

BIBLIOGRAPHIC DATA SHEET

1. CONTROL NUMBER
PN-AAJ-7032. SUBJECT CLASSIFICATION (695)
AE30-0000-0000

NF

3. TITLE AND SUBTITLE (240)

Relationships of rural development strategies to health and nutritional status: consequences for fertility; a state-of-the-art paper

4. PERSONAL AUTHORS (100)

Isely, R.B.; Zivetz, Laurie; Norman, Roland; Banatte, Hetty

5. CORPORATE AUTHORS (101)

Research Triangle Inst.; South East Consortium for International Development

6. DOCUMENT DATE (110)

1979

7. NUMBER OF PAGES (120)

93p.

8. ARC NUMBER (170)

304.63.I78

9. REFERENCE ORGANIZATION (130)

RTI

10. SUPPLEMENTARY NOTES (500)

(Produced for AID/Office of Rural Development and Development Administration as part of The Rural Development and Fertility Project)

11. ABSTRACT (950)

12. DESCRIPTORS (920)

Rural health Child health
Health services Child nutrition
Rural development
Nutrition
Fertility
Health
Maternal/child health

13. PROJECT NUMBER (150)

931117000

14. CONTRACT NO.(140)

AID/ta-CA-1

15. CONTRACT TYPE (140)

16. TYPE OF DOCUMENT (160)

304.63
I78

PN. HAJ-703



Relationships of Rural Development Strategies to Health and Nutritional Status: Consequences for Fertility

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**Conducted by
Research Triangle Institute
and
South East Consortium for International Development**

Produced for

**Agency for International Development/Office of Rural Development and
Development Administration as part of
The Rural Development and Fertility Project**

RELATIONSHIPS OF RURAL DEVELOPMENT STRATEGIES TO HEALTH AND
NUTRITIONAL STATUS: CONSEQUENCES FOR FERTILITY
A STATE-OF-THE-ART PAPER

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Submitted to the Research Triangle Institute and
the South East Consortium for International Development
as part of the Rural Development and Fertility Project.

(No. AID/ta-CA-1)

June, 1979

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FOREWORD

This report is part of a series of State-of-the-Art Papers called for under AID Project 931-1170, Rural Development and Fertility. The Project was designed to assist AID officials, overseas and in Washington, to comply with the mandate included in the 1975 Foreign Assistance Act, Section 104d. That section stipulates that "(1) Assistance shall be administered so as to give particular attention to the interrelationships between (a) population growth, and (b) development and overall improvement in living standards in developing countries, and to the impact of all programs, projects, and activities on population growth. All appropriate activities proposed for financing under this chapter shall be designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families, in programs such as education in and out of school, nutrition, disease control, maternal and child health services, improvements in the status and employment of women, agricultural production, rural development and assistance to the urban poor." The amendment to the FAA continues to authorize the President "...to study the complex factors affecting population growth in developing countries and to identify factors which might motivate people to plan family size or space their children."

These papers examine the extensive literature which encompasses rural development and fertility relationships. Seven State-of-the-Art Papers (SOAPs) were produced: addressing the primary determinants of fertility. From this research base the second phase of the project will "...study the complex factors affecting population growth..." in operational settings, particularly through the medium of project implementation. Case studies will be designed to examine development in rural areas and to isolate the fertility implications of changes in the socio-economic environment. Translating the results of this investigation to decision makers in developing nations and within donor organizations is also

a primary goal of the Project. In addition to publications, a series of seminars, workshops, and intensive technical assistance in participating countries are planned as part of an outreach component of the Project.

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The views and interpretations in this publication are those of the author(s) and should not be attributed to the Agency for International Development or to any individual acting in their behalf.

The seven papers were reviewed by an independent panel of experts including:

- Dr. William P. McGreevy, Battelle Memorial Institute
- Dr. Cecile E. De Sweemer, Johns Hopkins University
- Dr. Rae Lesser Blumberg, University of California
- Dr. Nadia Youssef, International Center for Research on Women
- Dr. Roxann Van Dusen, AID/PPC/PDPR

The SOAPS reflect the comments of the review panel: however, responsibility for content rests with the authors.

STATE OF THE ART PAPER:

RELATIONSHIPS OF RURAL DEVELOPMENT STRATEGIES TO HEALTH AND NUTRITIONAL STATUS: CONSEQUENCES FOR FERTILITY

I. INTRODUCTION: CONCEPTUAL FRAMEWORK

The purpose of this presentation is to summarize what is known and what is not known about a series of linkages between rural development strategies on the one hand and fertility indicators on the other, with the health status of populations, notably mothers and children, interposed between the two as an important intermediate variable. The approach to exploring these linkages will be a review of existing available literature in order to extract a series of supportable hypotheses, statements about the relationships among factors. Beginning with the ultimate outcome variable, fertility, first those health factors having an immediate effect will be discussed. Although health factors in the population at large may be considered, particular attention will be given to the health of mothers and young children because these groups influence fertility the most directly. Then sequentially, factors with decreasing degrees of immediate relationships to fertility will be explored, until factors can be identified which can be considered likely results of development strategies as well as determinants of fertility in a sequence with health factors. Three types of development strategies will then be examined in relation to these sequential determinants of health status and fertility:

1. Participatory development
2. Development with increased agricultural production and productivity as goals
3. Development with increased income as a goal.

As a prelude to the analysis of existing literature, a conceptual framework illustrating the aforementioned linkages is presented (Fig. 1).

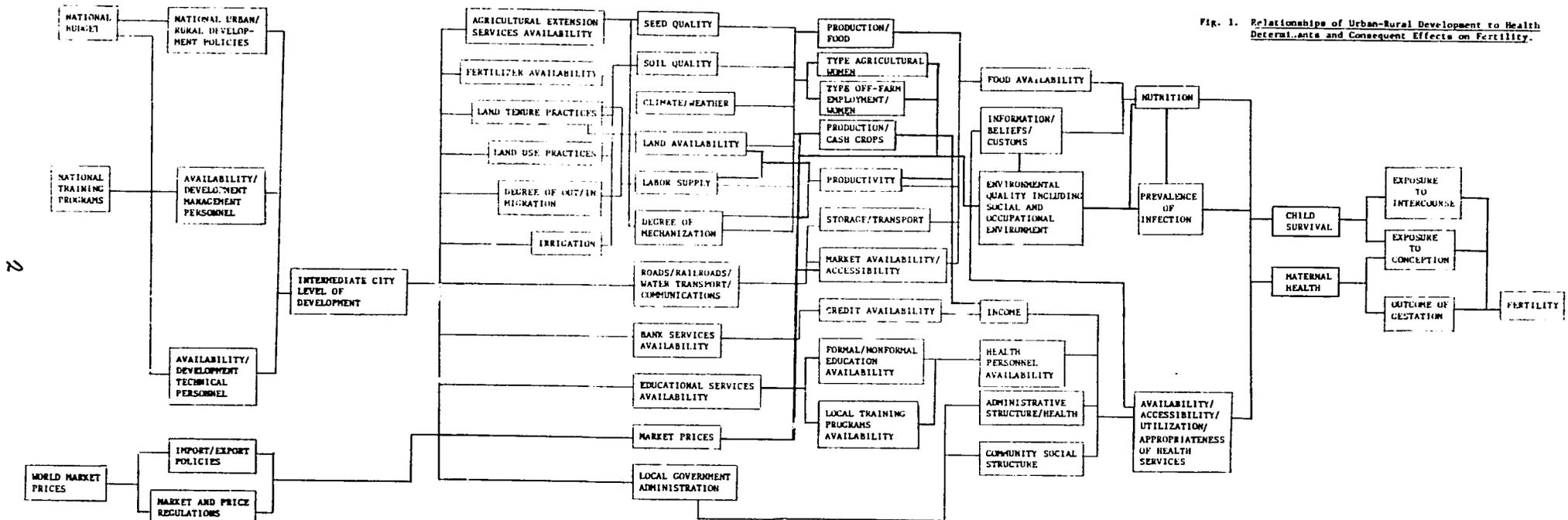


Fig. 1. Relationships of Urban-Rural Development to Health Determinants and Consequent Effects on Fertility.

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The diagram attempts to illustrate the complex nature of the relationships among factors subject to the effects of rural development strategies and fertility, as those effects are mediated through the health status of women and children. Because of the inherent limitations in such a diagram, however, certain important relationships could not be illustrated. For example, the effects of a development effort on outcomes such as health, nutrition or fertility status may be mediated by variable length networks. In fact, many of the intermediate variables have direct effects on fertility without assuming the interposition of health status (Wyon, 1979). This implies very different strengths of impact on health/nutrition/fertility status after a given period of exposure to a particular development strategy. These relationships will be discussed later as they are relevant. There are also many two-way relationships, such as that between fertility and health status, and many interactions among the variables which could not be illustrated, so that the diagram could be kept as simple as possible. With these limitations in mind, the conceptual framework should be nonetheless useful to the development officer or economic planner in assessing the potential effects of various program options on fertility as they impinge on the health status of women and children.

As indicated in the diagram, there are several levels of interrelationships of interest, from the macro concerns of national economic and social planning, to the micro considerations of community level service extension, production, income, health status, and fertility. Moving from left to right in the diagram, the first three columns may be assigned to the national or macro level of development, whereas the remaining columns focus on factors at the community level.

The left side of the framework is cast from a concept of integrated urban-rural development (Rondinelli, 1978), where it is assumed that socio-economic and health factors affecting fertility levels in a rural society are subject to the influence of urban-based institutions and services, that there exist, in fact, enormously complex networks of exchange of goods and services between urban centers and their populations, and the populations of rural communities, networks based on kinship and

social as well as economic ties. This theory has been developed extensively by Rondinelli and Ruddle (1978) and Esman (1978).

Two overall options exist for the implementation of development strategies to operationalize the linkages of the diagram: one assumes a centrally directed planning and implementation process for each of the major sectors affecting the quality of life in rural societies. This mode of operation is based on the familiar "trickle-down" theory of most Western planners, so extensively employed in the developing world. The other option is one of decentralized participatory development, used extensively in China and Tanzania but less so in other parts of the Third World. As various linkages are discussed in the course of this paper, these two options will be considered. Participatory development will be one of the three strategies studied at the end of this paper.

In the sections which follow, this conceptual framework will be discussed in detail. First the linkages of maternal health status and child survival to fertility will be explored, then the determinants of maternal health status and child survival will be discussed in detail. The proximal factors affecting these determinants will then be surveyed. Finally, the framework will be used to generate a number of research questions regarding the effects of three major development variables on health status and consequently on fertility. Answers to these questions will then be sought in the literature.

Evidence will be reviewed from every part of the developing world. In general, the hypotheses put forward and the conclusions drawn will be only those supported by evidence from more than one society. Because of the difficulty of generalizing about conditions in any country, however, more so in any region of the world, the evidence reviewed must be carefully weighed before conclusions can be transferred to another economic or socio-cultural context. Nonetheless some generalizations are possible. For example, the arid regions of the world have a great deal in common ecologically and culturally. The search for water dominates much of existence, as does the constant threat of drought. Cultural values tend to be less eroded than in urban or coastal areas. On the other hand, tropical particularly equatorial areas tend to have abundant food and

water. In Africa at least, societies in these regions are less coherent culturally. Cities of the developing world have in common rapid population growth, breakdown of traditional cultural values, and widespread unemployment. The primate cities, frequently only one or two in number, per country, tend to be coastal. Rural regions within the sphere of influence of primate cities, tend to exhibit marked demographic and economic effects as a result of the out migration of the young adult, particularly male population.

Generalizations such as these help to tie together areas of different countries with similar characteristics and to set the stage for some generalization of the findings of this review.

II. LINKAGES BETWEEN HEALTH STATUS AND FERTILITY

A. Definitions

1. Maternal Health Status

This term refers to the general state of health of the mother as well as such specific items as her pregestational weight, height and hemoglobin, the level of infection (syphilis, gonorrhea, tuberculosis, rickettsial infection and urinary tract infection) and parasitism (malaria, hookworm, and schistosomiasis) and the degree of chronic disease such as diabetes, cardiac disease, or hypertension. It includes also the maternal survival rate, parity, and intergestational interval.

2. Child Health Status

The ultimate criterion is, of course, the child survival rate at various ages (28 days, 12 months, 36 months, 60 months) but important elements in child survival include growth (weight principally but also height, weight for age, and weight for height), hemoglobin level, infection levels (gastroenteritis, bronchopneumonia, measles, whooping cough, tuberculosis, and tetanus of the newborn), and levels of parasitism (malaria and hookworm, principally).

3. Fertility

This end point may be measured most practically in terms of the crude birth rate (live births/1000 population) total fertility ratio (number of live births per woman at age 45), the general fertility rate (live births per woman 15-44 years), or age-specific fertility rates (live births per age cohort of women, e.g., 20-24 or 25-29).

