

**NUTRITION
AND FERTILITY
INTER-
RELATIONSHIPS
IMPLICATIONS
FOR POLICY
AND ACTION**

NATIONAL ACADEMY OF SCIENCES



Nutrition and Fertility Interrelationships

IMPLICATIONS FOR POLICY AND ACTION

Subcommittee on Nutrition and Fertility
Committee on International Nutrition Programs
Food and Nutrition Board
National Research Council

NATIONAL ACADEMY OF SCIENCES
WASHINGTON D.C. 1975

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Preface

In recent years there has been increasing recognition of the coexistence, in various populations, of malnutrition and high fertility, and of the likelihood that each is partly caused by the other. In light of this recognition, the Subcommittee on Nutrition and Fertility convened a workshop to which persons from various nations, experienced in family planning or nutrition programs, were invited. The roster of participants consisted of persons involved in laboratory and field research or in program administration. They came from governmental and private organizations and represented such disciplines as economics, social science, medicine, public health, nutrition, education, and communication. A dozen or more countries, from five continents, were represented. The report is, in essence, the consensus of a group of experienced professional and technical specialists.

Plenary sessions and small group discussions were held during the 2½ days of the workshop. Working from a transcript of the proceedings, Samuel M. Wishik and Susan Van der Vynckt prepared a preliminary draft of this report, a draft

that was made available to the participants for review and comment.

The Subcommittee acknowledges its indebtedness to the participants, to Mrs. Van der Vynckt, and to the heads of the collaborating elements of the Agency for International Development, Drs. Raymond T. Ravenholt and Martin J. Forman.

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Summary

Malnutrition and uncontrolled fertility* are phenomena of worldwide concern. They are closely interrelated—more babies mean more mouths to feed, with consequent malnutrition when food is scarce; ill-fed families have high net reproduction despite high pregnancy wastage.

General malnutrition in a population group customarily calls for action that is beyond the capacity of an individual or family. Some improvement can, of course, be realized from such local actions as better food production, careful storage of food supplies, sanitary measures to reduce intestinal malabsorption, wiser food selection and preparation, extended breast-feeding of infants, and limitation of family size. Supplementary feeding programs will be most effective if they focus on stages in life that are most vulnerable to nutritional insult and, at the same time, most amenable to correction. These stages are (1) the infant at weaning, (2) the nursing mother, (3) the pregnant woman, and (4) the adolescent and postadolescent female who is soon to become a mother.

*In this report, the term *fertility* refers to rate or number of live births (the demographic meaning) rather than to capacity to conceive or produce offspring.

Persons in these stages are vulnerable not only to immediate damage but to residual effects as well; conversely, remedial measures invoked at these times can be expected to have both short-term and long-term benefits. Relatively modest action, if taken at the proper time, can have substantial impact. *But unless fertility can be modified, there is little that can be done to improve nutrition for the marginal family.*

The theoretical maximum reproductive potential (about 12 children per adult female) has rarely been reached in any population. But the impairment of health deriving from the level that does pertain is devastating, especially when the pregnancies occur within a state of chronic malnutrition. Whenever pregnancy wastage and child losses are high, the lactation period tends to be shortened and there is no opportunity for a reasonable interbirth interval for physical recovery and preparation for the next pregnancy. Women begin having babies too soon; they continue having them too long; they have too many of them too close together.

To persons living in an economically marginal state, few arguments for fertility control are perceived as cogent. Having fewer babies does not alleviate hunger, but nutrition programs that raise the food intake and improve its quality help to reduce infant mortality and lengthen the intervals between births. As a result, it is postulated, family planning will seem more reasonable and acceptable. In many societies, unless there is improved nutrition, efforts to reduce the fertility of marginal families cannot accomplish much.

Nutrition programs for women and children and programs concerned with family planning do not aim at precisely the same target groups, but they do have common attributes. They can be administered by common agencies, and the services involved can be rendered by common personnel. Many factors support the argument for an integrated attack on malnutrition and high fertility, although it is obvious that integration should not be stubbornly insisted upon when

parallel or complementary approaches are more feasible and appropriate. Needs in these areas transcend the usual domains of existing organizations, suggesting that a concerted effort by national and international agencies is essential.

The second half of the 1970's will be a time of increasing stresses from a combination of interrelated major world problems in food, nutrition, population, energy, and environment. Meeting them—even anticipating and attempting to plan for them—calls for world statesmanship and pooling of resources and efforts. Nutrition and fertility constitute only a part of the problem complex, but it is an important part. The following conclusions and recommendations focus on aspects of policy, program development, and research that stem from common considerations of malnutrition and excess fertility and are within the grasp of the world community.

Policy and Planning

1. The sharp decrease in the practice of breast-feeding is a matter of widespread concern. It compounds the serious deficits in food availability and the high incidence of infant disease and death among many marginal populations. There should be established under suitable auspices a world program to sponsor education on human lactation and to provide nutritional and social support that will enable more women to breast-feed their babies successfully and for adequate periods.

2. Adolescent and postadolescent pregnancy may superimpose the physiologic demands of pregnancy upon the stresses of immaturity and recent or continuing body growth. When this occurs, the health hazard to the mothers is high, especially under conditions of malnutrition. Policies should be supported that (a) promote better nutrition among preadolescent and adolescent females, (b) aim to postpone the age of marriage and of first pregnancy, and (c) identify pregnancies

among very young women and offer special health supervision to them.

3. Policies should be devised to promote intervention programs that utilize effective integrated or parallel services of nutrition promotion and fertility modification in order to capitalize on their common requirements, common target populations, and probable synergistic effects.

4. More attention must be given to the implications of rapid urbanization in less developed countries, with emphasis on special types of programs for nutrition promotion, fertility modification, and other social services among recent migrants to the cities.

Program Development

1. In assessing need and evaluating progress, the multipurpose survey approach should be taken, so as to measure status and trends in nutrition and in fertility simultaneously and to gain information about the relationships between them.

2. Increasing dependence should be placed on less highly trained auxiliary field personnel, especially in rural areas. Various combinations of single-purpose or multipurpose workers should be developed to fit different situations, and efforts should be made to cross (and combine) traditional agency jurisdictions where appropriate.

3. Special investment should be made in an intermediate supervisory echelon between the administrative and field-worker levels. Supervision should be dispersed and focused selectively on points where greater needs are evident and results seem promising, rather than carried out on a routine basis. There is need for supervisory training and for increasing the effectiveness of supervision. Training should cross the traditional lines separating programs in fertility and nutrition.

4. Innovative approaches should be carefully and

thoroughly evaluated, with particular attention to evaluation of nutrition/fertility intervention programs in diverse experimental patterns and combinations.

Research

1. Comparative studies should be made of the relations between interbirth interval and pregnancy wastage, child loss and child growth, and physical and mental development under defined conditions of nutritional and socioeconomic status.

2. Studies are needed on the effects of different degrees of nutritional deprivation on ovulation, including effects on age at menarche, duration of postpartum amenorrhea, and frequency of anovulatory menstruation.

3. Side effects from the use of steroid and other contraceptives among nutritionally deprived populations should receive special study.

4. Attention should be given to the cultural, economic, and demographic factors that impinge on nutritional status and fertility rates.

Introduction

Industrially developed countries have attained low birthrates. This so-called demographic transition, although it has come under challenge in many respects, is traditionally regarded as having entailed three phases: high mortality and high birthrate; lowered mortality with continuing high fertility, giving rise to rapid population growth; and, finally, low fertility. Whatever the actual historical pattern in a given country that now finds itself in the first or second phase, it is generally accepted that a substantial number of countries will eventually reach the final phase in conjunction with, or following upon, improvement in literacy, standard of living, and general economic development. The uncertainty lies in how long a time will be required and whether that time can be shortened.

Some of the less developed countries face a more complex situation than that indicated here. Many have already arrived at a large absolute population and are under strong pressure to close rapidly the conspicuous gap between themselves and the more prosperous nations. The preferred approach seems to be to minimize the interval before arriving at improved socioeconomic status and slowed population growth and to

bolster available resources during the interim through worldwide collaborative efforts that include expansion of education, promotion of health, improvement of nutrition, and reduction in fertility. These improvements derive from the joint impact of societal and individual actions; the latter are especially significant where dietary habits and fertility behavior are concerned. At the very least, society should enable the individual to have the options of a wholesome diet and controlled fertility. The immediate issue is whether these two options can be made more accessible and attractive by an integrated approach.

