers into the field, has reached operational levels for a network of IUD quotas, supply lines, local manufacture of contraceptives, training of hundreds of M.D 's and nurses, and mass propaganda

Here one can see the implication that "population control" is being achieved through the dissemination of new contraceptives, and the fact that the "target women" exclude those who want more children One can also note the technological emphasis and the medical orientation

What is wrong with such programs? The answer is, "Nothing at all, if they work" Whether or not they work depends on what they are expected to do as well as on how they try to do it Let us discuss the goal first, then the means

Goals

Curiously, it is hard to find in the population-policy movement any explicit discussion of long-range goals By implication the policies seem to promise a great deal This is shown by the use of expressions like *population control* and *population planning* (as in the passages quoted above) It is also shown by the characteristic style of reasoning Expositions of current policy usually start off by lamenting the speed and the consequences of runaway population growth This growth, it is then stated, must be curbed—by pursuing a vigorous family-planning program That family planning can solve the problem of population growth seems to be taken as self-evident

For instance, the much-heralded statement by 12 heads of state, issued by Secretary-General U Thant on 10 December 1966 (a statement initiated by John D Rockefeller III, Chairman of the Board of the Population Council), devotes half its space to discussing the harmfulness of population growth and the other half to recommending family planning (*3*) A more succinct example of the typical reasoning is given in the Provisional Scheme for a Nationwide Family Planning Programme in Ceylon (*4*).

> The population of Ceylon is fast increasing [The] figures reveal that a serious situation will be created within a few years In order to cope with it a Family Planning programme on a nationwide scale should be launched by the Government

The promised goal—to limit population growth so as to solve population problems—is a large order. One would expect it to be carefully analyzed, but it is left imprecise and taken for granted, as is the way in which family planning will achieve it.

When the terms *population control* and *population planning* are used, as they frequently are, as synonyms for current family-planning programs, they are misleading Technically, they would mean deliberate influence over all attributes of a population, including its age-sex structure, geographical distribution, racial composition, genetic quality, and total size No government attempts such full control By tacit understanding, current population policies are concerned with only the *growth* and *size* of populations These attributes, however, result from the death rate and migration as well as from the birth rate, their control would require deliberate influence over the factors giving rise to all three determinants. Actually, current policies labeled population control do not deal with mortality and migration, but deal only with the birth input This is way another term, *fertility control,* is frequently used to describe current policies But, as I show below, family planning (and hence current policy) does not undertake to influence most of the determinants of human reproduction. Thus the programs should not be referred to as population control or planning, because they do not attempt to influence the factors responsible for the attributes of human populations, taken generally, nor should they be called fertility control, because they do not try to affect most of the determinants of reproductive performance

The ambiguity does not stop here, however When one speaks of controlling population size, any inquiring person naturally asks, What is "control"? Who is to control whom? Precisely what population size, or what rate of population growth, is to be achieved? Do the policies aim to produce a growth rate that is nil, one that is very slight, or one that is like that of the industrial nations? Unless such questions are dealt with and clarified, it is impossible to evaluate current population policies

The actual programs seem to be aiming simply to achieve a reduction in the birth rate Success is therefore interpreted as the accomplishment of such a reduction, on the assumption that the reduction will lessen population growth In those rare cases where a specific demographic aim is stated, the goal is said to be a short-run decline within a given period. The Pakistan plan adopted in 1966 (*5*, p. 889) aims to reduce the birth rate from 50 to 40 per thousand by 1970, the Indian plan (*6*) aims to reduce the rate from 40 to 25 "as soon as possible"; and the Korean aim (*7*) is to cut population growth from 2 9 to 1 2 percent by 1980 A significant feature of such stated aims is the rapid population growth they would permit. Under conditions of modern mortality, a crude birth rate of 25 to 30 per thousand will represent such a multiplication of people as to make use of the term *population control* ironic A rate of increase of 1 2 percent per year would allow South Korea's already dense population to double in less than 60 years.

One can of course defend the programs by saying that the present goals and measures are merely interim ones. A start must be made somewhere. But we do not find this answer in the population-policy literature. Such a defense, if convincing, would require a presentation of the *next* steps, and these are not considered. One suspects that the entire question of goals is instinctively left vague because thorough limitation of population growth would run counter

to national and group aspirations A consideration of hypothetical goals throws further light on the matter

Industrialized nations as the model. Since current policies are confined to family planning, their maximum demographic effect would be to give the underdeveloped countries the same level of reproductive performance that the industrial nations now have. The latter, long oriented toward family planning, provide a good yardstick for determining what the availability of contraceptives can do to population growth Indeed, they provide more than a yardstick, they are actually the model which inspired the present population policies

What does this goal mean in practice? Among the advanced nations there is considerable diversity in the level of fertility *(8)* At one extreme are countries such as New Zealand, with an average gross reproduction rate (GRR) of 1 91 during the period 1960–64, at the other extreme are countries such as Hungary, with a rate of 0 91 during the same period To a considerable extent, however, such divergencies are matters of timing The birth rates of most industrial nations have shown, since about 1940, a wavelike movement, with no secular trend The average level of reproduction during this long period has been high enough to give these countries, with their low mortality, an extremely rapid population growth If this level is maintained, their population will double in just over 50 years—a rate higher than that of world population growth at any time prior to 1950, at which time the growth in numbers of human beings was already considered fantastic The advanced nations are suffering acutely from the effects of rapid population growth in combination with the production of ever more goods per person *(9)*. A rising share of their supposedly high per capita income, which itself draws increasingly upon the resources of the underdeveloped countries (who fall farther behind in relative economic position), is spent simply to meet the costs, and alleviate the nuisances, of the unrelenting production of more and more goods by more people Such facts indicate that the industrial nations provide neither a suitable demographic model for the nonindustrial peoples to follow nor the leadership to plan and organize effective population-control policies for them