B. Linkages

According to Davis and Blake (1955) all the socio-economic determinants of fertility impinge upon three aspects of reproduction: exposure to intercourse, exposure to conception, and outcome of gestation. It will be evident in the discussion to follow that maternal health status and child survival affect fertility through each of these three aspects: maternal health by influencing both the possibility of conception and the outcome of pregnancy and child survival through its effect on exposure to intercourse and exposure to conception.

1. Maternal Health and Fertility

Obvious correlates of aspects of maternal health status with infertility, such as chronic gonorrhoea, pelvic tuberculosis, and pelvic schistosomiasis, point to the importance of this relationship. In addition, other conditions, such as malaria, syphilis, certain viral, bacterial, rickettsial, and protozoan diseases and obstetrical trauma affect pregnancy wastage (WHO, 1975). Finally, smoking and narcotic abuse, diabetes, cardiovascular disease, and pelvic skeletal abnormalities of varying etiology may affect both fetal loss and infant survival (Naeye, 1974).

Maternal malnutrition has its greatest effect on fertility through delayed menarche (Frisch, 1978a). Lately, new evidence has implicated maternal undernutrition in decreased ovulation (Frisch, 1978b). Maternal height as a measure of premenarchal nutritional status correlates directly with the stillbirth rate, foetal loss and the occurrence of low birth weight for gestational age (Butler, 1969). The latter is also influenced by maternal weight gain in particularly the third trimester of pregnancy (Naeye, 1973). There also seems to be a correlation of maternal nutrition with the incidence of prematurity (Baird, 1962).

One outstanding question is what effect a state of chronic undernutrition in women of childbearing age has on fertility. The evidence seems to point to both delayed menarche and earlier menopause in undernourished women (Frisch, 1978a) and diminished to completely arrested ovulatory activity with various degrees of nutritional deficiency. What remains unclear and somewhat controversial are the mechanisms whereby nutrition exerts these effects. Frisch (1978b) has suggested a critical role for the ratio of body fat to total body weight. By this mechanism she observes that women with too much fat may also experience a deleterious effect on fertility. Also unclear is the question of whether there are critical times in a woman's development when the fat/total body weight ratio has its most potent influence, as for example at menarche or at certain points during the child bearing years.

From the experiences during World War II in the Soviet Union, where women subjected to severe nutritional deprivation maintained

fecundity rates, although giving birth to much smaller infants (NRC, 1970), it may be safe to assume that maternal nutrition has little influence on fertility through its effect on fecundity. In Holland, however, a definite drop in conception rates was noted. We have seen the influence of maternal nutrition on fertility through its effect on foetal and neonatal mortality.

2. Child Survival and Fertility

The most studied aspect of the relationship of child health to fertility is child survival (the converse of child mortality). It is generally assumed that child survival rates in developing countries (i.e., countries where breastfeeding and postpartum abstinence are practiced, Ware, 1977) influence fertility negatively, i.e., as child survival increases, fertility declines. The degree to which child survival affects fertility remains, however, in doubt. Park *et al.* (1979) conclude that the total effect of infant death on national fertility rates may be minimal, explaining less than three percent of the total excess births, but that important micro level fertility effects must take place. The interplay of infant mortality with social and economic factors impinging on family size must also be taken into account. In any case, there is no country with a high infant mortality and low fertility rate (Birdsall, 1977). What is not clear, as will be discussed below, are the mechanisms operating to produce this effect.

If child survival influences fertility as we have assumed, then it follows that factors which increase child survival: improved environment, improved nutrition (see also below), and protection against infectious diseases will affect fertility in the same way and that factors which detract from child survival: inadequate environmental hygiene, undernutrition and high prevalence of infectious diseases will have a positive effect on fertility.

It is at these points where development strategies must have their effect if they are to bring about a diminution in infant and/or child mortality.

Child health is not easily separated from child nutritional status. The two, in turn, cannot be easily separated from maternal health and nutrition status. These interrelationships too will be discussed later. We have already implicated child nutrition in the determination of child survival. It is through this means that child nutrition most influences fertility. Approximately 25 percent of childhood and infant deaths in developing countries are

directly due to malnutrition (Morley, 1973) while in over 50 percent of deaths malnutrition is a contributing factor (Puffer, 1973). We cannot, therefore, ignore the influence of child nutritional status on fertility.

The effects of nutritional status are pervasive. The infant born with low birth weight for gestational age has in fact suffered an in utero malnutrition. These infants, depending on the environment into which they are born, are thus set back from the beginning. Werner, et al., (1971) have documented their prognosis.

The remaining determinants of nutritional status are environmental, chiefly food availability (Jeliffe, 1966) and the effects of recurrent acute infections (McGregor, 1976): anorexia, caloric loss through vomiting and diarrhea and increased caloric consumption with fever. Rowland (1977) has calculated that infants in rural areas of a developing country may have diarrhea 72 days out of a year.

Controversy surrounds the mechanisms whereby child survival and fertility factors interrelate. Friedlander (1977) has classified the theoretical effects of child mortality into four groups and reviewed the existing evidence for each one. In brief, these mechanisms include the following.

- . Replacement Effect

When additional births are attempted with the motivation to replace the actual death of a child or children.

- . Insurance Effect

When in anticipation of high and varying mortality levels in a society in which the fulfillment of a given large family size is an important familial goal, reproductive norms exceed the level necessary to produce the normative family size.

- . Physiological Effect

This operates largely through shortened breastfeeding periods leading to a more rapid return of ovulation following an infant death (i e., increased fecundity).

- . Effect on Fertility of Alternative Societal Responses to Change in Child Mortality

In this effect, responses in substitution for or complementary to changed reproductive norms are operative, for example, migration.

Differential effects for each of these mechanisms under various societal conditions are postulated. They are summarized in Figure 2 (Friedlander, 1977). Most of these theoretical constructs, while helpful to understanding the complex matrix of interacting factors, remain to be confirmed empirically (Gaisie and David, 1974).

There is, however, some evidence that populations at the lowest and highest levels of economic development exhibit the strongest replacement effects (Birdsall, 1977) but there is considerable variance of opinion as to whether the poorest of countries even with the strongest replacement effects end up with more or fewer people as mortality falls. The probability is that the effect of reduced mortality (increased survival) is delayed and operates indirectly to affect fertility: lowered mortality induces parents to invest more in their children and to have in turn a lowered desired fertility and ultimately a lowered completed fertility. Notions of this sort need further study for verification.

C. Immediate Determinants of Maternal Health Status and Child Survival

Three separate determinants are suggested in the diagram: nutrition, the prevalence (and incidence) of infection and the availability, accessibility and utilization of health services. They have obvious importance for both maternal health status and child survival. The list is incomplete, however, without mentioning two important interactions in the equation: the effects of fertility on both child survival and maternal health, well-documented in the literature, and the effect of maternal health itself on child survival. The list of immediate determinants expands thus to five. Development strategies will have to influence these immediate determinants if they are to affect fertility through health. Each relationship will be discussed in turn.

1. Determinants of Maternal Health Status

a. Nutrition

Two nutritional factors are of major importance to maternal health: iron levels and total caloric consumption. Deficiency in the former is well documented in the medical literature as a prevalent cause of morbidity among women. Menstrual loss is a primary contributor to iron deficiency, but diseases (malaria and ankylostomiasis) repeated closely-spaced pregnancies, (National Academy of Sciences, 1970) and iron-deficient diets all play major roles.

Characteristics in Modernization	Status of Family Planning Practice	Child Mortality Levels	The Demographic Impact of			
			Replacement Effect	Insurance Effect	Physiological Effect	Child Mortality Upon Fertility
Traditional	Low	High	Low	High	High	High
Less Modernized (Transitional)	Low	Low	Low	Low	High	Medium
Modernized	High	Low	Low	Low	Low	Low
Nature of Impact			Low	Medium	High	

Fig. 2. Intensity of the Demographic Impact of Child Mortality on Fertility Through Three Effects, Under Different Conditions in Child Mortality and Family Planning Practice Characterizing Less and More Modernized Societies.

Taken from Friedlander D. (1977), Proceedings of the IUSSP Conference, Mexico City, 183-203.

The consequences of iron deficiency to the woman include anemia, malabsorption of iron (Kimber and Weintraub, 1968), lowered work output (Basta and Churchill, 1974), lowered ability to cope with infection (Basta and Churchill, *ibid*) and greater risk of fatal hemorrhage during labor and delivery. For the foetus the consequences are minimal, since the woman normally transfers 500 mgm. of stored elemental iron to the foetus during the third trimester of pregnancy even if she is herself in a deficient state of iron balance (Woodruff, 1977).

Total caloric consumption is the single most important nutritional factor related to maternal health. Caloric deficiency is manifested in two dimensions: longitudinally it affects statural growth of women and consequently the size of the pelvis and the ability to deliver a normal foetus (Thomson and Billewicz, 1963). Maternal height has been positively associated with foetal size (Naeye, 1973), and negatively associated with still birth rates and the incidence of cephalo-pelvic disproportion (Thomson, 1968).

Concurrently deficient caloric input affects work output (Scrimshaw and Gordon, 1968), response to infection (Scrimshaw, *et al.*, 1968), and foetal size (Naeye, 1973). In many societies there are marked seasonal variations in adult weights (McGregor, 1968). In West Africa the low points in adult weight coincide, unfortunately, with the heaviest agricultural activity of the year, the greatest incidence of malaria and other infections, and the lowest supply of food.

Protein intake closely follows total caloric ingestion and there exists little information on the effects of isolated protein deficiencies in human adults. As a result, most of what has been said above concerning the effects of caloric deprivation applies equally to protein deficiency.

b. Prevalence and Incidence of Infection

The infections having the greatest impact on maternal health include malaria, schistosomiasis, venereal diseases, and tuberculosis. Strategies aimed at improving maternal health and consequently fertility and child survival must address these diseases.

Malaria incidence varies with season of the year and is generally greatest during the rains. Although most adults in endemic areas have a certain degree of immunity (premunition), protection is seldom complete. The severity of a given episode is dependent on the number of parasites engaged in simultaneous multiplication. Most episodes in adults are mild or even subclinical. Alterations in health status are due to the cumulative effects of repeated episodes. They include anemia, splenomegaly and weight loss from anorexia. In pregnant women there are in addition specific effects on placental function, leading to increased abortion, stillbirth, and retarded foetal growth.

Schistosomiasis is a chronic infection acquired from exposure to water contaminated with larval forms of the Schistosome. Women are particularly at risk in some societies because of their water related activities: water drawing, clothes washing, bathing children, and wet land rice cultivation. Health consequences include anemia from chronic blood loss, and weight loss from caloric loss, and anorexia in cases of renal or hepatic complications. Severity varies with intensity of infection, but complications may not occur in more than 10-15 percent of adults in endemic areas (Kloetzel, 1962). In women schistosomiasis may cause endometrial or ovarian lesions leading to lowered fertility through ovarian destruction or interference with implantation.

Venereal diseases, particularly syphilis and gonorrhea, contribute to maternal morbidity largely through their effects on pregnancy wastage and fecundity respectively. Fifty-seven percent of women with a positive serologic test for syphilis during pregnancy will terminate the pregnancy in an abortion or still birth. Eighty-five percent of live born children will be infected (McFalls, 1973). Existing data indicate that the prevalence of syphilis may vary from 7.5 percent to 22.6 percent (Retel-Laurentin, 1973) in societies of developing countries.

The prevalence and incidence of gonorrhea are much more difficult to estimate, given the lack of reliable means of diagnosis, but chronic gonorrhea in its various forms in the male-chronic epididymitis, and in the female-chronic oophoritis, chronic salpingitis, and tubo-ovarian abscess is estimated to be the leading cause of infertility in its secondary form (WHO, 1975).

Tuberculosis is an important infection of young women in nearly every developing country. In the population at large, incidence varies from 0.2 percent to 0.4 percent and prevalence from 0.1 percent to 0.2 percent (Labusquière, 1975). It ranks fifth to sixth among causes of death for adults, and is one of the contributors to a male/female ratio of greater than 1.0 in many societies. Specific health status effects are well-known: weight loss, lowered productivity leading to debility and death. In some women tuberculosis salpingitis or endometritis may be a cause of infertility (WHO, 1975).

Other infections of relative importance to the health of women in developing countries should be noted:

- Ankylostomiasis, responsible for anemia and caloric loss with particular impact during pregnancy.
- Leprosy causing physical debility in some women, but psycho-social debility in a greater number.
- Streptococcal infections especially when they lead to post-streptococcal rheumatic fever and rheumatic heart disease with its striking prevalence in women of child bearing age.

c. Availability/Accessibility/Utilization/Appropriateness of Health Services

These four concepts must all be included as one considers the effect of health services on health status, for available services are not necessarily accessible to a population, and even accessible services may not be utilized. Finally, services utilized must be appropriate to the needs of that population.