The consensus of workshop participants was that joint action is logical and might result in increased operating efficiency and program effectiveness. Adding fertility modification elements to a program of nutrition intervention, or introducing a concern for nutrition into community efforts at fertility modification, could well enhance both under certain circumstances. When joint action is infeasible or unlikely, each of the two programs should be moved forward in as timely a fashion as possible. In any case, it must be recognized that, in certain situations, the immediate effect of nutrition programs is to increase, not decrease, reproductive performance.

In developed societies, most people eat reasonably well, and most families voluntarily limit the number of their children. Still needed are diet education and improvement, more disease prevention and health care, and family-planning education and services available to the poorer segments of the populations. In countries that are underdeveloped but are experiencing rapid industrialization and urbanization, the challenge is to expand family-planning services at a rate adequate to meet demand and to achieve more-effective disease prevention and equitable distribution of food, especially among recent migrants to the cities. In the predominantly rural populations in the least developed countries, the

greatest urgency lies in social improvement, promotion of better nutrition, education to increase awareness of the benefits of fertility modification, and social supports to ensure that breast-feeding will continue to be the method of choice for almost all young children.

Clinical Considerations

Nutrition and Fertility: Relationships

Because the relationships between nutrition and fertility are interactive and cyclic, it is difficult to measure their separate influences and effects. Even in a simplified analysis, two elements must be considered: the effects of nutrition on fertility and the effects of fertility on nutrition.

Consideration of fertility (see footnote, page 1) as related to the woman can be divided into five components:

- **Number of pregnancies and births experienced**
- **Age at each pregnancy and birth**
- **Duration of the intervals between conceptions**
- **Lactation**
- **Health/nutrition services available to meet the needs of pregnancy, delivery, and postpartum care**

Nutritional considerations involve two persons, the mother and the child, both of whom are immediately affected by the mother's fertility behavior. These considerations are

- Dietary intake
- Incidence of disease, especially gastrointestinal infections and parasitic invasions
 - Duration of breast-feeding of each infant and the frequency of lactation periods
 - Family size and pregnancy intervals
 - Health/nutrition services

Effects of Nutrition on Fertility

Nutritionists have produced a rich literature on the effects of a woman's nutritional status on menstruation, ovulation, and the likelihood of conception (Frisch, 1974a, b, in press; Frisch and Revelle, 1971) as well as on the course and outcome of pregnancy (Hillman and Hall, 1968; Chopra *et al.*, 1970; PAHO, 1970; Siegel and Morris, 1970; Habicht *et al.*, 1973; NAS, 1973). Serious complications of pregnancy, delivery, and puerperium can be attributed to nutritional aberrations of women during pregnancy (Bergner and Susser, 1970; Rosa and Turshen, 1970; St. George *et al.*, 1970; Habicht *et al.*, 1974). In a related sense, congenital malformations, birth weight, constitutional strength, defenses against disease, growth and development, and chance of survival of offspring may be significantly modified by the mother's prenatal nutritional state (Scrimshaw *et al.*, 1968; Bergner and Susser, 1970; Albanese, 1973; Klein *et al.*, 1973).

Effects of Fertility on Nutrition

The immediate question posed here is: How do the frequency, timing, and circumstances of childbearing affect the nutrition of women and their children and therefore their health and lives? In addressing this question it is necessary to keep in mind certain pervasive socioeconomic determinants and to raise questions about women's variable physiologic readiness

to meet the physical demands of pregnancy and childbirth at different points in their childbearing years. "Excess fertility" might be characterized as "too soon, too late, too close, and too many."

Pregnancy during Postadolescent Years

Unfavorable mortality and morbidity statistics among very young mothers and their children are evident for all times and places. These have been assumed to result from endocrinologic and anatomical immaturity with respect to reproduction, aggravated by the composite nutritional demands of the mother's recent and continuing growth and those of her pregnancy (Gill *et al.*, 1970; Frisch and Revelle, 1971; Frisch, 1974a, b, in press).

That the phenomenon is not entirely physiologic, however, is clear. Childbirth among women in their late teens has become progressively less hazardous in modernized countries. In less developed countries, on the other hand, the greater risk among girls under 20 years of age persists (Jacobson, 1972). The differences may reflect better obstetric care as well as general socioeconomic improvement. In a Hawaii study of first births among the youngest group of mothers (15 to 19 years of age), comparison between those married and unmarried during pregnancy revealed a threefold differential in pregnancy wastage in the former after the first trimester and a sevenfold discrepancy in their having obtained a reasonable minimum of antepartum care. Thus the social definition of "illegitimacy" carried with it built-in barriers to health care (Wishik, 1944).

The situation is particularly severe in less developed countries because of the earlier age of marriage and of first pregnancies that usually prevail. Not uncommonly, the extended family counts the months that elapse following a

consummated alliance until pregnancy proves the bride's worth. In some cultures, pregnancy is a precondition to marriage, just as it so often leads to marriages for legitimization in Western societies. In the latter societies, there has been a dramatic trend toward earlier menarche and a tendency to earlier marriage and first birth among some groups in recent years (Marshall and Tanner, 1969; Jacobson, 1972).

In any event—and in all countries—the importance of giving special attention to improving the nutritional status of adolescent girls cannot be overemphasized. Effective ways of delaying the age of first pregnancy must be devised, ways that are culturally appropriate and societally feasible.

Pregnancy during the Immediate Premenopausal Years

No finding is more consistent than the correlation of pregnancy complications and unfavorable outcomes with advanced maternal age. The hazards associated with pregnancies occurring near the time of menopause are widely recognized.

This question of late pregnancies is closely tied to excess numbers of children, because the highest parity orders must cluster at the later years. Advanced age or high parity, each taken separately, is risky; together, the jeopardy is compounded (Omran, 1971; Jacobson, 1972).

A number of studies show the dangers of high parity, although such interrelated variables as age are not always satisfactorily defined in the research designs. Women of higher parity are more prone to anemia and to lower weight: height ratio (Venkatachalam, 1962). Children in larger families, especially those higher in the birth order or in families with more children of preschool age, suffer more from malnutrition, grow more slowly, are more anemic (Bailey, 1964; Rao and Gopalan, 1969; Omran, 1971), have somewhat

higher rates of impaired mental development (Cravioto *et al.*, 1966; Scrimshaw and Gordon, 1968; Klein *et al.*, 1973), and are offered diets that are poorer in calories and protein and that represent less per capita expenditure (Rao and Gopalan, 1969; Levinson, 1973).

Admittedly, socioeconomic differentials correlate with the higher parity and, consequently, with the greater frequency of unfavorable sequelae (Illsley and Kincaid, 1963). How much does the disadvantage stem from parity and how much from economic deprivation? To some extent, it must be the combination that is responsible. When the pregnancy wastage rates in less developed countries are compared with the rates in the developed countries (Figure 1), the curve for the latter is seen to be shallower as well as lower (Potter *et al.*, 1965b; Wray, 1971). Jeopardy, especially at the higher levels of parity, is less.

The issues are clear: The health and nutrition of mothers in less developed countries need special protection at the upper end of the childbearing years or of parity order, as long as

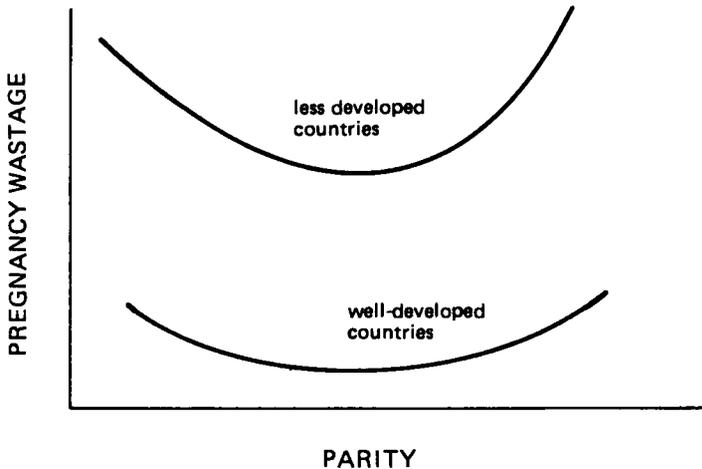


FIGURE 1 Relation of pregnancy wastage to parity levels.

complete avoidance of pregnancy is not assured. Contraceptive protection in these groups of women would seem to be an essential concurrent goal. In the large majority of cases, these women have attained or exceeded their desired family size (Wray, 1971). Their families do not expect or require them to produce more offspring, and their familial and social hierarchical status does not depend on continued childbearing. Women are often ready to accept sexual abstinence if permitted to do so, and in some cultures they even welcome or encourage other sexual outlets for their husbands. The pressures toward this latter alternative, with attendant likelihood of social dislocations, might well be lessened by fuller access to acceptable and reliable contraception. For the older age groups, surgical sterilization is an obvious measure that warrants emphasis in fertility modification programs.