Zero population growth as a goal Most discussions of the population crisis lead logically to zero population growth as the ultimate goal, because *any* growth rate, if continued, will eventually use up the earth Yet hardly ever do arguments for population policy consider such a goal, and current policies do not dream of it. Why not? The answer is evidently that zero population growth is unacceptable to most nations and to most religious and ethnic communities To argue for this goal would be to alienate possible support for action programs.

Goal peculiarities inherent in family planning Turning to the actual measures taken, we see that the very use of family planning as the means for implementing population policy poses serious but unacknowledged limits on the intended reduction in fertility The family-planning movement, clearly devoted to the improvement and dissemination of contraceptive devices, states again and again that its purpose is that of enabling couples to have the number of children they want. "The opportunity to decide the number and spacing of children is a basic human right," say the 12 heads of state in the United Nations declaration The 1965 Turkish Law Concerning Population Planning declares *(10)*

> *Article 1* Population Planning means that individuals can have as many children as they wish, whenever they want to. This can be ensured through preventive measures taken against pregnancy. . . .

Logically, it does not make sense to use *family* planning to provide *national* population control or planning. The "planning" in family planning is that of each separate couple The only control they exercise is control over the size of *their* family Obviously, couples do not plan the size of the nation's population, any more than they plan the growth of the national income or the form of the highway network There is no reason to expect that the millions of decisions about family size made by couples in their own interest will automatically control population for the benefit of society On the contrary, there are good reasons to think they will not do so At most, family planning can reduce reproduction to the extent that unwanted births exceed wanted births. In industrial countries the balance is often negative—that is, people have fewer children as a rule than they would like to have In underdeveloped countries the reverse is normally true, but the elimination of unwanted births would still leave an extremely high rate of multiplication

Actually, the family-planning movement does not pursue even the limited goals it professes. It does not fully empower couples to have only the number of offspring they want because it either condemns or disregards certain tabooed but nevertheless effective means to this goal One of its tenets is that "there shall be freedom of choice of method so that individuals can choose in accordance with the dictates of their consciences" *(11)*, but in practice this amounts to limiting the individual's choice, because the "conscience" dictating the method is usually not his but that of religious and governmental officials Moreover, not every individual may choose: even the so-called recommended methods are ordinarily not offered to single women, or not all offered to women professing a given religious faith.

Thus, despite its emphasis on technology, current policy does not utilize all available means of contraception, much less all birth-control measures. The Indian government wasted valuable years in the early stages of its population-control program by experimenting exclusively with the "rhythm" method, long after this technique had been demonstrated to be one of the least effective. A greater limitation on means is the exclusive emphasis on contraception itself Induced abortion, for example, is one of the surest means of controlling reproduction, and one that has been proved capable of reducing birth rates rapidly It seems peculiarly suited to the threshold stage of a population-control program—the stage when new conditions of life first make large families disadvantageous. It was the principal factor in the halving of the Japanese birth rate, a major factor in the declines in birth rate of East-European satellite countries after legalization of abortions in the early 1950's, and an important factor in the reduction of fertility in industrializing nations from 1870 to the 1930's *(12)*. Today, according to *Studies in Family Planning (13)*, "abortion is probably the foremost method of birth control throughout Latin America." Yet this method is rejected in nearly all national and international population-control programs. American foreign aid is used to help *stop* abortion *(14)* The United Nations excludes abortion from family planning, and in fact justifies the latter by presenting it as a means of combating abortion *(15)*

Studies of abortion are being made in Latin America under the presumed auspices of population-control groups, not with the intention of legalizing it and thus making it safe, cheap, available, and hence more effective for population control, but with the avowed purpose of reducing it (*16*)

Although few would prefer abortion to efficient contraception (other things being equal), the fact is that both permit a woman to control the size of her family The main drawbacks to abortion arise from its illegality When performed, as a legal procedure, by a skilled physician, it is safer than childbirth It does not compete with contraception but serves as a backstop when the latter fails or when contraceptive devices or information are not available As contraception becomes customary, the incidence of abortion recedes even without its being banned If, therefore, abortions enable women to have only the number of children they want, and if family planners do not advocate—in fact decry—legalization of abortion, they are to that extent denying the central tenet of their own movement The irony of anti-abortionism in family-planning circles is seen particularly in hair-splitting arguments over whether or not some contraceptive agent (for example, the IUD) is in reality an abortifacient A Mexican leader in family planning writes (*17*),

> One of the chief objectives of our program in Mexico is to prevent abortions If we could be sure that the mode of action [of the IUD] was not interference with nidation, we could easily use the method in Mexico

The questions of sterilization and unnatural forms of sexual intercourse usually meet with similar silent treatment or disapproval, although nobody doubts the effectiveness of these measures in avoiding conception Sterilization has proved popular in Puerto Rico and has had some vogue in India (where the new health minister hopes to make it compulsory for those with a certain number of children), but in both these areas it has been for the most part ignored or condemned by the family-planning movement

On the side of goals, then, we see that a family-planning orientation limits the aims of current population policy Despite reference to "population control" and "fertility control," which presumably mean determination of demographic results by and for the nation as a whole, the movement gives control only to couples, and does this only if they use "respectable" contraceptives.