Under availability would be included such concepts as physician/nurse/health center/hospital/population ratios. Accessibility has both geographic, economic and psychological dimensions. There is evidence to corroborate the seemingly general rule that persons who live beyond ten kilometers from health services rarely use them (King, 1968). The problem of distance is the first barrier to access to services. There are also economic barriers particularly in rural areas, but also in urban areas, where the barrier of distance may be minimal. Other

economic barriers include the fact that it is necessary to pay not only the fees for care and medications, but also the costs of taxi fare, and sometimes food and lodging as well, if a long trip is necessary. As a general rule in sub-Saharan Africa, no more than 30 percent and frequently less of the population, has access to any form of health care (Newell, 1975). A study at Kinshasa by the Presidency shows that 55 percent of the population is in the lower socioeconomic categories. Of these groups, only 19 percent have access to health services on a regular basis. In contrast among the 45 percent who are in upper socioeconomic classes, 100 percent have access (Synchrisis, 1975). An additional economic problem concerns the habit of tipping health staff in order to obtain services.

Beside the two groups of barriers discussed above, which prevent 60 percent of the population from seeking medical care, there are also strong psychological barriers which are effective even in the absence of economic or distance barriers. The first one is the great cultural distance which often exists between the sick person coming from his or her village to the personnel who give medical care. This cultural distance concerns factors such as: (a) the perceived cause of the disease, (b) the means and criteria of a diagnosis, (c) the means of effective treatment, and (d) factors which determine prognosis. Too often the nurse or the physician do not reflect upon the long years of socialization which were necessary for them to accept modern theories of medicine. They do not understand that for a sick person to accept these modern concepts, she or he must reject an entire health belief system. This psychological barrier is found especially among less educated persons whose accumulated experience creates for them the impression that the way to medical care is blocked. This impression is created by the frequent long wait in front of a clinic, the insensitivity of clerical personnel, the brusque attitudes of medical personnel, the absence of an explanation of the disease, its cause, its treatment, let alone the long duration or the difficulty of treatment. Frequently, the sick person begins and ends the course of a disease without even knowing the name of it. Even if the disease is diagnosed, it is often necessary to seek

treatment elsewhere because the stock of medications at the dispensary is used up.

Utilization refers to the rate at which both health services in general and particular services such as prenatal care intra-partum care, child spacing, etc. are used by a population at risk, in this case women of child-bearing age.

Finally, appropriateness of services depends upon a number of subsidiary factors: the ability of a population to perceive its health problems, the ability of health personnel to perceive of problems as the population does, and the supply of such personnel as well as necessary material and equipment to bring to bear on these problems. For example, seeing that women prefer to deliver in their own villages might lead health personnel to organize training for village midwives in aseptic delivery techniques and to promote village organization around their support (Villod et Raybaud, 1965).

The relationship of each of these four factors to maternal health is of interest in this paper.

. Availability

Statistics relating health service ratios to maternal mortality are not available, but a table (see Table 1) relating health expenditures and health resources to the life expectancy is instructive. Of note is the tendency almost without exception for countries with life expectancies under 50 years to have unfavorable population/physician and population/non-physician primary health worker ratios. Less consistent is the relationship between per capita health expenditures and life expectancy, although countries having an average life expectancy of less than 50 years have per capita health expenditures of only \$2.34 per capita, whereas those with life expectancy greater than 50, average \$4.08. There is thus an indirect indication that available health service resources may influence maternal health since a sizeable proportion of the mortality on which life expectancy tables are based is contributed by women in most developing countries.

. Accessibility

What effect if any does increasing the accessibility of health services have on maternal health status? Accessibility is

Table 1

LIFE EXPECTANCY BY PER CAPITA HEALTH EXPENDITURE, POPULATION
PER HOSPITAL BED, POPULATION PER PHYSICIAN, POPULATION PER NONPHYSICIAN
PRIMARY HEALTH WORKER IN SELECTED COUNTRIES¹

Country	Life Expectancy	Population Per Physician	Population Per Non-Physician Primary Health Worker	Government Health Expenditures Per Capita US \$
Burundi	39.0	59,066	11,770	-
Upper Volta	39.0	92,828	88,260	0.56
Ethiopia	40.0	73,289	24,800	0.67
Viet Nam	40.5	9,203	2,630	1.00
Malawi	41.0	75,254	5,170	0.50
Benin	41.0	29,118	14,100	-
Nigeria	41.0	20,525	3,830	-
Central African Empire	41.0	36,952	3,910	2.81
Mauritania	41.0	17,206	6,000	-
Guinea	41.0	51,688	4,570	-
Senegal	42.0	14,715	12,990	3.49
Liberia	43.5	13,818	5,020	2.90
Sierra Leone	43.5	17,148	1,630	1.95
Ghana	43.5	12,954	2,840	3.76
Congo	43.5	57,368	181,670	4.82
Ivory Coast	43.5	13,918	26,140	-
Tanzania	44.5	20,702	8,360	1.68
Zambia	44.4	13,472	2,130	-
Indonesia	45.4	26,367	10,230	-
Bolivia	46.7	2,301	58,010	3.74
Sudan	47.2	15,934	4,180	-
India	49.2	4,805	11,500	0.91
Pakistan	49.4	4,329	10,200	-
Egypt	50.7	1,913	2,130	3.91
Iran	51.0	3,297	7,820	2.60
Algeria	51.5	8,439	21,290	-
Iran	52.6	3,348	3,349	-
Nicaragua	52.9	2,065	-	-
Guatemala	52.9	3,617	-	-
Honduras	53.5	3,621	21,720	3.33
Syria	53.8	3,757	6,700	2.03
Tunisia	54.1	5,874	25,000	-
Peru	55.7	1,978	13,670	-
Turkey	56.4	2,222	3,110	8.21
Dominican Republic	57.8	2,102	32,540	7.71

(CONTINUED ON NEXT PAGE)

Table 1 (cont.)

Country	Life Expectancy	Population Per Physician	Population Per Non-Physician Primary Health Worker	Government Health Expenditures Per Capita US \$
Phillipines	58.4	9,097	7,880	1.06
Thailand	58.6	8,397	1,700	2.45
Malaysia	59.4	4,347	1,730	7.18
Ecuador	59.6	2,929	58,030	1.04
Colombia	60.9	2,285	2,500	2.04
Brazil	61.4	1,963	46,570	-
Paraguay	61.5	15,520	26,740	6.77
China	61.6	3,224	7,430	-
Cuba	62.3	1,978	13,670	-
Costa Rica	63.2	1,619	-	-
Mexico	63.2	1,491	-	-
Jamaica	69.5	2,659	21,950	-

¹ SOURCE: Figures taken from World Bank Health Sector Policy Paper, Appendices 2, 3, and 6, pp. 74-79, 1975.

defined in three ways: geographic, economic, and psychologic. Some help in answering the question might be gained from comparing the health status of mothers in urban centers where health care is more accessible with that of mothers in rural areas. For example, if maternal mortality, maternal height, maternal weight gain in pregnancy, or the incidence of one of the diseases cited earlier were more favorable in the urban center, increased health services accessibility might be assumed to be at least partially responsible. Again, an indirect approach must be taken. Bryant (1969) compares the distribution of doctors and hospital beds between the capital city and the rest of the nation in three countries: Jamaica, Senegal, and Thailand. Table 2 summarizes these findings. This table establishes only that accessibility of physicians and hospital beds, as indicators for health services generally, is greater in urban than in rural areas of these three predominantly rural countries.

One of the most available indices of maternal health status is the maternal mortality rate. Maternal mortality can be classified as being due either to obstetrical causes such as hemorrhage, toxemia, sepsis, and diseases which are nonlethal outside of pregnancy, or nonrelated causes, such as accidental death, homicide, and malignancies (Miller, 1974). Bearing in mind the fact that this figure does not usually include abortion-related deaths, since most of these pregnancies are not registered, one can nonetheless appreciate the significance of differences in maternal mortality rates among countries (Table 3).

Individual country studies shed some additional light on the issue of urban-rural, and by inference, high accessibility, low accessibility differentials. In the table, the figure for Nigeria reflects only the situation in Lagos State, one of the most privileged medically. Nigeria and Cape Verde are thus the only African countries with rates less than 100/100,000. The probable figure for all of Nigeria is much higher. Henin, *et al.* (1973), compared female mortality rates for different areas of Tanzania expressing mortality as life expectancy at birth. The estimates ranged from 29.5 in Kigoma, a predominantly rural area to over 50.0 in several areas serviced by larger towns and cities.

Table 2

PHYSICIANS AND HOSPITAL BEDS BY NATION, CAPITAL CITY, AND REST
OF NATION, THREE COUNTRIES¹

Country	Population (millions)	Physicians		Hospital Beds	
		No.	Pop/Phys.	No.	Pop/Bed
<u>Jamaica</u>					
Total	1.75	770	2,280	7,401	240
Capital	0.45	534	840	4,992	90
Rest of Nation	1.30	236	5,510	2,409	540
<u>Senegal</u>					
Total	3.14	164	19,100	4,492	700
Capital	0.44	103	4,270	1,565	280
Rest of Nation	2.70	61	44,300	2,927	920
<u>Thailand</u>					
Total	28.0	4,055	6,900	21,294	1,280
Capital	2.30	2,440	940	6,294	370
Rest of Nation	25.7	1,615	15,900	15,668	1,640

¹ Figures taken from 1964 Ministry of Health Statistics.

Table 3

MATERNAL MORTALITY IN SELECTED COUNTRIES, LATEST AVAILABLE FIGURE¹

Country	Rate/100,000	Year
Mozambique	647.4	1970
Bolivia	316.2	1966
Colombia	212.7	1968
Reunion	198.0	1969
Kenya	188.1	1970
Ecuador	187.3	1974
Peru	177.6	1972
Guadeloupe	144.0	1969
Phillipines	137.8	1974
Guatemala	136.6	1972
Jamaica	128.3	1971
Paraguay	125.6	1971
Angola	108.9	1972
Mexico	107.6	1974
Trinidad and Tobago	68.9	1974
Cape Verde	82.4	1974
Chile	78.1	1972
Panama	83.1	1974
Nigeria (Lagos)	67.3	1969
Costa Rica	59.9	1975
Cuba	59.4	1971
Bahamas	49.6	1975
Venezuela	49.4	1974
Uruguay	44.6	1974
Mauritius	37.2	1975
Jordan	19.6	1974
Barbados	18.9	1972
Singapore	17.5	1975
Kuwait	12.2	1974
Hong Kong	2.5	1975

¹ Source: Demographic Yearbook, 1976, pp. 330-333.

These crude estimates address only the question of geographic accessibility. Left for further study are those of economic and psychologic accessibility.

. Utilization

Do women who use maternity services have lower mortality and/or morbidity rates than those who do not use them? One approach to assuring the use of high quality maternity care is to offer training in delivery techniques to traditional birth attendants. Where this strategy has been attempted, in Senegal, for example (Villod and Raybaud, 1965), and in the Danfa Rural Health Project in Ghana (Ampofo 1975) there has been a decline in maternal mortality.

It seems reasonable that increased utilization of other services, viz. family planning, pre-natal care, post natal followup and general preventive health services would also have an effect on maternal health indices, not only maternal mortality, but also general female mortality, and morbidity from specific conditions cited earlier: anemia, malaria, venereal disease, tuberculosis, and schistosomiasis.

d. Effects of Fertility on Maternal Health Status

Maternal health is influenced by birth interval, maternal age (Population Reports, 1975) and the factors attendant on each individual pregnancy: whether complications of pregnancy such as tubal pregnancy, abortion, toxemia, and the aggravation of underlying diseases, complications of delivery, such as hemorrhage and malpresentation, or post-natal complications such as hemorrhage and sepsis. The influence of these factors may be primarily on maternal mortality. For others the chief manifestations will be in terms of weight loss, anemia, psychological problems or in general any inability to carry on normal functions. Each of these factors dependent on fertility will be briefly discussed.

. Parity

The likelihood of a woman dying from pregnancy-related causes during the first pregnancy is somewhat higher than from the second and third births. It rises thereafter, at first gradually, until after the fifth birth, when the rise becomes sharper (Omran, 1974). In countries where the average parity per woman is greater than 5, therefore, one would expect also a higher maternal mortality rate.

Women who have given birth to five or more children also have a higher incidence of the complications of pregnancy and delivery: toxemia, difficult labor, ruptured uterus, hypertension, and kidney disease (Baskett, 1975). Each of these complications is more severe at higher maternal age, with inadequate prenatal and obstetrical care, and with poor nutrition. Parity considerations include also the health of the childless woman who suffers frequently from severe social, psychologic and even economic consequences of her condition (Retel-Laurentin, 1974). These women are frequently divorced by their husbands and left to eke out a bare existence.

. Birth Interval

The shorter the birth interval, the greater the risk of mortality, pregnancy complications, and other morbidity (Wishik, 1974). This effect apparently takes place even in good nutrition, adequate medical care, optimal age and low parity, if pregnancies are spaced less than two years apart (Wishik, *ibid*). In particular the incidence of severe anemia and complications of pregnancy and childbirth are increased by decreasing the interval to less than two years (Alvarez-Bravo, 1969).