Close Birth Spacing

Birth spacing can be considered in terms of the three major components of the "closed interval" between successive conceptions (Figure 2).

Recent consensus rejects the traditional concept that pregnancy places a stress on a woman's normal physiology similar to that of disease (WHO, 1965; Hytten and Thomson, 1970; Wishik and Stern, 1974). The view now is that a woman adjusts to a new physiologic state that involves her, the fetus, and the placenta. These pregnancy-related physiologic changes must be reversed after delivery. In general, the readjustment seems to be a fairly prompt response to the restored hormonal balance after delivery; indeed, one would expect that adjustment would be reasonably complete in time for the next pregnancy. Overlap between incomplete restoration and a succeeding pregnancy is, almost by definition, undesirable. It can result from delay in restoration or failure to respect the "natural" interval between pregnancies.

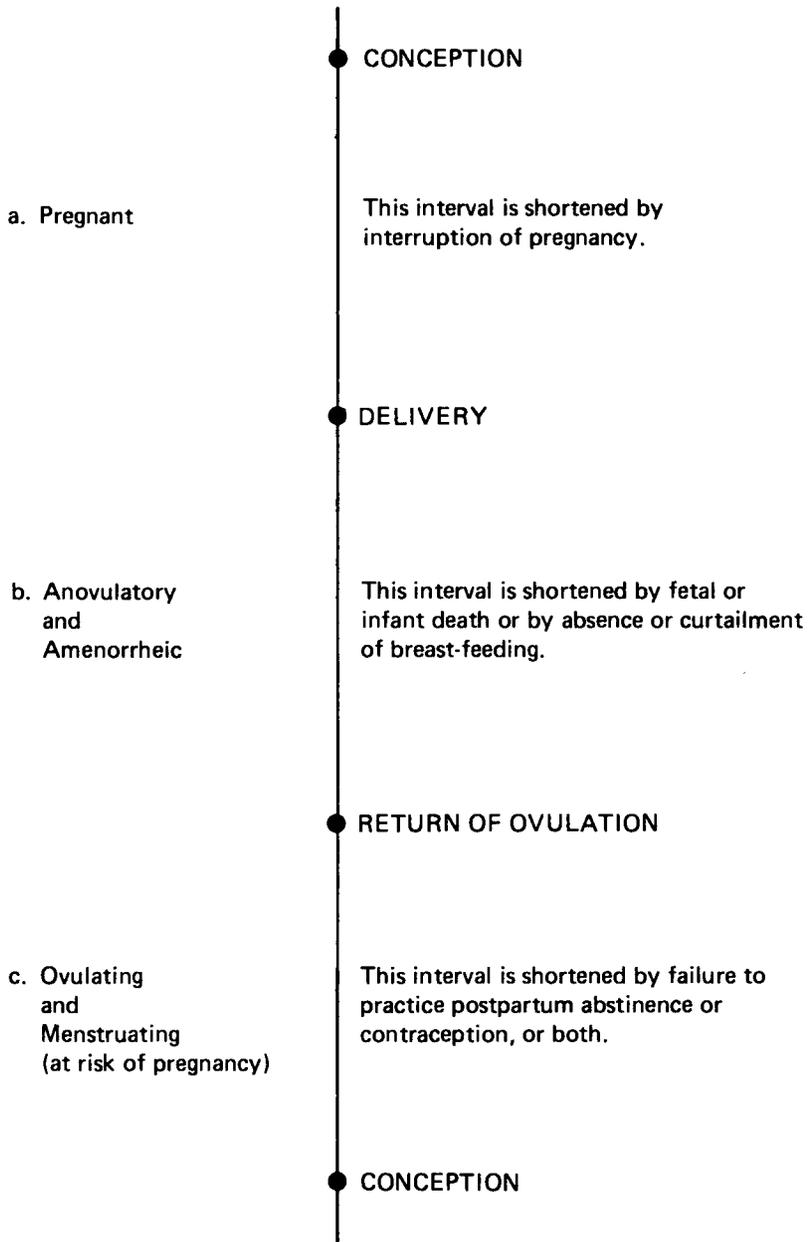


FIGURE 2 The closed interval between successive conceptions.

The interval between pregnancies is represented by parts *b* and *c* in Figure 2, the pregnancy-free period before and after the postpartum return of ovulation. In comparison with the state that prevailed among earlier societies (Table 1, part A), these two phases of the "natural" interval are being shortened. First, breast-feeding of infants is being replaced by artificial feeding (Jelliffe, 1968, 1971; Harfouche, 1970; Brown, 1973; Frisch, 1974a), thus reducing the effect that lactation has in delaying the return of ovulation (Potter *et al.*, 1965a; Salber *et al.*, 1965; Jelliffe and Jelliffe, 1972; Latham, 1972). Second, long-standing cultural avoidance of postpar-

TABLE 1 Factors Modifying Interbirth Intervals, with Estimated Duration

Factors in Sequence, Beginning with Pregnancy	Duration (months)
A. Interval resulting from common traditional patterns of abstinence during lactation	
Pregnant	9
Amenorrheic	9
Not at risk of conceiving, because of abstinence or contraception or both	15
At risk of conceiving	3
	—
Total	36
B. Interval resulting from early infant death or artificial feeding of surviving infant	
Pregnant	9
Amenorrheic	3
At risk of conceiving	3
	—
Total	15
C. Interval resulting from interruption of pregnancy	
Pregnant	4
Amenorrheic	2
At risk of conceiving	3
	—
Total	9

tum sexual intercourse is being weakened, in part because such abstinence had traditionally been associated with continued breast-feeding of the youngest baby. Both developments are widespread as concomitants of the urbanization and industrialization that accompany rapid population growth in less developed countries. The total interval between conceptions is further shortened by abortions and miscarriages and by fetal and early infant deaths (Table 1, parts B and C).

In populations where high fertility has prevailed and where modern methods of contraception have not been accessible, the prevailing interval between births has been about 2½ to 3 years. This will be shortened by at least 6 months if the protection of lactation amenorrhea and its associated abstinence is removed. The pregnancy-free interval almost disappears after fetal or neonatal death. To a healthy woman living under favorable conditions, a shorter interval than this may not be threatening, but for an unhealthy woman living in poverty and under environmental stress, a shorter interval may be dangerous.

Many early societies believed that short interbirth intervals were undesirable. Some groups in Africa and other areas have words to denote the incompatibility (mutual poisoning) between the baby at the breast and the one growing in the womb.

Program efforts must aim at maintaining a safe interval, the precise meaning of "safe" being heavily dependent on the general health of the mother. To prevent shortening gestation, there must be better nutrition before and during pregnancy and selective, focused antepartum health supervision and care. To prevent shortening the anovulatory period, it is essential to ensure a surviving infant by protecting its health and nutrition, by disseminating information on the benefits of breast-feeding—countering commercial pressures toward artificial feeding—and by establishing employment policies under which women will have enhanced opportunities to remain with and care for their nursing infants. As for the ovulatory

period, access to effective contraception is the modern equivalent of traditional postpartum abstinence. There is an associated need for nutritional protection of nursing mothers and of young children, at least through the postweaning period.