The Neglect of Motivation

By sanctifying the doctrine that each woman should have the number of children she wants, and by assuming that if she has only that number this will automatically curb population growth to the necessary degree, the leaders of current policies escape the necessity of asking why women desire so many children and how this desire can be influenced (*18*, p 41, *19*) Instead, they claim that satisfactory motivation is shown by the popular desire (shown by opinion surveys in all countries) to have the means of family limitation, and that therefore the problem is one of inventing and distributing the best possible contraceptive devices Overlooked is the fact that a desire for availability of contraceptives is compatible with *high* fertility

Given the best of means, there remain the questions of how many children couples want and of whether this is the requisite number from the standpoint of population size That it is not is indicated by continued rapid population growth in industrial countries, and by the very surveys showing that people want contraception—for these show, too, that people also want numerous children

The family planners do not ignore motivation They are forever talking about "attitudes" and "needs" But they pose the issue in terms of the "acceptance" of birth control devices At the most naive level, they assume that lack of acceptance is a function of the contraceptive device itself This reduces the motive problem to a technological question The task of population control then becomes simply the invention of a device that *will* be acceptable (*20*) The plastic IUD is acclaimed because, once in place, it does not depend on repeated *acceptance* by the woman, and thus it "solves" the problem of motivation (*21*).

But suppose a woman does not want to use *any* contraceptive until after she has had four children This is the type of question that is seldom raised in the family-planning literature In that literature, wanting a specific number of children is taken as complete motivation, for it implies a wish to control the size of one's family The problem woman, from the standpoint of family planners, is the one who wants "as many as come," or "as many as God sends" Her attitude is construed as due to ignorance and "cultural values," and the policy deemed necessary to change it is "education" No compulsion can be used, because the movement is committed to free choice, but movie strips, posters, comic books, public lectures, interviews, and discussions are in order These supply information and supposedly change values by discounting superstitions and showing that unrestrained procreation is harmful to both mother and children. The effort is considered successful when the woman decides she wants only a certain number of children and uses an effective contraceptive

In viewing negative attitudes toward birth control as due to ignorance, apathy, and outworn tradition, and "mass-communication" as the solution to the motivation problem (*22*), family planners tend to ignore the power and complexity of social life If it were admitted that the creation and care of new human beings is socially motivated, like other forms of behavior, by being a part of the system of rewards and punishments that is built into human relationships, and thus is bound up with the individual's economic and personal interests, it would be apparent that the social structure and economy must be changed before a deliberate reduction in the birth rate can be achieved As it is, reliance on family planning allows people to feel that "something is being done about the population problem" without the need for painful social changes

Designation of population control as a medical or public health task leads to a similar evasion This categorization assures popular support because it puts population policy in the hands of respected medical personnel, but, by the same token, it gives responsibility for leadership to people who think in terms of clinics and patients, of pills and IUD's, and who bring to the handling of economic and social phenomena a self-confident naiveté The study of social organization is a technical field, an action program based on intuition is no more apt to succeed in the control of human beings than it is in the area of bacterial or viral control Moreover, to alter a social system, by deliberate policy, so as to regulate births in accord with the demands of the collective welfare would require political power, and

this is not likely to inhere in public health officials, nurses, midwives, and social workers To entrust population policy to them is "to take action," but not dangerous "effective action"

Similarly, the Janus-faced position on birth-control technology represents an escape from the necessity, and onus, of grappling with the social and economic determinants of reproductive behavior On the one side, the rejection or avoidance of religiously tabooed but otherwise effective means of birth prevention enables the family-planning movement to avoid official condemnation On the other side, an intense preoccupation with contraceptive technology (apart from the tabooed means) also helps the family planners to avoid censure By implying that the only need is the invention and distribution of effective contraceptive devices, they allay fears, on the part of religious and governmental officials, that fundamental changes in social organization are contemplated Changes basic enough to affect motivation for having children would be changes in the structure of the family, in the position of women, and in the sexual mores Far from proposing such radicalism, spokesmen for family planning frequently state their purpose as "protection" of the family—that is, closer observance of family norms. In addition, by concentrating on *new* and *scientific* contraceptives, the movement escapes taboos attached to old ones (the Pope will hardly authorize the condom, but may sanction the pill) and allows family planning to be regarded as a branch of medicine overpopulation becomes a disease, to be treated by a pill or a coil

We thus see that the inadequacy of current population policies with respect to motivation is inherent in their overwhelmingly family-planning character Since family planning is by definition private planning, it eschews any societal control over motivation It merely furnishes the means, and, among possible means, only the most respectable Its leaders, in avoiding social complexities and seeking official favor, are obviously activated not solely by expediency but also by their own sentiments as members of society and by their background as persons attracted to the family-planning movement Unacquainted for the most part with technical economics, sociology, and demography, they tend honestly and instinctively to believe that something they vaguely call population control can be achieved by making better contraceptives available.