. Maternal Age

The optimal age for childbearing is between 20 and 30 years. The further away from this period a pregnancy occurs, the greater the risks to the woman of death from pregnancy or childbirth. The risk may be from two to six times increased (Nortman, 1974).

Morbidity is also increased outside this age range, particularly for women over 35. These women, compared with women 20-30 are two to three times more likely to develop complications of pregnancy and childbirth, especially hemorrhage, toxemia, and difficult or prolonged labor (Eastman, 1940).

2. Determinants of Child Survival

We have seen that child survival is the single most potent health factor influencing fertility. Even maternal health status may affect fertility largely through improved child survival. Obviously, then rural development strategies can affect fertility through an impact on child survival. To do so

the determinants of child survival discussed below serve as valuable leverage points for approaches to rural development.

a. Nutrition

Roughly 25 percent of all childhood deaths (ages 1-4) in developing countries are due to some form of malnutrition, while over 50 percent in all have undernutrition as a contributory cause (Morley, 1973).

Frank malnutrition of the marasmic, kwashiorkor, or marasmic-kwashiorkor type represents a small minority of the total number of children who are undernourished. More frequent are faltering weight gain, weight loss or minimal signs of kwashiorkor. Frank malnutrition of the marasmic type occurs more frequently in the first year of life, whereas, kwashiorkor occurs mostly in the second and third years.

The first signs of undernutrition appear typically about the fourth month of life (Satgé, 1967) when weight gain begins to fall off slightly as the caloric needs of the infant begin to outpace the caloric supply in the mother's milk. It is at this point that supplementary foods are frequently introduced, although in quantities usually insufficient to make up caloric deficits. From the sixth through ninth months weight gain continues to decelerate. Having lost the protection of maternally derived passive immunity, the infant is now vulnerable to a wide range of infections, especially gastrointestinal, which combine with caloric deficit, to retard growth (McGregor, 1970). In West Africa, if the infant reaches this age during the rains when many infections are more frequent and food is in short supply, growth retardation will be greater. If frank malnutrition occurs at this time it will more likely be of the marasmic type.

Following the first year, another factor of nutritional significance enters upon the child's already precarious existence. Weaning may occur at any time from the sixth to the thirty-sixth month, depending upon the particular society. Most often it occurs from the 18th to 24th month. In many societies weaning is an abrupt event accomplished by a complete separation of the child, not only from the breast, but from the mother herself. In the care of relatives for a varying period, the child must frequently pass from the breast to the household dietary regimen in

the space of a few hours. It is a crisis of no small proportions for the child (Thompson and Rahman, 1967).

Following weaning, the child is particularly vulnerable to infections, especially measles, dysentery, and tuberculosis. The appearance of signs of frank kwashiorkor may follow recovery from measles (Morley, 1973), an episode of dysentery (Scrimshaw et al., 1968), or may be the first sign of a case of tuberculosis (Morley, 1973).

Mortality curves reflect the impact of these events (see Fig. 3). After an initial peak in the first month of life, mortality declines rapidly and does not rise until the last three months of the year. It then remains high until the end of year three when it begins a gradual fall to a lower level after the fifth year.

Cantrelle (1967) reports a shift of the mortality peak from the first to the second and third years of life in Senegalese populations studied longitudinally over the past 20 years. The virtual disappearance of neonatal tetanus from the populations studied is probably responsible for this change. The net result is that the mortality for the years 1-4 may represent 71 percent of the total mortality 0-4 (Cantrelle, 1967).

b. Prevalence and Incidence of Infections

Many of the infections of importance to child survival have already been mentioned in the course of discussing the link with nutrition. The intertwining of nutritional and disease effects on child growth, and ultimately survival, is undeniable (Scrimshaw, 1968, McGregor, 1968, 1970). Each of the infections however, bears a brief discussion. They are listed in descending order of importance as causes of infant and child mortality, i.e., mortality in years 0-4 (Table 4).

The implication of these figures is that if these infections and undernutrition could be controlled a significant impact on infant and child mortality could be achieved. Development strategies to be considered later must take into account these infections if a diminution in childhood mortality is to be achieved and thereby an ultimate reduction in fertility. In particular, the kind of health services delivered to a population and the manner in which these services are delivered may make a difference.

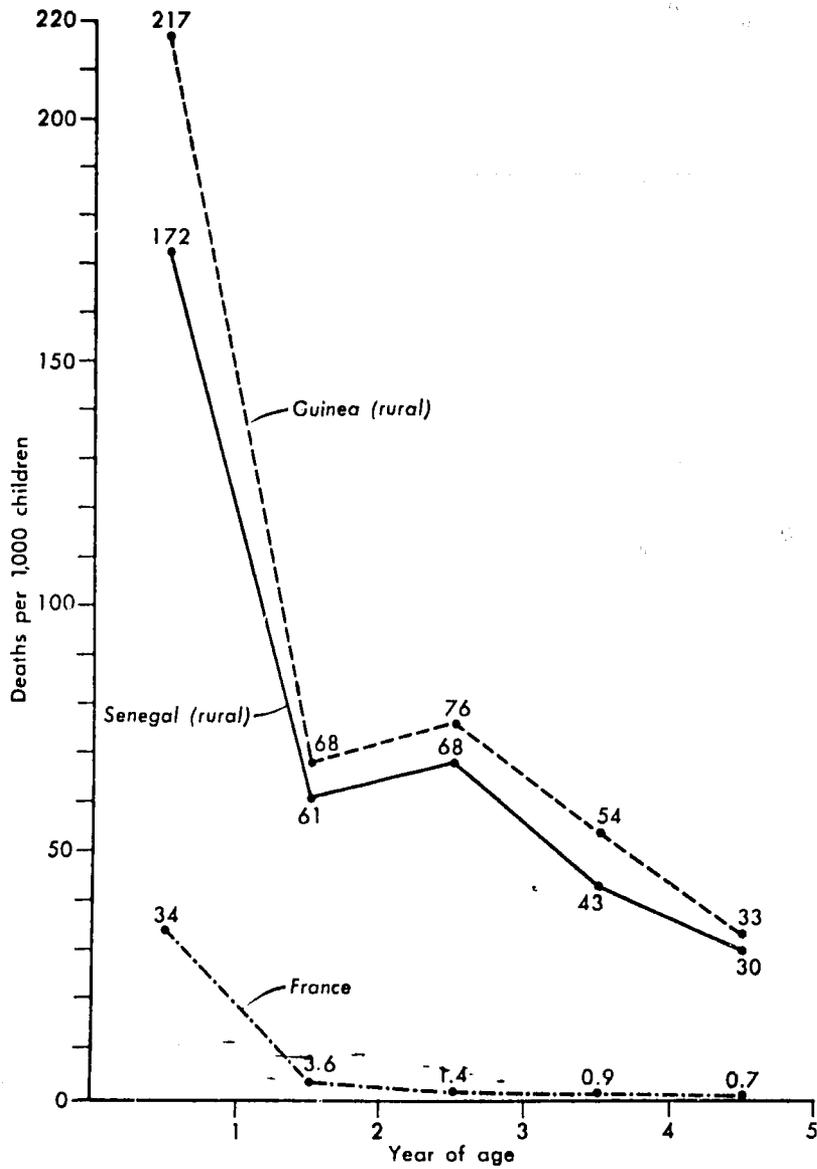


Fig. 3. Typical Mortality Curves for Developing Countries, Ages 0-4.

Source: Bryant, J. (1969). Health and the Developing World, New York: Cornell University Press.

Table 4

RELATION OF INFECTIOUS DISEASES TO INFANT AND CHILD MORTALITY

Infection	Estimated Percent of Mortality 0-4
Diarrhea and dysentery	30
Lower respiratory infections	15
Malaria	10
Measles	8
Tuberculosis	5
Pertussis	4
Tetanus	3
Total	75

Source: Isely, R.B. and J. Courtejoie, La Mère; l'enfant et leur santé,
in press.

Diarrhea and Dysentery

In nearly every society of developing countries this syndrome is the leading cause of death in children 0-4 years of age. Because it is the terminal event for many children its position as a cause of death may seem to be statistically over-represented, but in fact diarrhea is not only a terminal episode for many children, but an ever present part of their existence from the sixth month of life onward (Rowland, 1977). The diarrhea tends to be of a more protracted, chronic variety rather than acute episodes. Bacteriologic and viral studies reveal a low recovery rate for pathogenic bacteria, chiefly Salmonella and Shigella, but in several studies a 30-40 percent recovery rate for Rotavirus (Freij et al., 1978).

The likelihood of mortality from diarrhea depends somewhat on the date of birth of the child in relation to the seasons of the year. If the child reaches the sixth to ninth month of life in the rainy season, that is just as its caloric needs start to outstrip the potential of mother's milk, just as the child begins to crawl and reach for objects just as the mother may be more occupied by agricultural tasks, and just as bacterial and viral pathogens become more numerous in the environment, then the cycle of protracted diarrhea may set in. Caloric loss through the intestine, anorexia and diminished caloric intake all combine to retard growth and lower resistance (McGregor, 1970, Shiffman, 1976).

Lower Respiratory Infections

This group of diseases includes both the diffuse broncho and segmental pneumonias and bronchiolitis, all of which occur most frequently in children under two years of age (Morley, 1973). In some societies this group is the leading cause of death rather than the diarrhea/dysentery group.

The link with the child's nutritional status is more difficult to demonstrate; however, the effect of several days of fever, coughing, and anorexia on caloric intake is undeniable. More significant in the etiology of this group of diseases is the degree of crowding in housing and the tendency for the population to gather for festivals, markets, or water-drawing. Since the pathogens are spread by droplets, greater degrees of crowding favor transmission. The frequency of these

infections in the cool dry season of West Africa is perhaps best explained by the greater frequency of such gatherings in that season, and the greater tendency for the population to remain indoors because of the cold. The implications for housing quality are obvious.

. Malaria

The greatest mortality from malaria occurs between the ages of 6 months and 5 years (Morley, 1973). Before age 6 months many children benefit from a partial immunity acquired passively from the mother. This protection may occur if the placenta is heavily parasitized, as it is in 60 percent of primiparous women in holoendemic areas (Cannon, 1958). Babies born to such mothers are small for gestational age, particularly in the first pregnancy. Malaria is reportedly the principal cause of low birthweight in endemic regions.

In slightly older children, however, while malaria is an important cause of mortality, its effects on child growth appear to be only temporary. Children in the Gambia were observed to experience a temporary setback in growth with acute malaria, but eventually caught up with children on malarial suppressants (McGregor, 1964).

. Measles

Measles tends to be more severe in children of developing countries probably because of the effects of undernutrition on cell-mediated immunity (Chandra and Newberne, 1977). Measles mortality rates may reach as high as 25 percent in some West African communities (McGregor, 1964). The overall mortality rate is probably closer to 12-15 percent (Morley, 1973).

The disease occurs in epidemic form, yearly in densely populated areas, and every two to seven years where populations are more dispersed. Epidemics generally arrive in the dry season but the seasonal tendency is greater the farther a population is from the equator. In West Africa, the dry season is the occasion for more frequent gatherings of families, more travel, larger crowds around wells and markets, and greater opportunity for droplet transmission of measles virus between babies on mothers' backs. As it was for lower respiratory infections, more time spent in crowded houses during this season may also play an important role.

The age incidence of measles is determined by the disappearance of maternally derived antibodies from the fifth through twelfth months of life. In effect, from the fifth month onwards the disease becomes increasingly frequent. In more crowded communities, one-third of all children will have had the disease by the first birthday and three-quarters before the age of three years. The median age in Nigeria (Imesi) was 17 months (Morley, 1973).

Not only does malnutrition condition children to more severe measles, but measles itself may precipitate frank malnutrition (kwashiorkor) because of the protracted diarrhea, fever, and anorexia associated with the acute phase. Children are frequently sick for 10 days or more, and may recover only to appear a month later with edema and the typical changes in skin and hair.

Finally a word must be registered about the inter-relationship of measles and tuberculosis. Because of the suppression of cell-mediated immunity by the measles virus, a latent primary tuberculosis infection may become manifest in a fulminant manner in the recovery phase. Many have been the reports of the effects of a measles epidemic on the children of women hospitalized for the treatment of tuberculosis (Leary, 1966).

. Tuberculosis

The occurrence of tuberculosis in young children of developing countries goes frequently unnoticed. Because these children are not infectious, and the disease is often masked by other infections and malnutrition, the important contribution of tuberculosis to child mortality may not be readily apparent, yet more than one third of children autopsied may have culture-positive lesions (Morley, 1973).

The relationship of tuberculosis to nutrition is intimate. The infected child may present a picture of kwashiorkor or marasmus following a slow deterioration of nutritional status. In young infants, because there is little or no immunity derived from the mother, infection may occur at two or three weeks of age, lead to undernutrition because of caloric dissipation, which provokes in turn a worsening of the infection. Deficiencies not only in calories, but in protein, vitamin A, and vitamin D may lead to more severe tuberculosis.