The viewpoint chosen in explaining the impact on a given child of the length of the interbirth interval depends on whether the interval under consideration preceded or followed his birth. Given the total pregnancy history of the mother and working backward from birth, one is concerned with the course of the pregnancy during intrauterine residence, the nature of and sequelae from that pregnancy, the mother's health and environmental stresses during the pregnancy-free interval between the birth and that of the next older sibling, the length of that interval, and the occurrence of lactation during it. Working forward, on the other hand, one must include the mother's experience during embryologic and fetal development, the course of birth and postpartum, whether the child was breast-fed, subsequent diet and illnesses, and the span of time before the mother conceived again. The pregnancies on either side of the interval under consideration, as well as the events during that interval, enter into the weighing of factors contributing to the chances of survival and health of a child.

High Fertility as Insurance against Child Loss

Some social demographers and others have long held that family planning will not be accepted in developing countries until a significant reduction in infant mortality has been achieved. This "child-survival hypothesis" holds that once infant mortality declines, parents will perceive that fewer pregnancies are necessary to achieve desired family size (Frederiksen, 1969; Schultz, 1971; Wray, 1971, 1972; Berg,

1973; Taylor *et al.*, 1974). When more children survive, the initial effect is to increase family size and accelerate population growth. But the theory postulates that population growth will eventually decrease because of purposeful fertility control by parents. This hypothesis is questioned by many. In any event, it would have to be tested, probably on a large scale, in order to determine the time lag that occurs before fertility is reduced.

In the context of program planning, the child-survival hypothesis suggests that intervention might proceed from improved health/nutrition (which enhances the chance of survival) to family-planning education (which makes women aware that preventing or postponing pregnancy is possible) to providing a means of avoiding unwanted pregnancies.

Although such a simplistic view is subject to a number of criticisms, there is no disagreement about the overall importance of infant mortality. First, one cannot assume that children are not an economic asset—even a necessity—for families in certain situations, especially in agricultural societies. Some research is under way, and more is needed, to define the economic costs and benefits of children as perceived by families in different socioeconomic situations.

It is, furthermore, obvious that the mere fact of excess children—that is, more children than the families can care for—has not prevented marginal societies from having extremely high fertility. The key is not just awareness of the disadvantages of excessive family size, but recognition of the incompatibility between that circumstance and access to opportunity for the family's betterment. That opportunity must be real and visible. In urban areas and among most of the deprived peasantry of the world, the family with three children is hardly less hungry than the neighboring family with ten. In rural areas, housing seems to have inexhaustible capacity to absorb families as they grow. A strong element of social and economic improvement is essential in program

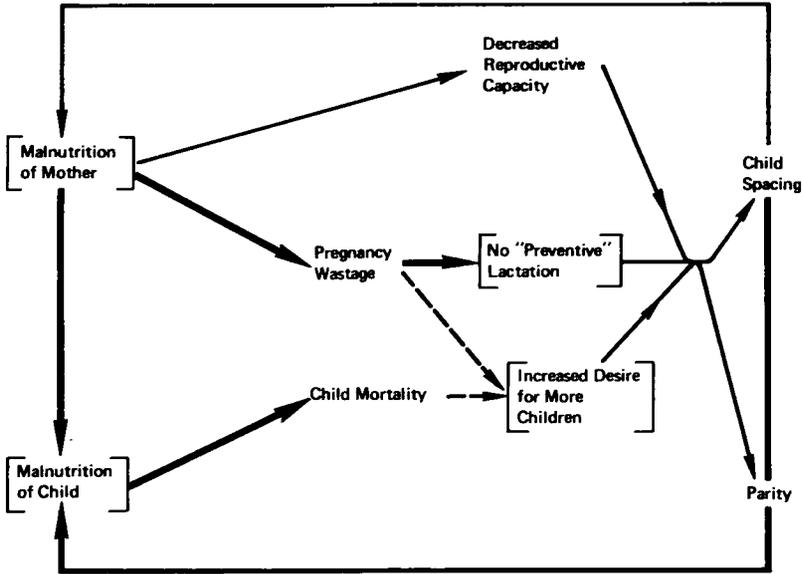


FIGURE 3 Nutrition/fertility relationships. Width of line indicates relative impact; dotted lines indicate uncertain interaction; items enclosed in boxes indicate points appropriate for intervention.

intervention. Research is needed to elucidate the dynamic sequence of attitudinal change at different levels of deprivation and opportunity in relation to different risks of child loss.

Wholly aside from a psychological or motivational explanation at the family level, infant mortality shortens lactation, vitiates cultural pressures for abstinence, and places women in a continuous state of reproductive effort. Under those circumstances, the very concept of protecting the pregnancy-free interval tends to disappear, and the changed attitude often extends to a surviving infant in need of care. Certain physiologic elements of this picture and their nutritional implications are shown in Figure 3 and considered in more detail later.

Program Considerations

Apart from the medical and social bases for integrated approaches in family-planning and nutrition programs, there are important aspects of organization and administration to be considered. There are no absolutes as to whether separate or integrated programs are more convenient, economical, acceptable, and effective. Underlying these arguments about programs are political arguments relating to allocation of resources.

Since certain aspects of nutrition, health, and family-planning intervention programs are aimed at the same target groups (women and children), they are similar in many respects. They often use the same "entry points," employ workers with similar skills, develop the same or similar delivery systems, and operate under the same administrative structures. Irrespective of acceptance and effectiveness, it is obvious that separate services to a large extent necessitate parallel or duplicate systems.

Common Target Populations

Health and nutrition programs consist chiefly of community measures (for example, general sanitation) and medical ser-

vices provided through health centers. In most health departments, at least half of the nursing and home visiting is connected with maternal and child health (MCH). Therefore, the MCH division is usually one of the better developed divisions in health departments. In almost every year since the establishment of the World Health Organization in 1948, MCH has been labeled a high-priority area in that organization. It also receives a great deal of attention in the United Nations International Children's Emergency Fund (UNICEF).

Public nutrition promotion programs tend to give special emphasis to mothers and children, in recognition of the fact that there are critical stages of development during which nutritional deficit can leave a permanent mark on the malnourished and on their offspring. Family-planning programs also clearly focus on women during the childbearing years, especially women with very young children for whom a respite from pregnancy can be crucial.

Given the complexity of societies, it is too much to expect that a single approach to a set of problems can meet all the needs. Therefore, the existence of a common target group for several services is not, *per se*, basis for program integration. But when the target group can receive services in common facilities, from common personnel, and with multiple impact upon several related needs, the arguments for integration become highly persuasive.

Common Facilities

Insofar as medical and clinical types of family planning and nutrition services are concerned, hospitals, health centers, and rural health posts are often used. Abortions and insertion of intrauterine devices, for example, are not usually thought of as services to be performed in the home. A trend, however, may be developing toward simplification of procedures, just as rehydration for cholera and protein feeding for kwashiorkor are sometimes brought closer to the patient and his home,

thereby obviating the need for transportation and saving valuable time.

Common Personnel

Traditional health personnel—physicians, nurses, and midwives—carry the general responsibilities for health, nutrition, and family-planning services. In the administrative structure, they are supported from above by consulting specialists when they are available, and from below by paramedical and auxiliary workers. For most direct family-planning and nutrition services, the health workers do not need to be specialized. It is more the sheer volume of work than technical complexity that calls for allocation of functions into separate compartments. Consequently, urban programs tend to be more specialized and rural ones more general so far as the scope of work undertaken by individual staff members is concerned.

Responsibility for repetitive tasks can be given to auxiliary workers. Because some of the commonly used terms—including *auxiliary*, *paramedical*, *subprofessional*, *nonprofessional*, *assistant*, and *untrained*—may seem to have a pejorative connotation, an attempt has been made to substitute positive, yet descriptive, terms. Among these is *warranted workers*, a term indicating that the workers have been selected, prepared, and assigned to particular duties. With the appropriate qualifying adjectives, they might then be called warranted family-planning workers, warranted health workers, and so on. It is a more flexible term than *technical worker*, *technician*, or *licensed worker*, and takes into account work done under various degrees of supervisory responsibility and autonomy, ranging from the urban hospital clinic to the solitary village agent. The antithetical term, *unwarranted health workers*, could replace designations such as *traditional*, *indigenous*, and *untrained practitioners*.

Experience gained in family-planning and nutrition pro-

grams in the field point toward a new type of multipurpose worker, in some ways analogous to the "barefoot doctor." Such field-workers are limited in technical skills and knowledge. By virtue of residence in the immediate locality, especially in rural areas, they can reach the people with the multiple services that are needed and assist in referring them to specialized services provided at some central location.