The Evidence of Ineffectiveness

If this characterization is accurate, we can conclude that current programs will not enable a government to control population size In countries where couples have numerous offspring that they do not want, such programs may possibly accelerate a birth-rate decline that would occur anyway, but the conditions that cause births to be wanted or unwanted are beyond the control of family planning, hence beyond the control of any nation which relies on family planning alone as its population policy

This conclusion is confirmed by demographic facts As I have noted above, the widespread use of family planning in industrial countries has not given their governments control over the birth rate In backward countries today, taken as a whole, birth rates are rising, not falling, in those with population policies, there is no indication that the government is controlling the rate of reproduction The main "successes" cited in the well-publicized policy literature are cases where a large number of contraceptives have been distributed or where the program has been accompanied by some decline in the birth rate Popular enthusiasm for family planning is found mainly in the cities, or in advanced countries such as Japan and Taiwan, where the people would adopt contraception in any case, program or no program It is difficult to prove that present population policies have even speeded up a lowering of the birth rate (the least that could have been expected), much less that they have provided national "fertility control."

Let us next briefly review the facts concerning the level and trend of population in underdeveloped nations generally, in order to understand the magnitude of the task of genuine control.

Rising Birth Rates in Underdeveloped Countries

In ten Latin-American countries, between 1940 and 1959 (*23*), the average birth rates (age-standardized), as estimated by our research office at the University of California, rose as follows: 1940–44, 43 4 annual births per 1000 population, 1945–49, 44 6, 1950–54, 46 4, 1955–59, 47 7

In another study made in our office, in which estimating methods derived from the theory of quasi-stable populations were used, the recent trend was found to be upward in 27 underdeveloped countries, downward in six, and unchanged in one (*24*) Some of the rises have been substantial, and most have occurred where the birth rate was already extremely high For instance, the gross reproduction rate rose in Jamaica from 1 8 per thousand in 1947 to 2 7 in 1960, among the natives of Fiji, from 2 0 in 1951 to 2 4 in 1964; and in Albania, from 3 0 in the period 1950–54 to 3 4 in 1960

The general rise in fertility in backward regions is evidently not due to failure of population-control efforts, because most of the countries either have no such effort or have programs too new to show much effect Instead, the rise is due, ironically, to the very circumstance that brought on the population crisis in the first place—to improved health and lowered mortality Better health increases the probability that a woman will conceive and retain the fetus to term, lowered mortality raises the proportion of babies who survive to the age of reproduction and reduces the probability of widowhood during that age (*25*) The significance of the general rise in fertility, in the context of this discussion, is that it is giving would-be population planners a harder task than many of them realize Some of the upward pressure on birth rates is independent of what couples do about family planning, for it arises from the fact that, with lowered mortality, there are simply more couples.

Underdeveloped Countries with Population Policies

In discussions of population policy there is often confusion as to which cases are relevant Japan, for instance, has been widely praised for the effectiveness of its measures, but it is a very advanced industrial nation and, besides, its government policy had little or nothing to do with the decline in the birth rate, except unintentionally. It therefore offers no test of population policy under peasant-agrarian conditions Another case of questionable relevance is that of Taiwan, because Taiwan is sufficiently developed to be placed in the urban-industrial class of nations However, since Taiwan is offered as the main showpiece by the sponsors of current policies in underdeveloped areas, and since the data are excellent, it merits examination

Taiwan is acclaimed as a showpiece

Table 1 Decline in Taiwan's fertility rate, 1951 through 1966

Year	Registered births per 1000 women aged 15–49	Change in rate (percent)*
1951	211	
1952	198	−5 6
1953	194	−2 2
1954	193	−0 5
1955	197	+2 1
1956	196	−0 4
1957	182	−7 1
1958	185	+1 3
1959	184	−0 1
1960	180	−2 5
1961	177	−1.5
1962	174	−1 5
1963	170	−2 6
1964	162	−4 9
1965	152	−6 0
1966	149	−2 1

* The percentages were calculated on unrounded figures Source of data through 1965 *Taiwan* Demographic Fact Book (1964, 1965), for 1966 *Monthly Bulletin of Population Registration Statistics of Taiwan* (1966, 1967)

because it has responded favorably to a highly organized program for distributing up-to-date contraceptives and has also had a rapidly dropping birth rate. Some observers have carelessly attributed the decline in the birth rate —from 50 0 in 1951 to 32 7 in 1965— to the family-planning campaign (*26*), but the campaign began only in 1963 and could have affected only the end of the trend Rather, the decline represents a response to modernization similar to that made by all countries that have become industrialized (*27*) By 1950 over half of Taiwan's population was urban, and by 1964 nearly two-thirds were urban, with 29 percent of the population living in cities of 100,000 or more The pace of economic development has been extremely rapid Between 1951 and 1963, per capita income increased by 4 05 percent per year Yet the island is closely packed, having 870 persons per square mile (a population density higher than that of Belgium) The combination of fast economic growth and rapid population increase in limited space has put parents of large families at a relative disadvantage and has created a brisk demand for abortions and contraceptives Thus the favorable response to the current campaign to encourage use of the IUD is not a good example of what birth-control technology can do for a genuinely backward country In fact, when the program was started, one reason for expecting receptivity was that the island was already on its way to modernization and family planning (*28*)