Initial infection seems to be favored by crowding as well, but studies in East Africa revealed no improvement in the incidence of progressive disease through improved housing (Leitch, 1945). An improved diet, however, did reduce the incidence of progressive disease (Laugesen, 1972).

Pertussis

In the absence of coverage with DPT vaccine in most developing countries, whooping cough infection of infants, particularly those under six months, is an important contributor to infant mortality. Because maternally induced antibodies do not cross the placenta, the young infant is unprotected. Thirty percent of the deaths from whooping cough occur from 0-3 months, 23 percent from 3-6 months and 12 percent from 6-12 months (Morley, 1966). As in the case of measles, infection is favored by opportunity for droplet transmission at close proximity. Thus in the dry season in West Africa the incidence goes up. More girls die from whooping cough than boys.

The relationship to malnutrition appears as a tendency to lose weight following the acute attack, leading not infrequently to marasmus in the small infant. The weight loss is probably secondary to anorexia, fever, vomiting, and inability to suckle, which leads to milk retention and reduced lactational volume (Morley, 1973).

Tetanus

Tetanus is a cause of mortality in particularly the first month of life. The median age of infection is about 10-14 days. Case mortality rates are from 60-70 percent in all series reported (Nourmand, 1970).

The prevalence of neonatal tetanus is favored by two factors: mothers who are not immune and thus cannot transfer antibodies passively to their infants; and customary practices regarding the umbilical stump which lead to direct infection. In some societies cow dung is placed on the stump as a dressing, in others a soiled ceremonial knife is used to cut the cord, in still others the infant is placed in a grass-lined pit after birth. In all these instances the tetanus bacillus, which is prolific in the soil, has ample opportunity to colonize the open stump.

Where neonatal tetanus can be controlled as in Senegal (Villod et Raybaud, 1965), infant mortality rates may fall dramatically.

c. Availability/Accessibility/Utilizational and Appropriateness of Health Services

Much of what has been written regarding the influence of these factors on maternal health holds true for child survival as well. The evidence is, however, greater that each one makes an important difference in survival. In most cases, however, it is difficult if not impossible to distinguish the effects of improvements in health service delivery on availability, from effects on accessibility. The evidence for accessibility is frequently found in changes in utilization rates. Finally, the only services which will affect child survival will be those which are appropriate.

Table 5 summarizes the relationship of population/physician and nurse ratios to infant mortality rates in some Asian countries. These figures of course address only the question of availability, although presumably factors of accessibility, utilization and appropriateness of services must lie somewhere behind the figures.

Satgé et al. (1970) report a significant drop in child mortality in six Senegalese villages compared with over 30 control villages. Services made accessible to the population were not only used, but were appropriate as well, in that they focused on health and nutrition education and careful following of weights.

Morley (1968) observed a child mortality diminution of more than 50 percent in villages served by a lower grade midwife given special training in maternal and child health. Services were in effect available, accessible, appropriate and therefore used.

These examples can be multiplied several fold in the instances of other special projects such as Danfa or Narangwal; or in countries or states where social policy has favored equitable distribution of appropriate health services: Kerala, Sri Lanka, China, Cuba, and Tanzania.

d. Interactions of Maternal Health Status and Child Survival

Several aspects of maternal health status merit some discussion of their effect on child survival. Most exert their influence in the neonatal period.

Table 5

VARIOUS HEALTH PERSONNEL PER CAPITA, IN SELECTED ASIAN COUNTRIES
GROUPED ACCORDING TO INFANT MORTALITY RATES

	Population Per Physician ^a 1973 or 1974	Population ^a Per Nurse*
Countries with low IMR (<100)		
Thailand	8,530	4,069
Malaysia (West)	7,300	1,786
Singapore	1,400	379
Hong Kong	1,560	1,331
South Korea	1,940	21
Philippines	2,990	3,054
Average	3,953	1,803
Countries with High IMR (>100)		
Pakistan	3,970	11,106
India	4,160	6,525
Nepal	36,450	35,880
Indonesia	18,160	3,074

^a World Health Statistics Report. Geneva: World Health Organization, p. 132, 1976.

* Includes all nurses in three categories: nurses, assistant nurses, and midwives and nursing auxiliaries.

. Maternal Nutrition

If caloric intake is insufficient, especially in the third trimester, birth weight will be adversely affected (Naeye, 1974). Total weight gain in pregnancy should be at least 12.0 kg. for optimal foetal growth. Most of that weight gain should occur during the third trimester.

. Maternal Health Status

Certain infections during pregnancy may have deleterious consequences for the foetus. Syphilis may lead to abortion, stillbirth or congenital syphilis in the newborn in nearly 100 percent of cases of an active infection in the mother. Malarial infection of the placenta leads frequently to low birthweight, especially in the primiparous woman (Morley, 1973).

Certain viral infections such as hepatitis, rubella and cytomegalic inclusion disease may lead to severe consequences in the foetus: in rubella congenital defects of heart, sensory organs, and brain; in hepatitis to hepatic infection of the infant; in cytomegalic disease to brain damage.

Other infections of the mother are more important postnatally: active tuberculosis leads almost inevitably to a primary infection of the infant. We have observed earlier the course of such an infection.

Breast infections may interfere with suckling and become complicated by milk retention and breast engorgement. Growth of the infant may be retarded or weight loss may occur.

Psychological disturbances in the mother may interfere with lactation, child care, or feeding, with ill effects on the infant or child's growth and physical well-being.

e. Interactions of Fertility and Child Survival

Two aspects of fertility appear to influence child survival: parity and birth interval.

. Parity

Infant and child mortality are slightly higher with the first pregnancy because of increased rates of prematurity and low birth

weight for gestational age. With the second through fourth pregnancies these mortality rates are lower, presumably because of improved birth weights, maturity at birth and more satisfactory breast feeding. From the fifth pregnancy onwards, however, mortality rates rise sharply (Population Reports, 1975). Both prenatal factors leading to prematurity, small size for gestational age; and postnatal factors: child care, intrafamilial food distribution and other effects of a large number of children on household resources make life more precarious for small children.

. Birth Interval

A minimum of two years' interval between births appears necessary to assure adequate survival of the young child (Population Reports, 1975). If the interval is shortened because of an early pregnancy, sudden weaning of the child at the breast, with the attendant risk of weight loss and severe malnutrition may result. We have already observed in the study of Cantrelle et al. (1967) the continued high mortality in the second and third years of life, much of which is related to early and/or abrupt weaning. At least one-third of women who decide to wean at 18 months may be already pregnant (Zempleni-Rabain, 1967). Widespread noncompliance with taboos on sexual intercourse during lactation (Hull, 1977; Thompson 1967) undoubtedly contribute significantly to the occurrence of early pregnancy. The death of the young child at the breast, of course, brings about deleterious consequences for the subsequent pregnancy and the survival of the subsequent child.

III. LINKS OF THESE IMMEDIATE DETERMINANTS OF MATERNAL HEALTH STATUS AND CHILD SURVIVAL TO THEIR MORE PROXIMAL DETERMINANTS

The section of the overall conceptual framework of concern is reproduced on the following page (Figure 4). This section focuses on factors which are at the same time influential in determining nutrition, the prevalence and incidence of infections, and health services accessibility, etc., and are the theorized results of development strategies.

A. Proximal Determinants of Nutrition

1. Food Availability

There seems little doubt that food, or caloric availability, is of critical importance to both health and nutritional status of mothers and children. Well documented are the relationships of seasonal food shortages to child growth (McGregor, 1976), disease severity (Morley, 1968), and on adult weights and productivity (McGregor, *ibid.*). Such phenomena are a part of the rhythm of life in many parts of the world.

It is essential to ask, however, to whom the food is available. In many societies, food within the household is most available to adult men and least available to the groups of persons of interest here, namely, mothers and children. Herein lies one important reason to include health-related beliefs and practices in the equation.

At the community level, that is among households, (for the purpose of this discussion, household is defined as that group of persons who eat from the same food supply), the evenness of food distribution must be considered. The nature of the community social structure will be important. Where rigidly stratified social structures exist, as in India, food distribution patterns will be much more uneven. Even in areas of generally even food distribution, as in Africa, certain persons such as childless widows, the physically or mentally handicapped, or persons with certain socially stigmatized health problems such as tuberculosis, leprosy, or alcoholism, may not share evenly in the common but limited good.

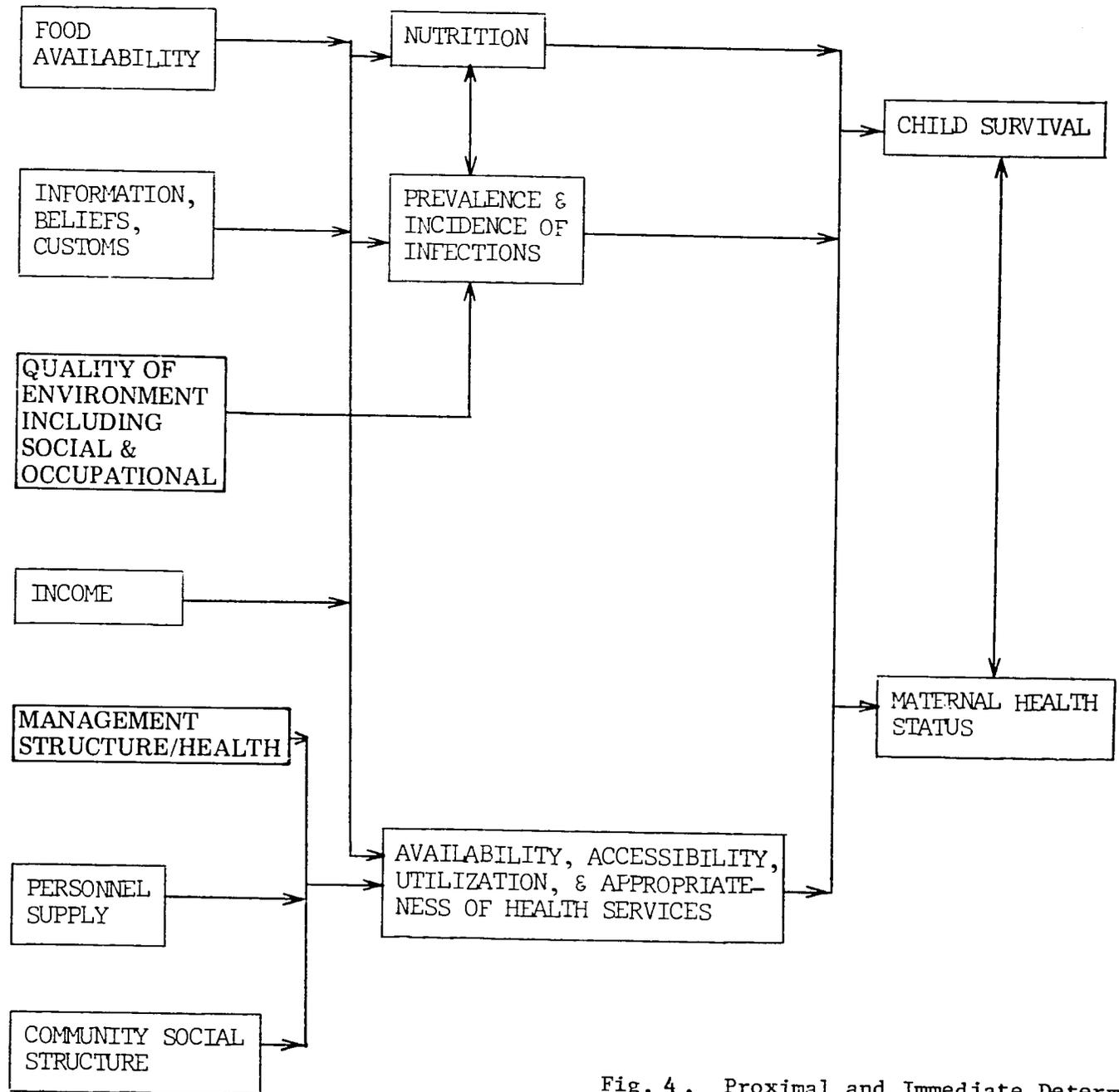


Fig. 4. Proximal and Immediate Determinants of Maternal Health Status and Child Survival.

In the generally egalitarian rural societies of Africa, Latin American Indians, and parts of South-East Asia, an apparently even distribution of food among households is a function of the belief in a "limited good." All resources are believed in limited but sufficient supply. Only by an equal apportionment of those resources can survival be assured to all. The household having obviously more of the "good" than other is assumed to have obtained its larger share at the expense of the others, whether by thievery, sorcery, or disregard of community mores.

Further, food availability depends on food production, transport, adequacy of storage (Jelliffe, 1966), market distribution and methods of preparation. The development strategies under consideration in this project have obvious connections to these factors affecting food availability.