Multipurpose workers of this type have made possible innovations in program design. In some countries, indigenous health workers (e.g., the dais in India and comadormas in Latin America) whose traditional tasks were already multipurpose—birth attendance, child care, and "homespun" marriage and sex counseling—are being given training for broader responsibilities. In other parts of the world, persons who started out merely as distribution agents for contraceptive supplies in time began performing a variety of health and family planning activities.

Administration

Program integration at the periphery—the moment of providing service—can exist even if it is not in effect all the way back to the central administration. At that latter level, responsibility may be vested in a single agency—the health ministry or department—or it may be apportioned among two or more governmental agencies. For example, the nutrition program may be located in a food or agriculture department, whereas family planning may be in an independent commission. When functions are separate, liaison personnel and mechanisms should be established. If all are located in a health department or ministry, they may be housed in a combined division or in separate units. Even if they are in a single maternal and child health unit that encompasses nutrition and family planning—sometimes also health education, dental care, and other

specialized activities—personnel with specialized functions and interests may well have little communication with each other.

In many instances, lack of central coordination effectively precludes the mutually fortifying impact of integrated service. To take advantage of the effect of lactation on increasing birth interval, there must be joint effort of nutritionists and family planners. At the postpartum period, women and infants who are at special medical risk need to be identified for ongoing health supervision to correct anemia, support lactation, ensure proper growth and development of the baby, and delay the next pregnancy. Coordinated service implies joint policies and planning, agreement on priorities and program emphases, coterminous or complementary logistics, and pooling of funds and other resources. Aside from unified administration, measures aimed at fostering effective cooperative efforts include having interagency councils, committees, or liaison persons with specific responsibility for ensuring that each element works closely with its counterparts.

Effective integration is probably most difficult in the intermediate echelons; yet the quality of consultation and supervision in these echelons usually determines the worth of the end product.

Certain aspects of management in relation to family planning programs have been discussed by Austin (1973).

Consultation

Guidance from qualified experts introduces special elements into the programs and makes it possible for staff workers to keep abreast of new knowledge and methods. Such consultants as public health nutritionists, nurses, gynecologists, and pediatricians make their most important contribution at the policy and planning level and may often limit their input to that level. Preferably, they also influence program content,

practices, and procedures and are in a better position to do so if they spend part of their time in the field. They should meet jointly with supervisors and workers to outline new ideas and review problems. Staff should be encouraged to select concrete cases for presentation and group discussions. It seems particularly desirable for specialists in nutrition and in family planning to plan some joint visits and case conferences, so that common and interacting aspects may be highlighted and ways found to meet common or related needs.

Supervision

The commonest and most serious gap in the manpower pyramid is the absence of meaningful supervision between the administrative headquarters and the field base. Supervisors almost always have too large a geographic area and too many service units and personnel under their jurisdiction. Since they are expected to, or believe they should, contact each local unit regularly, they set for themselves a schedule of routine visits at fixed intervals. The schedule may be conspicuous on the wall of the supervisor's office, but it almost inevitably collapses from the day it is posted. A better procedure is to make visits selectively, at intervals determined by need. Identification of priorities for selective visiting can be made from indexes based on routine periodic reports received from the field.* Criteria might be the average number of revisits of newly admitted contraceptive users per year, the estimated percentage of newborn infants who are breast-fed, and the percentage of child immunizations that remain incomplete. Each supervisor would have the reporting units in his jurisdiction ranked according to selected indexes. The ones at the upper and lower ends of the ranking would be

*P. O. Talwar and S. M. Wishik. Selective supervision. Manual in preparation at the International Institute for the Study of Human Reproduction, Columbia University, New York.

selected for visits to learn the reasons for their marked departure from the mode. Other visits would be made for special reasons, as time permitted.

The issue of integration adds to the logistic pressures that interfere with getting adequate supervision. Although the consultants are specialists, it is desirable as a rule that the supervisors be generalists. Their breadth of coverage should mesh with that of the workers whom they are supervising; this requirement calls for departure from rigid bureaucratic domains and for alternative patterns to fit different situations.

Political Advantages

Integrated family-planning and nutrition programs are not only intrinsically valuable but are often persuasive in the political struggle for funding and in the competition for limited resources. Family-planning programs are often more likely to be accepted if they show concern for the health and well-being of mothers and children and do not simply aim at limiting family size. This can be overstated, however; acceptance of any public service is largely a reflection of the respect and confidence that have been won by the sponsor of the service. If government programs are generally regarded with suspicion, no official activity will be immune from that suspicion. Nor is acceptability alone sufficient basis for adopting a pattern of administration; it is the other benefits that should be the determining factors.

Cautionary Statements

There are, of course, certain aspects of family planning and nutrition that do not fit easily together and hence cannot be integrated (e.g., development of new crop varieties, or new

contraceptive methods). There may also be situations where integrated services are not the most effective approach, where disadvantages outweigh programmatic convenience and economy (e.g., tying nutrition services to abortion clinics).

Difficulties sometimes arise primarily from the way things are done, especially by distortion of objectives. An example is the use of food as an incentive for acceptance of family planning, on the argument that giving the food also promotes nutrition. Specific instances cited include giving rice to men along with vasectomy and offering women powdered milk for attending family-planning clinics. Of course, the rice gifts do not in fact constitute integration of nutrition services with family planning, since the rice might just as easily have been any commodity with a recognized market value. The provision of one service should never be contingent on the acceptance of another, if only because (apart from the ethical considerations) the dropout rate from the program will be extremely high when the inducements are withdrawn, or are no longer attractive. For example, since the women stopped coming to the family-planning clinic when the milk supply was cut off, neither the nutritional effect nor the family-planning effect was sustained.

Another complication may arise when services of a substantially different type are "piggybacked" onto a successful program. A not uncommon instance has been to add family-planning services to successful malaria-control programs. The idea behind this scheme is that if a program has been successful, personnel could begin devoting released time to other duties. In the instance just cited, the plan did not work out, since the service and revisit logistics of the family-planning programs were different. More important, since malaria workers are nearly always men, in some cultures they cannot appropriately deal with prospective family-planning clients.

Similarly, incentives should not favor one type of activity

over another. For example, in one instance of record, the family-planning program paid volunteer workers from a nutrition program to locate prospective family-planning clients. Since the volunteers were not being paid by the nutrition program, they naturally devoted most of their time to the family-planning work. This is, again, hardly an example of integrated services, but merely an example of programs taking advantage of existing structures or personnel in ways that are neither logistically nor methodologically sound.

Even where activities are closely related in almost every way, experience has shown that a broader scope of duties means a greater volume of work. Unfortunately, compensatory increase in number of workers does not usually occur, the most common reason being that rural areas usually have only one local worker. As a result, rather than achieving a synergistic improvement in all components of service, there may be a reduction in the effectiveness of a given program because of the sheer physical impossibility of devoting enough time to it. Which of the several service components will be short-changed is not always predictable. With a work overload, the peripheral worker is put in the comfortable position of being able to select those activities that are easiest (e.g., scheduled clinic revisits) or the responsibilities that provide more personal gratification (e.g., acute medical care). Under such stresses, it is hardly possible to achieve distribution of staff time according to stated priorities.

In summary, then, integration of nutrition and family-planning programs offers many theoretical advantages that can become realities under sound planning and administration. But integration is not always desirable. Inappropriate combinations and unacceptable exploitation of program resources can do more harm than good.

Suggested Opportunities for Program Integration

Program integration is most promising at points where activities tend to overlap or interact. The subject can be shown to have seven components: clinical services—hospital; clinical services—health centers and clinics; distribution of commodities; education; surveys; program evaluation; and strategies of evaluation.

Clinical Services—Hospital

Postpartum

Immediate initiation of family-planning service may be advisable for women who are unlikely to maintain contact or to carry out instructions. Postpartum tubectomy should have been discussed during the antepartum period with couples for whom this measure is appropriate and acceptable. For lactating women, steroid contraceptives might well be avoided at

this stage, and emphasis placed upon the importance of lactation. Instruction on infant care while in the hospital and advice for management after discharge should encourage the mother to achieve and maintain successful breast-feeding. Mothers in need should receive early food supplementation. For children at high risk, such as low-birth-weight babies, special regimens of care and follow-up should be established.