At most, the recent family-planning campaign—which reached significant proportions only in 1964, when some 46,000 IUD's were inserted (in 1965 the number was 99,253, and in 1966, 111,242) (*29*, *30*, p 45)—could have caused the increase observable after 1963 in the rate of decline Between 1951 and 1963 the average drop in the birth rate per 1000 women (see Table 1) was 1 73 percent per year, in the period 1964–66 it was 4 35 percent But one hesitates to assign all of the acceleration in decline since 1963 to the family-planning campaign The rapid economic development has been precisely of a type likely to accelerate a drop in reproduction The rise in manufacturing has been much greater than the rise in either agriculture or construction The agricultural labor force has thus been squeezed, and migration to the cities has skyrocketed (*31*) Since housing has not kept pace, urban families have had to restrict reproduction in order to take advantage of career opportunities and avoid domestic inconvenience Such conditions have historically tended to accelerate a decline in birth rate The most rapid decline came late in the United States (1921–33) and in Japan (1947–55) A plot of the Japanese and Taiwanese birth rates (Fig 1) shows marked similarity of the two curves, despite a difference in level All told, one should not attribute all of the post-1963 acceleration in the decline of Taiwan's birth rate to the family-planning campaign

The main evidence that *some* of this acceleration is due to the campaign comes from the fact that Taichung, the city in which the family-planning effort was first concentrated, showed subsequently a much faster drop in fertility than other cities (*30*, p 69, *32*) But the campaign has not reached throughout the island By the end of 1966, only 260,745 women had been fitted with an IUD under auspices of the campaign, whereas the women of reproductive age on the island numbered 2 86 million Most of the reduction in fertility has therefore been a matter of individual initiative To some extent the campaign may be simply substituting sponsored (and cheaper) services for those that would otherwise come through private and commercial channels An island-wide survey in 1964 showed that over 150,000 women were already using the traditional Ota ring (a metallic intrauterine device popular in Japan), almost as many had been sterilized, about 40 000 were using foam tablets; some 50 000 admitted to having had at least one abortion, and

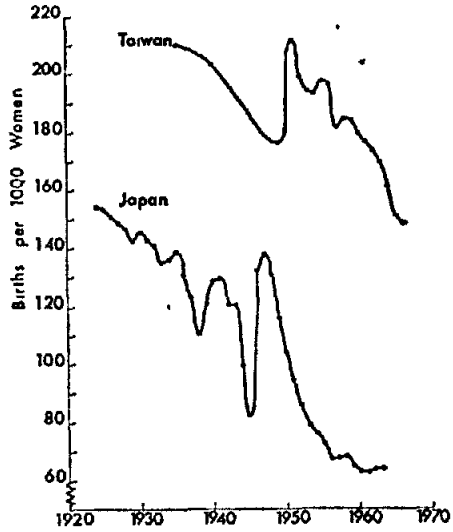

Fig. 1 Births per 1000 women aged 15 through 49 in Japan and Taiwan

many were using other methods of birth control (*30*, pp. 18, 31).

The important question, however, is not whether the present campaign is somewhat hastening the downward trend in the birth rate but whether, even if it is, it will provide population control for the nation Actually, the campaign is not designed to provide such control and shows no sign of doing so It takes for granted existing reproductive goals Its aim is "to integrate, through education and information, the idea of family limitation *within the existing attitudes, values, and goals* of the people" [*30*, p. 8 (italics mine)]. Its target is *married* women who do not want any more children; it ignores girls not yet married, and women married and wanting more children

With such an approach, what is the maximum impact possible? It is the difference between the number of children women have been having and the number they want to have A study in 1957 found a median figure of 3 75 for the number of children wanted by women aged 15 to 29 in Taipei, Taiwan's largest city, the corresponding figure for women from a satellite town was 3 93, for women from a fishing village, 4 90, and for women from a farming village, 5.03 Over 60 percent of the women in Taipei and over 90 percent of those in the farming village wanted 4 or more children (*33*). In a sample of wives aged 25 to 29 in Taichung, a city of over 300,000, Freedman and his co-workers found the average number of children wanted was 4, only 9 percent wanted less than 3, 20 percent wanted 5 or more (*34*) If, therefore, Taiwanese women used

contraceptives that were 100-percent effective and had the number of children they desire, they would have about 4.5 each. The goal of the family-planning effort would be achieved. In the past the Taiwanese woman who married and lived through the reproductive period had, on the average, approximately 6.5 children, thus a figure of 4.5 would represent a substantial decline in fertility. Since mortality would continue to decline, the population growth rate would decline somewhat less than individual reproduction would. With 4.5 births per woman and a life expectancy of 70 years, the rate of natural increase would be close to 3 percent per year (*35*).

In the future, Taiwanese views concerning reproduction will doubtless change, in response to social change and economic modernization. But how far will they change? A good indication is the number of children desired by couples in an already modernized country long oriented toward family planning. In the United States in 1966, an average of 3.4 children was considered ideal by white women aged 21 or over (*36*). This average number of births would give Taiwan, with only a slight decrease in mortality, a long-run rate of natural increase of 1.7 percent per year and a doubling of population in 41 years.