2. Health-Related Information Beliefs, Attitudes, and Practices

A voluminous theoretical literature exists on the relationship of health beliefs and to a lesser degree on health attitudes to health and illness related behavior (Becker, 1975). Very little of this literature pertains to developing countries. What does exist is largely confined to the family planning (Kim, 1974) and communicable disease control (Ogionwo, 1973) literature. Critical to maternal and child health and nutritional status are questions surrounding women's roles, age at marriage, family size, prenatal care, childbirth, breastfeeding and weaning, child care, and infant feeding practices. The intricate relationship of each of these, and of all of them together, to social, cultural, and economic conditions makes it likely that nearly any rural development strategy will have an effect of significance on health beliefs and attitudes. For example, well targeted health education as a part of extended health services, literacy classes, or participatory development, may affect the intrafamilial maldistribution of food (Satgé, 1964). The introduction of a profitable labor intensive cash crop may undermine the authority of the head of an extensive household over the women and other males of the unit and consequently the enforcement of behavioral expectations covering a wide range from reproduction to health to education and economic-related behavior (Herzog, 1975).

Increased food production when sustained through participatory development may lead to far-ranging alterations in behavior from water seeking to fertility (Department of International Health, 1978a). Could it be that populations come to recognize an expansion of the "limited good"?

3. Income

Income becomes an important determinant of nutrition when rural populations must purchase food, as during the growing season when last season's stores are depleted and the new harvest is yet to come, or when drought, flood, or pest damage local food crops. In some areas of Africa too, the rural exodus has left rural communities short of agricultural manpower so that food production is inadequate for the needs of the population of women, children, and elderly persons which remains. Income may also make possible the addition of items having an aesthetic as well as nutritional value to an otherwise drab diet. If food supplies are not available, however, increasing income may have little effect on nutritional status.

B. Proximal Determinants of the Prevalence and Incidence of Infections

1. Environmental Quality

If food availability is essential to the nutritional status of mothers and children, then the quality of the environment, especially with respect to water, waste disposal, and housing, is probably the critical element in determining health status. Undernutrition arising from deficient calories and protein in the diet, combined with infectious diseases arising from a contaminated environment and resulting in caloric loss through vomiting, diarrhea, and fever, are responsible for more than 60 percent of infant and child deaths in developing countries (Morley, 1959) and for innumerable maternal deaths and pregnancy wastages (WHO, 1975). Specifically, water quantity and quality both appear to be related to diarrheal disease (Feacham, 1977), waste disposal to malaria and hookworm, and housing to malaria, bronchopneumonia, and tuberculosis. Other factors certainly influence both the incidence and prevalence of these diseases, but there seems little doubt that development strategies could have their greatest impact on maternal and child health through improvement of environmental quality.

Recently, Latin American governments and the Pan American Health Organization have paid specific attention to the provision of basic sanitation and safe water for the people of these countries. By the end of 1977, 78 percent of the urban population had water services through house connections. In the rural areas, however, only 34 percent had services; even then only half of services were direct house connections. (PAHO, 1978). Data collected at the end of 1977 indicate that 43 percent of the urban population and only 3 percent of the rural population had sewage services (PAHO, 1978). Disease statistics and estimates of populations served by piped water supply and sewage systems in Asia indicate that the mass of the population, both rural and periurban, are lacking in the rudiments of a clean and safe environment.

An exception to this situation is the People's Republic of China. Widespread decentralized programs of sanitary disposal and reuse of human fecal matter, protection of wells, snail removal from canals and ponds, and other measures have brought many perennial disease problems under control. The success of such projects is notable in the decentralization of authority to local communes, each responsible for its own environment (Horn, 1971). Remarkable progress has also been made in isolated instances in the Philippines (Flavier, 1970), Indonesia (Johnston, 1978), India (Arole, 1972) and Thailand (Cunningham, 1970). In each instance, community participation coupled with skilled, responsive personnel, has played a major role.

The social and occupational environment must also be considered, particularly as they affect women and consequently their children. Women who must work long hours in rice paddies expose not only themselves but the small children who accompany them to an increased risk of malaria (Cissé, 1967). If the rice fields are irrigated, the risk of schistosomiasis for the mother or any toddling children with her is increased. If the fields are distant, the mother may choose to wean her nursing infant earlier than she otherwise would, particularly if the child reaches 12-18 months of age during the growing season (Thompson and Rahman, 1967). Even a younger child over 6 months of age may be left in the care of an old woman or a younger child during several hours of the day, rather

than brought with the mother to the fields where continuous breastfeeding would be possible. Only nonagricultural employment appears to be related to a diminution in breastfeeding frequency and duration (Butz and DaVanzo, 1977).

Breastfeeding is, in fact, a key behavioral intermediate resulting from the influence of development strategies on the social and occupational environment. Because it is a key link between maternal nutrition and health, and that of the child, and makes great demands on the mother's energy, time, and spatial movements, it is in many societies particularly vulnerable to changes in the socioeconomic milieu affecting women's roles. Studies assessing this set of interrelationships must focus on this pivotal position.

2. Health-related Beliefs, Attitudes, and Practices

Every human society possesses a formulated set of beliefs and related practices concerning the diseases most prevalent in that society (Frake, 1961). Morley (1967) surveyed beliefs and attitudes regarding measles and found them varying widely from society to society, but well-developed in nearly every case. These beliefs and practices extend in varying degree to the diagnosis, including the diagnostic nomenclature, the therapy and occasionally the prognosis of disease. Extensive medico-anthropologic studies of individual ethnic groups throughout Asia have made significant contributions to understanding health belief systems, including diagnostic terminology, diagnostic and therapeutic criteria and techniques, and sick role behavior. Little, if any systematic epidemiologic work has been done, however, to relate health beliefs or behavior to the impact on health and nutrition status of various development approaches.

From the vantage point of traditional belief systems, one can begin to formulate a rational approach to the health education, necessary in the prevention of each of the several infections discussed in relation to maternal health and child survival. Rural populations of developing countries, it must be understood, conceive of measles, malaria, pertussis, or schistosomiasis within the framework of these beliefs. Their diagnostic and therapeutic practices will reflect as well this framework. Following Jelliffe's advice (1962), the health workers needs to carefully examine

the health practices of a community in order to determine which practices to reinforce, which to ignore, and which few to target for an intense educational program.

C. Proximal Determinants of the Availability, Accessibility, Utilization and Appropriateness of Health Services

1. Management Structure of Health Services

In large measure, each of the characteristics of health services desired in order to improve maternal health and child survival, depend more upon the management of those services than on any other factor in the equation. Included in the concept of management are personnel supervision, supply, and maintenance of equipment and materials, information and communication, and planning and budgeting. Since it is the delivery of health services at the level of communities, popularly referred to as primary health care, which is of concern in this paper, the degree of management need not be highly sophisticated. In most instances, such management as there is emanates from the district (or arrondissement) level, headquartered at an important market town. This is not to say that management at higher levels is not important, but simply that the bottleneck nearest the community is at this level.

The failure of "pilot" preventive health projects to be incorporated into the management system existing at the district level is an often recurring scenario (Isely, 1978). Such projects arrive on the scene, bringing innovation in service delivery, community participation, health and nutrition education, home visitation of mothers and children, school health, or improved environmental sanitation. Sustained by special funds, the project achieves sometimes rapid success. Local personnel are seconded. Local administrators lend their support as well. The management of project activities, however, is never incorporated into the structure of health services in the area. When special funds are withdrawn, that structure goes on operating a health center or a small hospital and a network of village dispensaries as before. The first requirement for sustained available, accessible, and appropriate services, therefore is that the management of services be incorporated into the local structure.

2. Personnel

Given the adequacy of management of health services, the next most important determinant of their availability, accessibility, utilization, and appropriateness is the supply of appropriate personnel. In most instances, this personnel will be composed of medical and nursing auxiliaries (Habicht, 1973, Morley, 1973, Fendall, 1972).

One important feature of that auxiliary personnel is its simple availability to the population. Well-established is the notion that people simply do not use services which are more than ten kilometers away and use less than often services more than two or three kilometers away (King, 1968, Gish, 1977). China has built its rural health service system on the notion that services should be brought to where people dwell (Sidel and Sidel, 1972). If this objective can be achieved, then accessibility and utilization will also be increased.

The character of personnel will also determine the appropriateness of services. Two optional models exist: the categorical model where curative and preventive services are delivered by separate personnel and where preventive services may be further subdivided into maternal and child health family planning, health education, nutrition, environmental sanitation, and immunization and case-finding services. The other is the integrated model with varying degrees of combining different services. Much has been written in favor of the integrated model of service delivery, in particular models featuring the integration of family planning with maternal and child health services (Johnston and Meyer, 1977) of health education and nearly every other service (Aujoulat, 1969), and of overall integration of preventive and curative care (Williams, 1972). Further, the model has been extended to include combinations of health with educational, agricultural, and social welfare services, best achieved in a participatory approach to rural development (Esman, 1978).

Integration of services is difficult to achieve and more difficult to evaluate. Wherever it is attempted, the integration of services must of necessity take place in the personnel responsible for delivering the services. The problem posed by integration of services is thus one of training and supervision. Both trainee, teacher-supervisee,

and supervisor must embody to some degree the idea of integration in their thinking and style of work. Such can be achieved only through an experiential training model and a system of supervision which includes training and support as well as control. Where such principles have been followed, positive effects on health service utilization have been achieved.

A study is currently under way in Nepal (Delgado, 1979) to examine the impact of integrated vs. nonintegrated health and family planning services on certain parameters of fertility related behavior, as well as fertility and infant mortality rates. The integration is in the form of an auxiliary health worker responsible for monthly home visits to a population of around 5,000. This worker role model has been developed since 1968 when a new category of paraprofessional health worker, the Health Aide, was introduced. It was found that these workers, when village-based, were more effective in promoting contraception than when clinic-based. Having established the effectiveness of the village-based worker, the Nepalese government then sought to integrate FP functions into a multivalent community health worker role, and to include several previously separate categorical disease programs, and vital statistics reporting as well. Based on acceptorship and continuation rates, this latter worker performed five times better than controls (His Majesty's Government of Nepal, 1979). The current study postulates that through the integrated approach a positive effect on child survival and maternal health can be achieved which will in turn augment the effect of direct family planning education, on fertility.

The Danfa rural health project in Ghana (Asante 1978) tried four separate models of rural health delivery, one a control, and observed longitudinal measures of change in demographic characteristics, health problems, and health status. Training of personnel in community organization and the provision of comprehensive health services all figured in one or more of the models. Initial findings include nearly conclusive evidence of the efficacy of a cadre of well-supervised auxiliary personnel to provide the package of services at both the health center and at satellite clinics, as well as the community organization inputs, and of

the validity of participation by communities in promoting local health improvements. As yet, results in terms of changes in health status or in the prevalence of health problems awaits analysis of data.

The importance of the Danfa project and other pilot health service schemes in Ghana is that their results have been incorporated into the planning of health services delivery at the national level. Both the use of an auxiliary personnel and community participation feature prominently in the Brong Ahafo Rural Integrated Development Program in the National Health Care Strategy (Asante, 1978).

3. Health-Related Beliefs, Attitudes, and Practices

These factors impinge most closely upon the utilization of health services by a population. Reference has been made earlier to the existence of formulated systems of belief and practice in most societies and of the necessity for the health worker to build upon those systems in programs of health promotion and health education. Experiments with these approaches in developing countries have frequently found in populations an ability to distinguish health problems for which traditional medicine is appropriate from those more appropriately treated at a western-style health center (Parker, et al., 1978). Generally speaking, diseases assumed due to disturbances in a person's relationships or to the breaking of taboo or custom, are referred to a traditional healer, diviner, or herbalist; whereas, diseases of unknown cause or those deemed life-threatening may be referred to a western medical practitioner.

These generalities are subject, of course, to variations in culture, educational level of household members, economic level, and experience with different modes of therapy and different types of health problems.