Postabortion

Initiation of an effective method of contraception is advisable immediately after abortion (spontaneous or induced) to minimize early repetition of unwanted conception. Oral contraceptive pills are suitable and may reduce the amount and duration of uterine bleeding. Special attention should be given to diagnosis and treatment of more severe degrees of anemia.

Adult Medical Service

Women being treated for a nutritional or other health problem that would be exacerbated by pregnancy should also be given contraceptive advice and treatment.

Pediatric Service

Mothers who are candidates for family-planning assistance—e.g., those with large families—should receive it. It is especially important that postadolescent and premenopausal women have attention. Close birth spacing should be avoided in such women and in others who have nutritional deficits. Services for health supervision of young children provide an opportunity to recognize needs and to introduce counseling and care. These are known by such names as mothercraft centers, under-five clinics, child health stations, and well-baby clinics.

Clinical Services—Health Centers and Clinics

Postpartum women should be given both nutritional and contraceptive assistance. Those who have just emerged from a complicated pregnancy or one that ended in fetal or neonatal death or other unfavorable outcome should be considered high medical risks. For them, the postpartum checkup is not so much a time to close the maternity episode as it is an occasion to introduce the matter of continuing interconceptional health supervision. Whatever health deficits or other factors contributed to the unfortunate recent experience are likely to be operative during the next pregnancy if it follows quickly. Rather than being consoled and advised to "go make another baby," the woman should be helped to regain full health and readiness before conceiving again. Conditions to be included under the classification "high medical risk" are not only those that call for preventive action, such as very severe anemia and hypertension, but also severe complications of unknown cause, which call for respite on general principles.

In less developed countries, the most crucial need is to achieve adequate duration and completeness of lactation. Women should understand that, although lactation delays the return of ovulation and menstruation, prolonged lactation does not protect against conception indefinitely. Discussion needs to be held on cultural practices relating to abstinence, geographic separation from husband, and contraception. The time of weaning should be anticipated and the mother should be counseled about the implications thereof.

Particularly in rural areas, local health posts should give special attention to known cases of nursing mothers who are approaching possible weaning time. Through simple monitoring and more-than-routine contact, families and health workers should be alert to the occurrence of acute infections, especially gastrointestinal ones, among the infants at that

time. Proper feeding and hydration for diarrheal episodes are essential components of the counseling and care. Preferably, immunization against measles should be completed before weaning.

The multipurpose worker—e.g., the warranted health agent residing in the village—is probably the only type of person who could be expected to achieve and maintain the intimacy of relationship, accessibility, and general scope of interest that such regimens of health protection demand. The common family crises should not fall into discrete compartments as a consequence of inappropriate specialization of personnel and services. The essential element is individualization and selectivity, not routine attitudes and practices, although implementation of such concepts is difficult and sometimes impossible. For example, to focus on supplemental feeding for certain infants rather than for the whole community may or may not make supplemental feeding feasible. Placing emphasis on lengthening the birth interval for high-medical-risk women does make such advice reasonable and more acceptable.

One of the more serious shortfalls of family-planning programs is the high discontinuation rate among those newly admitted to them. An appreciable number of dropouts may be related to nutrition factors. The willingness of some women to tolerate such side effects of contraceptive measures as bleeding, nausea, and weight gain will be influenced by their degree of anemia and their digestive and general nutritional status. Nutrition promotion could play a greater role than it now does in selection of contraceptive methods and amelioration of secondary symptoms.

Distribution of Commodities

The customary daily distribution of supplemental foods usually does not coincide with the distribution of contraceptives, which is usually done once in 3 months. It is such logistical

differences as these that militate against the easy merging of programs.

Commodity distribution does, however, involve setting up depots for storage, delivery of bulk supplies, maintenance of inventory and timely reordering, and financial and distribution records and reports—all procedures that vary little from one program to another. Similarly, import, manufacture, taxation, transportation, jobbing, and other components of merchandising logistics have much in common.

Distribution is an ancillary consideration, not a central issue, when considering integration between nutrition and family-planning services.

Education

Public education through mass media, schools, and other channels seeks primarily to inform and to increase general awareness and interest. When information on nutrition and fertility relationships is disseminated for these purposes, it should be presented in simplified, understandable form. It should be easily comprehended by peasant people familiar with domestic animals, crops, and the general significance of nurture and disease or stress.

Migrants from the countryside to the city experience radical family dislocation—geographically, socially, economically, and occupationally. While undergoing these changes in their basic values and attitudes, they are likely to be receptive to, as they are in need of, health education and health service. Special effort is needed to identify and serve the recently transplanted residents of marginal sections of the cities. Among the serious problems is the precipitous decrease in the practice of breast-feeding whenever the women accept employment outside the home or simply imitate the infant-feeding practices of groups at higher socioeconomic levels.

For the individual program client, the educational compo-

ment of service includes counseling and instruction. Through counseling, the individual's general awareness and interest is made personally relevant. It involves particularizing what may have been heard on the radio or from the neighbor in a way that leads to constructive action—e.g., choosing from among several available contraceptive methods or giving new foods to the child at weaning.

When the client has been thus informed and motivated, instruction as to specific details helps to ensure success and to increase the likelihood of continual satisfaction in the actions decided upon. For example, the woman may be instructed on how to grow beans in her yard and to mix them with the carbohydrate staple of the society. She may also be told precisely what to do if she forgets to take a day's contraceptive pill. Not only can warranted workers be trained in both counseling and instruction, but they can become extremely skillful in conducting interviews. They can sense when the case is beyond their capacity and should be referred to the nearest professional resource or scheduled for the next visit of the supervisor or itinerant team. Newer communication technology, such as by satellite relay, promises to reach more of the population. The remaining challenge will be to adapt messages to local interests and understanding.

Surveys

For many years, nutritionists have been surveying population groups to assess the extent of malnutrition or to measure the effect of intervention. Similarly, the community fertility survey constitutes a nearly essential technique for evaluating the impact of family-planning programs on fertility. The general procedures are similar, in that both types collect demographic data about households. It is, therefore, not difficult to envision a single survey that serves both ends.

In community studies related to program administration and

modification, simplified methods should be used. From the wealth of data that could be collected, specific items should be selected because they are suitable for large numbers of short interviews and because they are highly informative. No absolute, rigid set of items can be applicable to all situations, but the following list illustrates how certain investigators have reduced the task to practicable dimensions. Recommended observations and measurements include:

- Socioeconomic status of the family
- Age and education of both parents
- For the mother: height, weight, and parity; number and sex of living children; birth intervals and pregnancy experiences within the last 5 years
- For the young children: height, weight, age, and total plasma protein

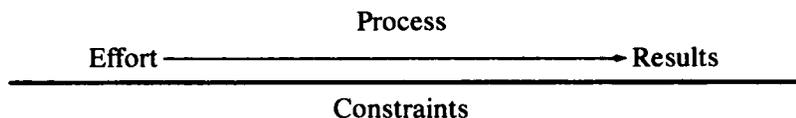
These few items alone would furnish a tremendous amount of valuable information about both nutrition and fertility and would provide a basis for studying the relationships between them. Thus, a threefold set of objectives might be met with a single survey.* The first phase would constitute the preprogram base line for serial repetitions at intervals of 2 or 3 years within the same defined populations, but not on the same cohort of households.

Program Evaluation

In order to evaluate an integrated nutrition/family-planning program, one must first know how to evaluate each component separately.

*S. M. Wishik, S. Van der Vynckt, and B. Liskin. A multipurpose nutrition/fertility survey manual. In preparation at the International Institute for the Study of Human Reproduction, Columbia University, New York.

Evaluation seeks to measure the results obtained in relation to the effort made, as mediated through a defined administrative process within a set of environmental constraints. It is necessary to characterize, measure, and time the effort and the results or effects that seem to or are expected to stem from it. The administrative process and the environmental constraints or circumstances modify and set limits upon both the effort and what it can achieve. The evaluation construct is suggested in the following diagram:



Such an approach can be applied to nutrition promotion programs and fertility modification programs either separately or together.