Detailed data confirm the interpretation that Taiwanese women are in the process of shifting from a "peasant-agrarian" to an "industrial" level of reproduction. They are, in typical fashion, cutting off higher-order births at age 30 and beyond (*37*). Among young wives, fertility has risen, not fallen. In sum, the widely acclaimed family-planning program in Taiwan may, at most, have somewhat speeded the later phase of fertility decline which would have occurred anyway because of modernization.

Moving down the scale of modernization, to countries most in need of population control, one finds the family-planning approach even more inadequate. In South Korea, second only to Taiwan in the frequency with which it is cited as a model of current policy, a recent birth-rate decline of unknown extent is assumed by leaders to be due overwhelmingly to the government's family-planning program. However, it is just as plausible to say that the net effect of government involvement in population control has been, so far, to delay rather than hasten a decline in reproduction made inevitable by social and economic changes. Although the government is advocating vasectomies and providing IUD's and pills, it refuses to legalize abortions, despite the rapid rise in the rate of illegal abortions and despite the fact that, in a recent survey, 72 percent of the people who stated an opinion favored legalization. Also, the program is presented in the context of maternal and child health; it thus emphasizes motherhood and the family rather than alternative roles for women. Much is made of the fact that opinion surveys show an overwhelming majority of Koreans (89 percent in 1965) favoring contraception (*38*, p. 27), but this means only that Koreans are like other people in wishing to have the means to get what they want. Unfortunately, they want sizable families. "The records indicate that the program appeals mainly to women in the 30–39 year age bracket who have four or more children, including at least two sons . . ." (*38*, p. 25).

In areas less developed than Korea the degree of acceptance of contraception tends to be disappointing, especially among the rural majority. Faced with this discouragement, the leaders of current policy, instead of reexamining their assumptions, tend to redouble their effort to find a contraceptive that will appeal to the most illiterate peasant, forgetting that he wants a good-sized family. In the rural Punjab, for example, "a disturbing feature . . . is that the females start to seek advice and adopt family planning techniques at the fag end of their reproductive period" (*39*). Among 5196 women coming to rural Punjabi family-planning centers, 38 percent were over 35 years old, 67 percent over 30. These women had married early, nearly a third of them before the age of 15 (*40*); some 14 percent had eight or more *living* children when they reached the clinic, 51 percent six or more.

A survey in Tunisia showed that 68 percent of the married couples were willing to use birth-control measures, but the average number of children they considered ideal was 4.3 (*41*). The corresponding averages for a village in eastern Java, a village near New Delhi, and a village in Mysore were 4.3, 4.0, and 4.2, respectively (*42*, *43*). In the cities of these regions women are more ready to accept birth control and they want fewer children than village women do, but the number they consider desirable is still wholly unsatisfactory from the standpoint of population control. In an urban family-planning center in Tunisia, more than 600 of 900 women accepting contraceptives had four living children already (*44*). In Bangalore, a city of nearly a million at the time (1952), the number of offspring desired by married women was 3.7 on the average, by married men, 4.1 (*43*). In the metropolitan area of San Salvador (350,000 inhabitants) a 1964 survey (*45*) showed the number desired by women of reproductive age to be 3.9, and in seven other capital cities of Latin America the number ranged from 2.7 to 4.2. If women in the cities of underdeveloped countries used birth-control measures with 100-percent efficiency, they still would have enough babies to expand city populations senselessly, quite apart from the added contribution of rural-urban migration. In many of the cities the difference between actual and ideal number of children is not great, for instance, in the seven Latin-American capitals mentioned above, the ideal was 3.4 whereas the actual births per women in the age range 35 to 39 was 3.7 (*46*). Bombay City has had birth-control clinics for many years, yet its birth rate (standardized for age, sex, and marital distribution) is still 34 per 1000 inhabitants and is tending to rise rather than fall. Although this rate is about 13 percent lower than that for India generally, it has been about that much lower since at least 1951 (*47*).

Is Family Planning the "First Step" in Population Control?

To acknowledge that family planning does not achieve population control is not to impugn its value for other purposes. Freeing women from the need to have more children than they want is of great benefit to them and their children and to society at large. My argument is therefore directed not against family-planning programs as such, but against the assumption that they are an effective means of controlling population growth.

But what difference does it make? Why not go along for awhile with family planning as an initial approach to the problem of population control? The answer is that any policy on which millions of dollars are being spent should be designed to achieve the goal it purports to achieve. If it is only a first step, it should be so labeled, and its connection with the next step (and the nature of that next step) should be carefully examined. In the present case,

since no "next step" seems ever to be mentioned, the question arises: Is reliance on family planning in fact a basis for dangerous postponement of effective steps? To continue to offer a remedy as a cure long after it has been shown merely to ameliorate the disease is either quackery or wishful thinking, and it thrives most where the need is greatest. Today the desire to solve the population problem is so intense that we are all ready to embrace any "action program" that promises relief. But postponement of effective measures allows the situation to worsen.

Unfortunately, the issue is confused by a matter of semantics. "Family *planning*" and "fertility *control*" suggest that reproduction is being regulated according to some rational plan. And so it is, but only from the standpoint of the individual couple, not from that of the community. What is rational in the light of a couple's situation may be totally irrational from the standpoint of society's welfare.