4. Climate and Geography

Mention has been already made of the problem of distance in relationship to utilization of health services. The significance of this factor can be readily summarized in a diagram taken from Gish (1977). (Fig. 5)

In addition to distance, climate and geography exert other influence on the ability of a population to use fixed health services,

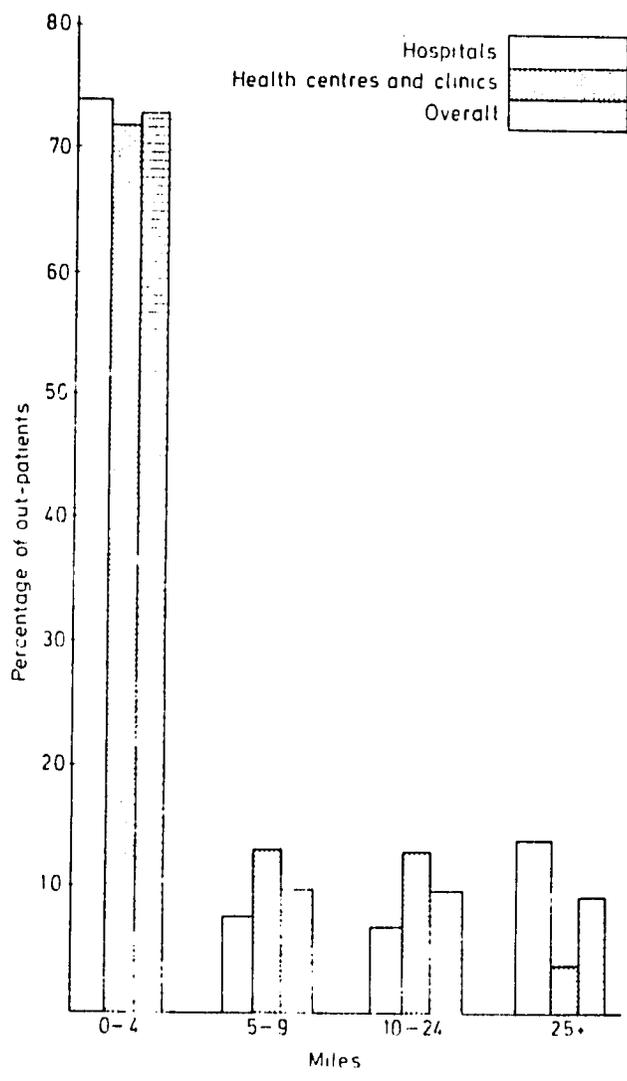


Fig. 5. Relationship from Health Facilities to Utilization

Source: Gish, O. (1977) Mobile Health Services, London, Tri Md.

or the ability of mobile health services to reach a population. Mountainous terrain, marshlands, seasonally inundated flood plains, and all areas served by permanently or seasonally impassable roads may serve as obstacles to effective utilization of services.

Special approaches must be made to certain groups, such as nomads. Imperato (1972) describes how it was necessary first to study the migratory movements of populations in the Niger river valley before designing a program of smallpox and measles vaccination. Sandford (1978), too, pleads for special consideration for nomadic pastoralists in the design of all forms of social service delivery. Focusing on the primary education and primary health care services he points out the vast differences in the requirements of the two types of service and posits several criteria for planning their provision: population density, population mobility, and the economic resources of the population. Certain minimal levels in each are required for various models of schools and health services along a mobile to static continuum. Additional considerations of the costs and acceptability may make one or more models ineffective. The training of personnel from among the population itself may be ultimately the only viable approach.

5. Community Social Structure

The reason for including this factor as a determinant of health services availability, accessibility utilization and appropriateness may not be readily apparent. If one considers, however, the potential role played by community participation in increasing the coverage of populations by health services, the importance of the social structure of a community cannot be underestimated (Isely et Mvele, 1979).

Elements in the social structure to note include: leadership, communication patterns, decision-making, communication of decisions, and resources: human (demographic), economic, material, and geographic-climatic. Of equal importance is the history of the community: its origins, whether factual or mythical, any experience of conquest or colonialism, major migrations, and major economic junctures, such as the introduction of a major new cash crop or the occurrence of a major economic setback, such as a drought. All these considerations and still

more will shape and determine the ability of a community to undertake one of several models of participatory health services development: village health committees (Fountain, 1976; Isely and Martin, 1977; Ross, 1979), village health worker training and support (Department of International Health, 1978a) or traditional birth attendant training and support (Villod et Raybaud, 1965).

6. Income

Income is essential to health services utilization in two ways: income may be necessary to pay for services, or at least drugs; and perhaps more importantly income is required to pay for transportation to fixed service sites, hospital or health center, when the population lives more than 5-10 kilometers away, the greatest distance over which most people will walk to obtain health care. Taxis, buses, lorries, or where feasible boat, ferry or canoe, represent types of surface transport in developing countries. Each one is an entrepreneurial operation. Costs must be covered and a profit made. Rural populations needing health services will think twice before paying to reach a distant clinic for a service of questionable value.

The correlation between the per capita GNP in Latin American countries, life expectancy at birth and the infant mortality rate indicated in Table 6 emphasize the relationship between income level and health status. It is apparent from the data that a higher GNP is indicative of a lower infant mortality rate and a higher life expectancy. A comparison between the Barbados and Argentina data and those of Honduras or Haiti underlines this point.

Life expectancy and infant mortality are also correlated with income in a comparison of Asian countries as displayed in Table 7. These are, however, only indirect measures of the influence of income on health services availability and accessibility, since at least a large part of the effect of rising income on mortality is mediated through improved diet.

Table 6
 PER CAPITA GROSS NATIONAL PRODUCT, LIFE EXPECTANCY
 AT BIRTH, AND INFANT MORTALITY IN SELECTED
 LATIN AMERICAN COUNTRIES

Country	1973 GNP/Cap.	Life expectancy at birth (years)	Infant Mortality Rate per 1,000
Argentina	1,640	68	60
Barbados	1,000	69	31
Mexico	890	63	61
Brazil	760	61	71
Dominican Republic	520	58	98
Guatemala	500	53	79
Columbia	440	61	76
Guyana	410	68	40
Paraguay	410	62	84
El Salvador	350	58	58
Honduras	320	50	115
Boliva	230	47	108
Haiti	130	50	150

Source: Roger D. Hansen and the staff of the Overseas Development Council.
The U.S. and World Development Agenda for Action 1976, pp. 132-134.

Table 7

PER CAPITA GNP AND PERCENT OF THE POPULATION WITH INCOME LESS THAN \$75.00 A YEAR BY IMR AND LIFE EXPECTANCY IN SELECTED ASIA COUNTRIES

	Per Capita ^a GNP	Percent Earning < \$75.00/year
Countries with low IMR (<100) and high LE (>50)		
Sri Lanka	270	63.5
Thailand	270	44.3
China	270	n.a.
Malaysia	570	15.5
Singapore	1,830	n.a.
Hong Kong	1,430	n.a.
Taiwan	660	14.3
South Korea	400	17.0
Philippines	280	30.0
West Samoa	250	n.a.
Average	608	25.7
Countries with IMR >100 and LE <50		
Pakistan	102	57.9
India	120	66.9
Bangladesh	80	n.a.
Nepal	90	n.a.
Bhutan	60	n.a.
Burma	80	71.0
Cambodia	81	n.a.
Laos	100	n.a.
Indonesia	130	n.a.
Papua New Guinea	410	n.a.
Average	127	65.2

^a SOURCE: Overseas Development Council. The U.S. and World Development. New York: Praeger, pp. 121-162, 1976.

IV. DEVELOPMENT STRATEGIES AND THEIR RELATIONSHIP TO PROXIMAL
AND IMMEDIATE DETERMINANTS OF MATERNAL HEALTH
AND CHILD SURVIVAL

The left two-thirds of the diagrammatic presentation of the conceptual framework of this paper (Fig. 6) contains over 30 elements, each bearing a determinative relationship at varying degrees of proximity to maternal health status and child survival. Rather than discuss each one separately in relation to the others, an overall approach comparing three categories of development strategies is suggested. This comparative framework may also suggest further research to the extent permitted by existing data.

A. A comparison of development strategies using a participatory model with those not using participation

Here the major question is the impact of successful participation in a variety of development programs on the intermediate determinants of health, of fertility, and of fertility via health.

B. A comparison of development strategies whose objective is increased agricultural production/productivity with those having other objectives

Do projects with a successfully achieved production and productivity objective have a differentially greater impact on intermediate determinants of health, of fertility and of fertility through health?

C. A comparison of development strategies whose objective is increased income with those having other objectives

There is a variety of approaches to increasing income. When those approaches are successful, do they result in positive effects on intermediate determinants of health, of fertility, and of fertility through health?

It seems justified at this point to emphasize the exceedingly complex nature of the interrelationship among the items described in the diagram. Not only are they interrelated in the manner depicted by the lines and arrows of the diagram, but in a host of interactions and reverse relationships which make impossible the direct submission of the model to rigorous analysis. All the model permits is the identification of leverage points

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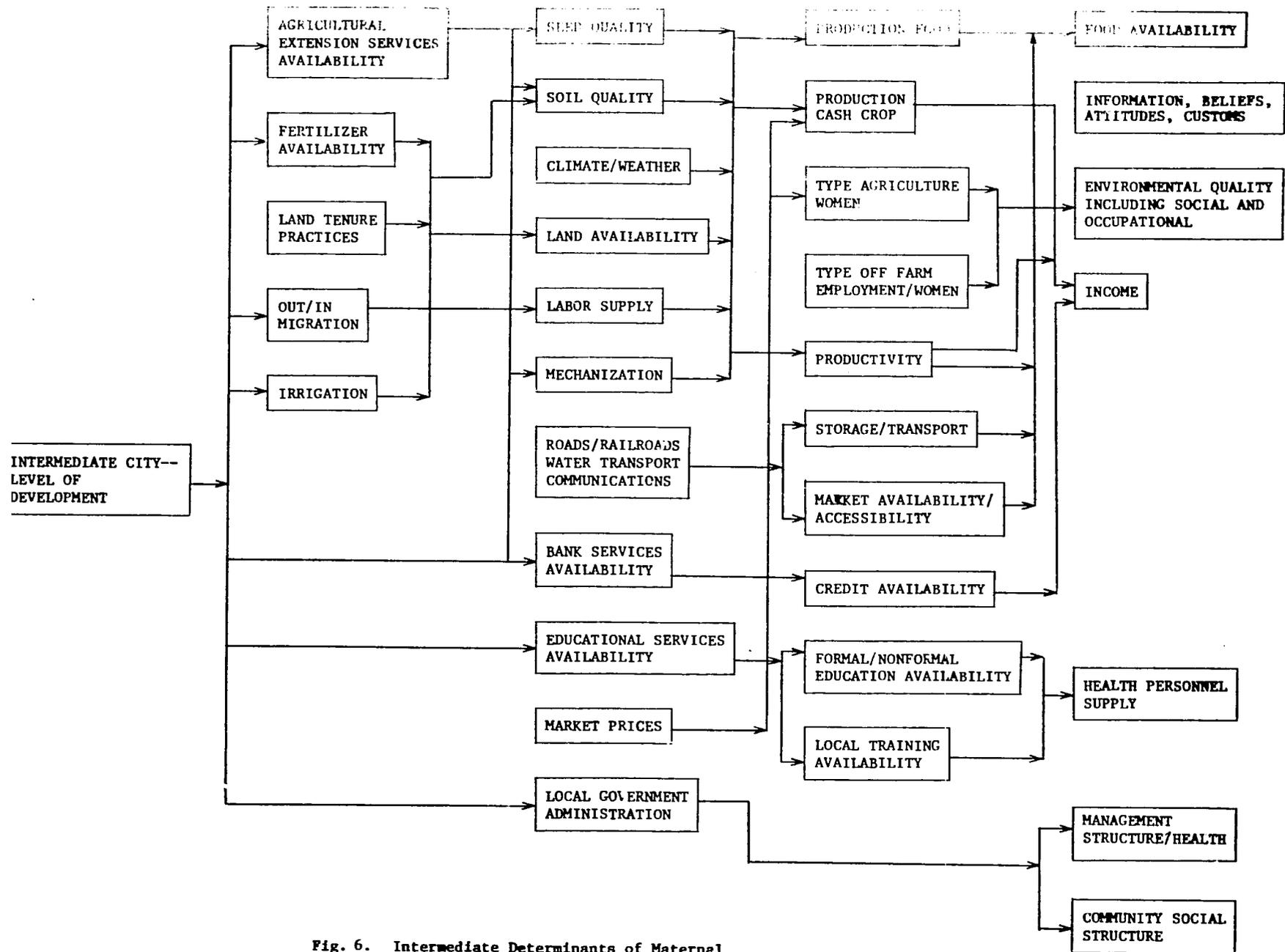


Fig. 6. Intermediate Determinants of Maternal Health Status and Child Survival.

within the system where development programs can hope to have an effect.

Secondly, the model should in no way be construed to mean that all development programs must lead to or be measured by their effect on fertility rates. The interest of this paper is merely to identify likely effects on fertility, but more specifically those effects on the health of mothers and children likely to produce an influence on fertility.

A. Influence of Participatory Development on Maternal Health Status and Child Survival via Various Intermediates

Participative models of several different types have been reported in the literature (Sai, 1972; Sam 1976; New Internationalist, 1976). Common to all of them no matter what the substantive theme may be (agriculture, education, health) has been a generic process of community organization in which community members have varying degrees of responsibility for problem definition, priority setting, decisionmaking regarding allocation of community resources as well as the implementation of strategies through local labor and materials. Development Alternatives, Inc. (Morss, 1975) in an empirical examination of 36 rural development projects sponsored by various organizations in 11 countries concluded that project success depends on: (1) involvement of the small farmer in decisionmaking and (2) resource commitments by the small farmer to the project.

Health is a frequently occurring theme in these experiences. Some have, in fact, suggested health as an effective springboard for community participation (Isely and Martin, 1977). As a result of this emphasis, dispensaries have been built and started, village pharmacies established (Sanwogou, 1976), village health workers trained (Ram, 1978), village sanitation programs launched (Konde, 1976), and village nutrition rehabilitation centers set in motion (Ebrahim, 1971). All of these projects promise to have beneficial effects on the health and nutrition status of mothers and children, but it is not yet clear whether participation by the people per se is of critical importance in bringing about improved status. It seems that it should but empirically verified evidence is as yet lacking.