Evaluation of Effort

Joint evaluation of certain measures of effort is rather easy for the two programs. These measures would include facilities and equipment, manpower (units of staff activity), commodities and supplies, and costs.

Manpower, facilities, and cost could be counted in much the same way by making appropriate adaptations. Even measures of units of activity might have a common classification, such as radio time, audience listening time, or number of personal contacts, home visits, or group meetings. Common facilities can be evaluated in terms of how much time and space are allocated to each component of the program. When funds come from various sources, it is important to distinguish between the sources. Greater difficulties arise when commodities are considered: Since commodities differ between

the two types of programs, they must be measured differently and separately.

Evaluation of Process

Process, or administration, is on three levels. Following are questions—equivalent to analyses—that may be asked about these levels:

Central administration: What are the funding mechanisms? Are they separate or combined? Is there a liaison between the participating agencies? What are the relationships with other cooperating agencies in government, in the private sector, and in the international donor community?

Supervisory administration: Are multipurpose field-workers supervised by multipurpose supervisors, or does each agency establish its own supervisory staff?

Local administration: What is the local administrative structure? Are local administrative officers integrated or separate?

Evaluation of Results

Examples of measurable criteria through which effects of dual nutrition/fertility programs may be demonstrated are given in the following list. The effects are divided into three groups: effects that may appear promptly (within 1 year), effects that are delayed (occurring in 1 to 5 years), and effects that are remote in time (occurring after 5 years).

EFFECTS APPEARING PROMPTLY

Nutritional Phase of Programs

- For women of childbearing age: anovulatory menstruation
- For children, especially at postweaning time: decrease in clinical signs of malnutrition
- For pregnant women, infants, and young children: weight gain

Fertility Phase of Programs

Contraceptive practice: acceptance and dropout
 Among family planning clients: pregnancies (failures)

DELAYED EFFECTS

Nutritional Phase of Programs

Prematurity rate
 Birth weight
 Fetal and neonatal mortality
 Lactation span and completeness
 For young children: growth and development
 For adolescent females: age of menarche

Fertility Phase of Programs

Intervals between births, between pregnancies, and between postpartum return of ovulation and pregnancy

REMOTE EFFECTS

Both Phases of Programs

Population growth
 Selected diseases: incidence, severity, and residual effects
 Women (in relation to age-specific parity and family size): health status and maternal mortality
 Children (in relation to birth order and number of living siblings): growth and development; mortality
 Adolescent and postadolescent females: mature height and readiness for motherhood

Each criterion for a particular group within the population is chosen because a particular outcome is likely within a given time period under conditions of deprivation, and because those outcomes can be ameliorated or prevented by known intervention programs if they are pressed aggressively and in adequate volume. Criteria for assessment must be specific to the purposes. For example, if the practice of breast-feeding is being fostered, the index will be the proportion of infants breast-fed and the duration of effective lactation. If family-planning service has been added to a postpartum return clinic,

the percentage of women who return after childbirth for that important checkup can be used to measure success. For a program of food supplementation in the latter months of pregnancy, the incidence of low birth weight would be considered. When postpartum women at high medical risk are selected for special continuing health supervision, the length of the next pregnancy-free interval and the occurrence of toxemia and other complications in the succeeding pregnancy would fairly be considered as direct and indirect means of measuring success in health promotion.

Obviously, beneficial results are achieved in varying periods of time. Hypoproteinemia and anemia can generally be corrected promptly. Pregnancy can be avoided almost immediately by modern effective contraceptive methods. Improvement in growth among young children takes somewhat longer, whereas reduction in maternal mortality may not become apparent for a decade. Difficulty encountered in reversing a deficit tends to be directly correlated with the time required for the deficiency to develop. The child with kwashiorkor can be cured in weeks. The mother of ten children does not obtain much relief by postponing the birth of the eleventh.

Desired early responses to nutrition and fertility programs can be separated more easily for purposes of assessment and measurement than can the later ones. Eventually, the common objectives for both programs merge. The combined results are reduction in population growth, reduction in incidence of selected diseases and in severity of residual effects (e.g., malnutrition and diarrhea in young children), improvement in health status and longevity in women, increased likelihood of children's survival and of their favorable growth and development, increase in height at maturity, and better preparation of adolescent and postadolescent females for motherhood.

Improvement in the macroeconomy is achieved even more

slowly and is more difficult to attribute quantitatively to the program efforts. The cost/benefit question is difficult, since it is not appropriate or even possible to create equivalents among certain kinds of benefits. For example, how does good health relate to happiness, family welfare, longevity? Benefits that do not have a common unit of measurement cannot be equated. However, certain benefits can be measured and tied to achievements (e.g., child growth and development as the result of more adequate dietary intake). In any event, distinct benefits are not simply additive.

Strategies of Evaluation

As evaluation proceeds from the immediate impact to the more remote, the direct to the indirect, additional variables come into play, and the task becomes more difficult. It is not necessary for every evaluation to cover the whole job. As the time frame of evaluation is extended, changes will be taking place in the society. The setting is never static, and certain changes may be such as to nullify the previously established purpose of an evaluation. Extending time periods introduces into the dynamics of the environment changes that may be too complex to handle in a continuing study—for example:

Have disease patterns altered over time? Are new prevalent diseases affecting mortality and morbidity?

Have biases been introduced during the longitudinal observation?

Have statistical control mechanisms been maintained?

Because of the contextual changes that come about in long-term studies, cross-sectional studies, repeated periodically, perhaps every 3, 4, or 5 years, may well be more useful than longitudinal cohort studies. If cross-sectional studies are

carefully planned, some longitudinal inferences can usually be safely drawn from retrospective data.

Periodic cross-sectional studies must take into consideration seasonal variations. Changes in food intake often occur from month to month. Disease patterns in a community can change with the seasons and over time. Even fertility rates have seasonal fluctuations; seasonality becomes an especially critical consideration when looking at questions of nutrition and fertility simultaneously.

Evaluation should aim to measure not only desired positive effects but also potential negative effects, such as increase in venereal disease, possible shortening of the lactation span, steroid excretion in breast milk, and influences on vitamin metabolism.

Studying cyclically interactive associations between nutrition and fertility cannot be done in isolation from such other associations as socioeconomic status, literacy, education, modernization, and urbanization. One needs to consider these associations carefully before stating, for example, that declining fertility relates to better nutrition or that greater acceptance of contraception relates to offers of food supplements.

In any evaluation it becomes apparent that proper experimental controls are essential. In experimental studies, especially intervention programs, an important ethical issue arises: Who gets and who does not get the commodities or the service? This question can be approached by conducting a "natural experiment," a phased experiment, or a participant/nonparticipant experiment.

Natural Experiments

The opportunity for natural experiments arises where one finds pre-existing differences in an area or situation that can be compared. This is risky, because there are always underlying reasons for the existence of such a situation, and infer-

ences must be guarded. For example, in the 1960's, the government of Pakistan made an official policy decision that rural villages should have local family-planning workers. Toward this end, 30,000 workers were recruited. However, there were about 100,000 named villages in the country at that time, which meant that one worker would be required to cover about three villages. Therefore, each worker was assigned three villages and given a schedule for traveling among them. Obviously, the worker was resident in only one of the three villages, which almost certainly meant that she would spend more time there than in the other two. This situation afforded an opportunity for a natural experiment; the effectiveness of the family-planning workers in the villages of residence could have been compared with their effectiveness in the other villages. Unfortunately, the comparison was not made.

Phased Experiments

In this approach, more and more areas or populations are added progressively to an original experimental area. At the beginning, base-line information is gathered for all; thus, by the end of intervention, a model of increasing lengths of time between the base-line point and each successive intervention phase is created. In this way, time intervals can be correlated with the occurrences and magnitude of measured changes.

Participant/Nonparticipant Experiments

This approach compares the population of an area that receives the intervention program with that of one that does not, although in both areas there will be some persons practicing the contraceptive or nutritional behavior under study. This technique confronts the common fallacy of trying to focus on individuals rather than on a group: i.e., although it is wise to identify treatment and result in the same individuals,

it often is neither possible nor feasible to do so. For example, some family-planning programs have compared contraception “users” with “nonusers” on the assumption that the difference between the two groups is an acceptable index of program effect. Clearly, the initial difference between the groups—the decision to practice contraception to avoid pregnancy—is tied inseparably to the measured outcome, the avoidance of pregnancy. The behavior of the total eligible populations in the two communities composed of users and nonusers, in whatever proportions, is a more appropriate indication of whether there has been an impact on the society.