The need for societal regulation of individual behavior is readily recognized in other spheres—those of explosives, dangerous drugs, public property, natural resources. But in the sphere of reproduction, complete individual initiative is generally favored even by those liberal intellectuals who, in other spheres, most favor economic and social planning. Social reformers who would not hesitate to force all owners of rental property to rent to anyone who can pay, or to force all workers in an industry to join a union, balk at any suggestion that couples be permitted to have only a certain number of offspring. Invariably they interpret societal control of reproduction as meaning direct police supervision of individual behavior. Put the word *compulsory* in front of any term describing a means of limiting births—*compulsory sterilization, compulsory abortion, compulsory contraception*—and you guarantee violent opposition. Fortunately, such direct controls need not be invoked, but conservatives and radicals alike overlook this in their blind opposition to the idea of collective determination of a society's birth rate.

That the exclusive emphasis on family planning in current population policies is not a "first step" but an escape from the real issues is suggested by two facts. (i) No country has taken the "next step." The industrialized countries have had family planning for half a century without acquiring control over either the birth rate or population increase. (ii) Support and encouragement of research on population policy other than family planning is negligible. It is precisely this blocking of alternative thinking and experimentation that makes the emphasis on family planning a major obstacle to population control. The need is not to abandon family-planning programs but to put equal or greater resources into other approaches.

New Directions in Population Policy

In thinking about other approaches, one can start with known facts. In the past, all surviving societies had institutional incentives for marriage, procreation, and child care which were powerful enough to keep the birth rate equal to or in excess of a high death rate. Despite the drop in death rates during the last century and a half, the incentives tended to remain intact because the social structure (especially in regard to the family) changed little. At most, particularly in industrial societies, children became less productive and more expensive (*48*). In present-day agrarian societies, where the drop in death rate has been more recent, precipitate, and independent of social change (*49*), motivation for having children has changed little. Here, even more than in industrialized nations, the family has kept on producing abundant offspring, even though only a fraction of these children are now needed.

If excessive population growth is to be prevented, the obvious requirement is somehow to impose restraints on the family. However, because family roles are reinforced by society's system of rewards, punishments, sentiments, and norms, any proposal to demote the family is viewed as a threat by conservatives and liberals alike, and certainly by people with enough social responsibility to work for population control. One is charged with trying to "abolish" the family, but what is required is selective restructuring of the family in relation to the rest of society.

The lines of such restructuring are suggested by two existing limitations on fertility. (i) Nearly all societies succeed in drastically discouraging reproduction among unmarried women. (ii) Advanced societies unintentionally reduce reproduction among married women when conditions worsen in such a way as to penalize childbearing more severely than it was penalized before. In both cases the causes are motivational and economic rather than technological.

It follows that population-control policy can de-emphasize the family in two ways: (i) by keeping present controls over illegitimate childbirth yet making the most of factors that lead people to postpone or avoid marriage, and (ii) by instituting conditions that motivate those who do marry to keep their families small.

Postponement of Marriage

Since the female reproductive span is short and generally more fecund in its first than in its second half, postponement of marriage to ages beyond 20 tends biologically to reduce births. Sociologically, it gives women time to get a better education, acquire interests unrelated to the family, and develop a cautious attitude toward pregnancy (*50*). Individuals who have not married by the time they are in their late twenties often do not marry at all. For these reasons, for the world as a whole, the average age at marriage for women is negatively associated with the birth rate: a rising age at marriage is a frequent cause of declining fertility during the middle phase of the demographic transition, and, in the late phase, the "baby boom" is usually associated with a return to younger marriages.

Any suggestion that age at marriage be raised as a part of population policy is usually met with the argument that "even if a law were passed, it would not be obeyed." Interestingly, this objection implies that the only way to control the age at marriage is by direct legislation, but other factors govern the actual age. Roman Catholic countries generally follow canon law in stipulating 12 years as the minimum *legal* age at which girls may marry, but the actual average age at marriage in these countries (at least in Europe) is characteristically more like 25 to 28 years. The actual age is determined, not by law, but by social and economic conditions. In agrarian societies, postponement of marriage (when postponement occurs) is apparently caused by difficulties in meeting the economic prerequisites for matrimony, as stipulated by custom and opinion. In industrial societies it is caused by housing shortages, unemployment, the requirement for overseas military service, high costs of education, and inadequacy of consumer services. Since almost no research has been devoted to the subject, it is difficult to assess the relative weight of the factors that govern the age at marriage.

Encouraging Limitation of Births within Marriage

As a means of encouraging the limitation of reproduction within marriage, as well as postponement of marriage, a greater rewarding of nonfamilial than of familial roles would probably help. A simple way of accomplishing this would be to allow economic advantages to accrue to the single as opposed to the married individual, and to the small as opposed to the large family. For instance, the government could pay people to permit themselves to be sterilized (*51*), all costs of abortion could be paid by the government, a substantial fee could be charged for a marriage license, a "child-tax" (*52*) could be levied, and there could be a requirement that illegitimate pregnancies be aborted. Less sensationally, governments could simply reverse some existing policies that encourage childbearing. They could, for example, cease taxing single persons more than married ones, stop giving parents special tax exemptions, abandon income-tax policy that discriminates against couples when the wife works, reduce paid maternity leaves, reduce family allowances (*53*), stop awarding public housing on the basis of family size, stop granting fellowships and other educational aids (including special allowances for wives and children) to married students, cease outlawing abortions and sterilizations, and relax rules that allow use of harmless contraceptives only with medical permission. Some of these policy reversals would be beneficial in other than demographic respects and some would be harmful unless special precautions were taken. The aim would be to reduce the number, not the quality, of the next generation.