Implications for Program Intervention

The need for a combined approach to achieve the dual objectives of improved nutrition and modified fertility emerges clearly when findings and trends are simulated in different, admittedly hypothetical, communities.

Table 2 presents these relationships in four types of communities.

Community O is a deprived population, where mothers are on inadequate diets and their fertility is uncontrolled. Since maternal nutrition is poor, mothers will be more vulnerable to unfavorable pregnancy outcomes and interrupted pregnancies. Despite fairly adequate lactation performance, these mothers will still have high infant losses that shorten the interbirth interval. Eventually, higher parity will result. The combined cyclic interactions adversely affecting pregnancy wastage, maternal nutrition, chances of infant survival, child growth and development, and maternal longevity will persist.

In Community A, diets have been modified. Maternal nutritional status should improve somewhat, and pregnancy outcomes should be more favorable. However, if fertility is uncontrolled, mothers for parts of their childbearing years remain in risk categories that aggravate pregnancy wastage and infant loss. A secondary result would be birth intervals

TABLE 2 Expected Status in Comparison with Acceptable Levels^a

	Community O: Diet and Fertility Unmodified	Community A: Diet Only Effectively Modified	Community B: Fertility Only Effectively Modified	Community AB: Both Diet and Fertility Effectively Modified
Maternal nutritional status	-	+	-	+
Likelihood of pregnancy completion	-	+	-	+
Lactation competence	+	+	+	+
Likelihood of infant survival	-	±	-	+
Birth interval	-	±	±	+
Fertility rates	-	-	+	+
Total pregnancy wastage	-	±	±	+
Family welfare	-	±	-	+
Child growth and development	-	±	-	+
Maternal longevity	-	±	-	+

^a (-) indicates undesirable situation; (±) improved, but not fully satisfactory; (+) desirable situation.

shorter than desired, high overall parity, and possibly reduced maternal longevity.

In Community B, fertility modification has been introduced. If the fertility factor alone is "effectively" controlled, maternal nutrition and its sequelae would not be corrected. As a result, pregnancy wastage remains high, as in Community O, and leads to shortened birth intervals and undesirable sequelae despite adoption of effective contraception.

Community AB has an effective combined diet and fertility modification program. This is the only approach that breaks through these interrelated cyclic phenomena and permits the attainment of positive results in all the categories listed.

Implications for Future Action

Policy Development

- The sharp decrease in breast-feeding is a matter of widespread concern. It compounds the serious deficits in food availability and the high incidence of infant disease and death among many marginal populations. There should be established under suitable auspices a world program to sponsor education on human lactation and to provide nutritional and social support that will enable more women to breast-feed their babies successfully and for adequate periods.

- Adolescent and postadolescent pregnancy may superimpose the physiologic demands of pregnancy upon the stresses of immaturity and recent or continuing body growth. When this occurs, the health hazard to the mothers is high, especially under conditions of malnutrition. Policies should be supported that (a) promote better nutrition among preadolescent and adolescent females, (b) aim to postpone the age of marriage and of first pregnancy, and (c) identify pregnancies among very young women and offer special health supervision to them.

- Policies should be devised to promote intervention programs that offer integrated or parallel services of nutrition promotion and fertility modification in order to capitalize on their common requirements, common target populations, and probable synergistic effects.

- More attention must be given to the implications of rapid urbanization in less developed countries, with emphasis on special types of programs for nutrition promotion, fertility modification, and other social services among recent migrants to the cities.

Program Development

Once suitable policies are established, they should be implemented through program development, which possibly should be the responsibility of bilateral and multinational aid agencies and national governments. Funds might well be pooled in order to establish action programs in various parts of the world, which would constitute a matrix of patterns and approaches applicable to diverse settings and stages of development.

- Most programs should have immediate objectives rather than remote ones, on the assumption that the former are prerequisite to the latter. The world changes too fast to allow the luxury of setting long-term goals in the face of the present-day deficits of malnutrition and pregnancy wastage.

- Integrated nutrition/fertility programs should be started where there are not yet programs of either kind. Otherwise, where there are already two separate programs, either might be woven into the infrastructure of the other.

- Especially in rural areas, emphasis should be placed on the critical life points for protection of nutrition and human reproduction—the adolescent female, the pregnant and lactating woman, and the weaning child.

Certain supportive efforts and measures would be necessary. These include inventory and dissemination of information, assessment of status by surveys and other methods, strengthening of administrative infrastructures, manpower development, program evaluation, and research.

Information

It might be useful to set up a worldwide inventory of outstanding examples of different types of programs and to give special attention to illustrations of successful integration between fertility modification and nutrition promotion.

Surveys

The methodology of the multipurpose nutrition/fertility survey should be sharpened in specific pilot populations, and general techniques and guidelines for adaptation to different settings should be developed. Aspects suggested for priority attention are

- Establishing standards and indexes for nutritional assessment, fertility measurements, and socioeconomic differentials
- Designing and conducting cross-sectional benchmark surveys as a basis for national policy, planning, and program development
- Maintaining a dynamic approach and technique in order to change the focus of analysis as the issues of nutrition and fertility become more central to national policy
- Giving full consideration to the role of socioeconomic factors; attention must be paid to nonhomogeneity, even at the lowest levels of poverty
- Building base-line and periodic serial surveys into integrated experimental programs

Administration

Patterns must be developed and tested for different combinations of agencies and agency units, with liaison mechanisms that capitalize on integration between nutrition-promotion and fertility-modification resources and develop approaches for parallel and complementary activities. The objective should be to contact as many as possible of the total population, commencing in an area that already has a significant amount of service and moving progressively to other geographic areas as resources permit.

Personnel Development and Training

Ways should be found to strengthen resources for manpower development and to promote activities aimed at giving single-purpose workers complementary skills needed in integrated programs, by

- Augmenting personnel and curricula of international, regional, and national teaching institutions and training centers
- Sponsoring seminars for the training of trainers, including the use of educational materials in the local training of large numbers of workers
- Building evaluation into training programs for progressive improvement in successive rounds

Evaluation

In most intervention programs, evaluation should aim to associate rates of change in time, place, and population groups quantitatively with amounts and types of program effort. In selected programs, an experimental approach with suitable controls should be attempted and carefully evaluated.

Research

It is important to recognize the paucity of information on issues that are essential to progress, especially when these issues relate to the interactions of, and the potential for complementary attack upon, nutrition and fertility. Much of this information can be obtained only through research.

Research Needs

Further research is necessary in the following areas:

Physiology and Biology

- Effects of nutritional status on age of menarche and on regularity of later ovulation
 - Relations between nutritional status, age of menarche, body growth, and teen-age pregnancy
 - Effects of birth spacing and parity on maternal health (nutritional status, morbidity, and mortality)
 - Effects of maternal nutritional status on pregnancy wastage
 - Effects of maternal nutritional status, birth spacing, and birth order on child health status (birth weight, growth and development, morbidity and mortality, and intellectual capacity)
 - Length of delay in return of postpartum ovulation with full, partial, and no lactation at different levels of maternal nutritional status
 - Effects of induced abortion on maternal nutritional status, health, and fecundity; and effects of maternal nutritional status on complications of induced abortion
 - Mutual interrelationships between nutritional status, especially iron stores and metabolism, and the use of the intrauterine device

- **Hormonal contraception and nutrient interaction: epidemiologic studies of contraceptive users at different levels of nutritional status (especially relevant in less developed countries)**
 - **Contraception and lactation performance: effects on milk production, supply, and composition**
 - **Hormonal contraception and effects through breast-feeding on neonatal and postneonatal infant nutrition and metabolism**

Culture, Economics, and Demography

- **Interrelationships among nutritional status, fertility rates, socioeconomic levels, and population growth**
 - **Extent and timing of influence of decreasing infant mortality on fertility levels**
 - **Effects of fertility rates and patterns on maternal and child mortality rates**
 - **Economic value and cost of children in different settings, as estimated and as perceived by the families, and relationship to nutritional status and dietary intake of members of the family**

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