A closely related method of deemphasizing the family would be modification of the complementarity of the roles of men and women. Men are now able to participate in the wider world yet enjoy the satisfaction of having several children because the housework and childcare fall mainly on their wives. Women are impelled to seek this role by their idealized view of marriage and motherhood and by either the scarcity of alternative roles or the difficulty of combining them with family roles. To change this situation women could be required to work outside the home, or compelled by circumstances to do so. If, at the same time, women were paid as well as men and given equal educational and occupational opportunities, and if social life were organized around the place of work rather than around the home or neighborhood, many women would develop interests that would compete with family interests. Approximately this policy is now followed in several Communist countries, and even the less developed of these currently have extremely low birth rates (*54*).

That inclusion of women in the labor force has a negative effect on reproduction is indicated by regional comparisons (*18*, p. 1195, *55*). But in most countries the wife's employment is subordinate, economically and emotionally, to her family role, and is readily sacrificed for the latter. No society has restructured both the occupational system and the domestic establishment to the point of permanently modifying the old division of labor by sex.

In any deliberate effort to control the birth rate along these lines, a government has two powerful instruments—its command over economic planning and its authority (real or potential) over education. The first determines (as far as policy can) the economic conditions and circumstances affecting the lives of all citizens, the second provides the knowledge and attitudes necessary to implement the plans. The economic system largely determines who shall work, what can be bought, what rearing children will cost, how much individuals can spend. The schools define family roles and develop vocational and recreational interests, they could, if it were desired, redefine the sex roles, develop interests that transcend the home, and transmit realistic (as opposed to moralistic) knowledge concerning marriage, sexual behavior, and population problems. When the problem is viewed in this light, it is clear that the ministries of economics and education, not the ministry of health, should be the source of population policy.

The Dilemma of Population Policy

It should now be apparent why, despite strong anxiety over runaway population growth, the actual programs purporting to control it are limited to family planning and are therefore ineffective. (i) The goal of zero, or even slight, population growth is one that nations and groups find difficult to accept. (ii) The measures that would be required to implement such a goal, though not so revolutionary as a Brave New World or a Communist Utopia, nevertheless tend to offend most people reared in existing societies. As a consequence, the goal of so-called population control is implicit and vague, the method is only family planning. This method, far from de-emphasizing the family, is familistic. One of its stated goals is that of helping sterile couples to *have* children. It stresses parental aspirations and responsibilities. It goes along with most aspects of conventional morality, such as condemnation of abortion, disapproval of premarital intercourse, respect for religious teachings and cultural taboos, and obeisance to medical and clerical authority. It deflects hostility by refusing to recommend any change other than the one it stands for: availability of contraceptives.

The things that make family planning acceptable are the very things that make it ineffective for population control. By stressing the right of parents to have the number of children they want, it evades the basic question of population policy, which is how to give societies the number of children they need. By offering only the means for *couples* to control fertility, it neglects the means for societies to do so.

Because of the predominantly pro-family character of existing societies, individual interest ordinarily leads to the production of enough offspring to constitute rapid population growth under conditions of low mortality. Childless or single-child homes are considered indicative of personal failure, whereas having three to five living children gives a family a sense of continuity and substantiality (*56*).

Given the existing desire to have moderate-sized rather then small families, the only countries in which fertility has been reduced to match reduction in mortality are advanced ones temporarily experiencing worsened economic conditions. In Sweden, for instance, the net reproduction rate (NRR) has been below replacement for 34 years (1930–63), if the period is taken as a whole, but this is because of the economic depression. The average replacement rate was below unity (NRR = 0.81) for the period 1930–42, but from 1942 through 1963 it was above unity (NRR = 1.08). Hardships that seem particularly conducive to deliberate lowering of the birth rate are (in managed economies) scarcity of housing and other consumer goods despite full employment, and required high partici-

pation of women in the labor force, or (in freer economies) a great deal of unemployment and economic insecurity When conditions are good, any nation tends to have a growing population

It follows that, in countries where contraception is used, a realistic proposal for a government policy of lowering the birth rate reads like a catalogue of horrors squeeze consumers through taxation and inflation, make housing very scarce by limiting construction, force wives and mothers to work outside the home to offset the inadequacy of male wages, yet provide few child-care facilities, encourage migration to the city by paying low wages in the country and providing few rural jobs, increase congestion in cities by starving the transit system increase personal insecurity by encouraging conditions that produce unemployment and by haphazard political arrests No government will institute such hardships simply for the purpose of controlling population growth Clearly, therefore, the task of contemporary population policy is to develop attractive substitutes for family interests, so as to avoid having to turn to hardship as a corrective The specific measures required for developing such substitutes are not easy to determine in the absence of research on the question

In short, the world's population problem cannot be solved by pretense and wishful thinking The unthinking identification of family planning with population control is an ostrich-like approach in that it permits people to hide from themselves the enormity and unconventionality of the task There is no reason to abandon family-planning programs, contraception is a valuable technological instrument But such programs must be supplemented with equal or greater investments in research and experimentation to determine the required socioeconomic measures

References and Notes

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57 Judith Blake's critical readings and discussions have greatly helped in the preparation of this article