Essential would be information on those factors both facilitating and inhibiting the community participation process, especially as these relate to improved health and nutrition status of women and children. Additional

questions concern the viability of community participative structures and the development of local autonomy.

The evaluation of the impact of projects utilizing participative models is frequently impeded by a lack of adequate data on such important outcome indicators as infant and child mortality and child growth. Gwatkin, et al. (1979), surveyed ten health projects having adequate data (Many Farms, USA, Rural Guatemala I, Imesi, Nigeria, Northern Peru, Etimesgut, Turkey, Narangwal, India, Jamkhed, India, Rural Guatemala II, Hanover, Jamaica, and Kavar, Iran), seven of which had important nutrition components and only two, (Jamkhed and Kavar), of which gave major concern to community participation. In selecting projects for study, in fact, these authors found only one of the many participative projects described in the WHO publication, Health by the People (Newell, ed., 1975) with data adequate for evaluative purposes. There were certainly no differences in effect among these projects which could be ascribed to participation per se. All projects achieved decreases in infant and child mortality, some increase in child growth parameters, and others a diminution in fertility. Some important contributions to an overall understanding of maternal and child health issues in developing countries emerged, but in all, only 20-30 percent of the variance in child weight, for example, could be explained by project inputs. Gwatkin, et al., conclude that this level of robustness of results, while impressive, suggests the need to identify, quantify, and take other factors into account. Among the factors recommended are the impact, both intended and unintended, of project activities on social structures and on villagers' perceptions of the degree to which they can meaningfully participate in a project, both of which may contribute to improved child growth and mortality.

It is with respect to community participation that most of the intermediate variables cited earlier demonstrate their importance: food availability because of the potential impact of participation on increasing local food production (cooperative purchase of tools, fertilizers, etc.), or organizing local markets; environmental quality because water source protection, waste disposal facilities, and improved housing are quite amenable to organized community efforts (Isely, 1978); health beliefs and behavior

because they seem to be subject to modification when populations experience success in meeting locally defined problems with local resources; health services availability, accessibility, utilization, and appropriateness because it can be improved by means of community-based programs such as village health workers (Ram, 1978), village maternities (Satgé, 1964), community roadbuilding or village pharmacies (Sanwogou, 1976); income particularly income distribution, since credit cooperatives, buying and selling cooperatives, and local market organizing all require a heavy input of community participation.

Ross (1979) recounts on an experience of community participation in a hospital-related health services extension program in Sierra Leone. Although it is too early in the program to speak in terms of improved health status, there is every indication that the extension of MCH, environmental sanitation and primary care services to village populations would not have been possible without participation. There is but one step to concluding that any consequent improvements in health status would likewise have necessitated the participative process. Isely and Martin (1977) and Fountain (1975) corroborate this notion in studies of the health projects involving community participation in the Cameroon and Zaire respectively, where water supply and sanitation schemes were central themes in the participative process.

Van Balen (1975) suggests that where the political organization of an African country has created community level structures, these should be viewed as the avenues of approach to extending health services rather than resorting to costly integrated mobile services (Ross, 1979) or to the classic pattern of fixed curative and mobile preventive services. The world energy crisis has certainly made the first alternative preferable to both the other two and by direct implication then community participation becomes a necessary ingredient in the process.

Joseph and Scheyer (1977) likewise posit community participation as a necessary element in the development of a health service infrastructure in the Sahel, and suggest further the usefulness of community participation in health affairs as a catalyst to further involvement of communities in their development.

Noah (1975) studied a Cameroonian village to determine whether it had the resources necessary to provide a minimum of water supply and sanitation. Basing his calculations on the amount of revenue already dispensed for medical care and related transportation, and assuming a lowered morbidity as a result of the environmental improvements, he concluded that per family there were financial resources to spare. Gwatkin, et al., note that the average expenditure per family on medical care exceeds the national per capita health expenditure in developing countries. This study helps to answer one of the perplexing questions associated with community participation in health, that is, whether or not it is worthwhile undertaking given the limited resources of rural populations.

On a broader scale, participation has underlain the development strategies of both Sri Lanka and Kerala state in India, where impressive improvements in health and educational indices and declines in fertility have been achieved with almost no increase in per capita GNP (Gwatkin, 1978). In response to a highly articulate electorate in both instances, political leaders have deliberately allocated resources to remarkably equitable distributions of food, educational facilities, and health services. The same policies have characterized the People's Republic of China where decentralization has been the key to effective coverage of the population with the rudiments of health services. Fertility decline in China has been largely responsible for the current downward revisions in world population estimates for the year 2000 (Johnston and Meyer, 1977).

Thus, while the evidence to support the beneficial effect of participation on health and fertility outcomes is not directly forthcoming from studies undertaken to date, it is a fair assumption that participation has been an essential ingredient in many successful projects as well as in several national or state-level development strategies. Participation is achieving increasing attention as a vehicle for development. The World Bank with respect to both village water supply and sanitation has given recognition to the involvement of villagers in the design phase of systems (World Bank, 1976, 1978). The Conference on Primary Care at Alma Ata too adopted participation as a major theme (Martin, 1978).

B. Increasing Agricultural Production Productivity as a Strategy for Improved Health and Nutrition

The health and nutrition effects of deliberate attempts to increase agricultural production have been observed in a number of different contexts. Whether or not and in what measure these benefits are achieved, especially by the populations most closely related to fertility outcomes, namely women and small children, seems to depend upon several essential factors:

- 1) The extent to which the economic benefits of increased agricultural production are shared by the entire rural population.
- 2) Whether the goal of increased production/productivity is applied uniformly to the whole spectre of agricultural endeavor in rural areas, or to one or two activities only.
- 3) Whether health, nutrition, and family planning programs are included in the package of programs (Johnston and Meyer, 1977).

1. Distribution of Economic Benefits

The point need not be belabored that increased agricultural production, which benefits only the landed few, is not likely to have an appreciable effect on health or nutritional status of the entire rural population. Where the benefits of increased production are widely distributed, however, as in the Punjab (Department of International Health 1978a) a chain of social and environmental changes follows on the availability of cash: improved housing, electrification, increased availability of primary education, improved roads, increased literacy, and greater access to health services. There is evidence in fact that these changes may have been responsible for the diminution in fertility already in progress before the Narangwal study began (Department of International Health, 1978b).

2. Unimodal Increased Agricultural Production/Productivity

The term "unimodal" has been coined (Johnston and Meyer, 1977) to characterize an approach to agricultural development which takes into account the entire spectrum of agricultural production, including food as well as commercial, and thus encompasses a sufficiently large segment of rural society to make likely a major impact on rural quality of life.

We have earlier made explicit the underlying assumption of this contention, namely that the single most important element in improved

nutrition is to make available to vulnerable groups a sufficient supply of calories. Earlier preoccupation with the "protein gap" now seems unwarranted. Nutrition research has apparently revealed the interdependence of caloric consumption and protein utilization (FAO, 1973). This shift in emphasis has permitted subsequently a single-minded concentration on increasing the level and stability of crop yields.

There is a growing body of empirical evidence to support the unimodal approach to increased production/productivity (Berry and Cline, 1976). The best example of this approach is again Kerala. Since independence government agricultural policy has deliberately supported increased rice production along with the production of traditional export crops: pepper, tea, coconut, coffee, and rubber. Since the 1960's, increased attention has been given to tapioca production, which has increased by 5 percent annually. Tapioca, a low protein food grows well on unirrigated, infertile land. Output per acre is six times that of rice. Because of its introduction, famine has been averted, since rice production had reached a maximum at a rate less than population growth (Gwatkin, 1978).

Where efforts at increasing production/productivity have been "bimodal," i.e., where efforts have been aimed at rapid increase in productivity and output within a subsector of agricultural production, the impact on health and nutrition has been less dramatic. A longitudinal study of the Serer, who inhabit the northern section of the Senegalese groundnut basin (Herzog, 1975) illustrates the point well. Government policy has almost singlemindedly pursued a policy of increased groundnut production for the last 40 or more years. Pursuit of this policy has taken the form of introducing improved strains, partial mechanization, fertilizers, cooperatives, and other technical assistance. Yields have increased as have per household incomes. The Serer, who seem to have had high fertility rates in the past, have responded by throwing increasing amounts of their reserve land and increasing numbers of their labor force into groundnut production, until at present, little reserve or meadowland remains. During the period of rapid expansion, the high fertility output was absorbed by the labor needs. With mechanization and the maximal use of available land, needs for increased labor supply have fallen off. Still fertility remains high. Two

factors seem to come into play: (1) Infant and child mortality have remained high through this entire period, exhibiting only a shift in the age group shouldering the greatest amount of the mortality. Whereas infant (0-1) mortality formerly accounted for the greatest proportion of the 0-4 mortality, it is now the mortality in the second and third years predominates. (Cantrelle, 1969). (2) With increasing incomes has come increased independence of women and other men in a household from the authority of the headman of the household, not only in matters relating to food distribution and land use, but to marital and sexual behavioral norms, which the headman is charged to enforce. There is evidence (Herzog, 1975) that such norms as abstinence during lactation and relatively late age of marriage for men are breaking down.

3. Health, Nutrition, and Family Planning as Priorities in Agricultural Development

As important as increasing agricultural production/productivity, particularly in the food sector, may be to improvements in maternal health status and child survival, the process necessary to achieve these objectives may be rather slow, particularly if pains are taken not to bypass any segment of rural society. In consideration of this factor, some (Johnston and Meyer, 1977) have argued persuasively for setting health, nutrition, and family planning in deliberately prominent positions at the forefront of rural development. Malnutrition and poor health, it is argued, are "especially serious manifestations of poverty" and as such deserving of direct attack. To do so, however, one must contend with the extreme inequality in availability of health services in much of the developing world. Health services, after all, are the vehicle through which an appropriate mix of maternal and child health preventive and curative services, nutrition, and health education, environmental sanitation, and family planning services will reach the population. Most health service infrastructures in developing countries, while inadequate and under-utilized, still represent an extensive network of entry points into population groups.

What mix of services is the most effective for reducing infant and child mortality, and improving maternal health status sufficiently to affect fertility? How can proper emphasis be given to these programs in an

overall rural development strategy? These are the questions which arise if one attempts seriously to address this third issue.

The Narangwal project occurring as it did on the heels of the "Green Revolution" in the Punjab represents effectively an integration of health nutrition and family planning services with agricultural development. The project (Department of International Health, 1978b) was, in fact, two projects working in close relation: a population project, emphasizing family planning and women's services, and a nutrition project, with emphasis on child care. Services were delivered to samples of villages in different combinations including controls, and results were monitored in terms of morbidity, mortality, growth parameters, and fertility measures. Infant mortality was 25-40 percent lower in treatment areas than in control areas: child mortality (1-4 years) was 30-40 percent lower. At 36 months of age, children receiving nutrition services were 6-7 percent heavier and 1-2 cm. taller than children in control areas. In the family planning areas, the general fertility rate fell 4-21 percent compared with 3 percent in control areas. Services were delivered at a cost of \$1.50-2.00 per person, roughly 1-2 percent of India's per capita gross national product.

In more specific terms, nutrition services delivered to mothers seem to have been of value particularly to averting early infant death through increasing birth weights. Immunizing mothers against tetanus made it possible to avert 80 percent of deaths from neonatal tetanus. Through reliance on family health workers to diagnose and treat diarrheal and respiratory diseases, deaths from these conditions were reduced.

Nutrition services alone were most effective in reducing early infant deaths; health services alone reduced childhood deaths, but the two together were more effective than either one alone.

Similar results have been reported preliminarily from the Danfa (Ghana) comprehensive maternal and child health/family planning project, where a similar research design was used (Asante, 1978), but complete reporting of the data from that project awaits the analysis.

Gwatkin (1979) reviewed ten health, nutrition, and family planning projects in varying mixes and came to roughly the same conclusion i.e., that combined services are more effective in reducing morbidity and mortality and lowering fertility, than any component used alone.

In most of these projects as well as those with insufficient data for evaluation, health, nutrition, and family planning services have been delivered outside the context of total rural development, where increased agricultural production and productivity were the principal goals. For examples of these services in proper context, we must turn again to Kerala and Sri Lanka, which we have discussed in relation to community participation, and to China (Sidel and Sidel, 1972) and Cuba (Vinceremos Brigade, 1975). In each area remarkable results have been achieved in terms of both mortality and fertility rates, through a totally integrated approach, i.e., health and nutrition services have been a part of a total strategy for rural areas, differing cultural, political, and economic circumstances notwithstanding. Ultimately, as our initial conceptual framework indicates, there must be a national political commitment to rural development of an integrated type in order for programs to be implemented and a further commitment to the development of intermediate urban centers and the strengthening of local government.

Increased agricultural production/productivity can lead potentially to improved health status and nutrition for mothers and children depending on an interplay of factors related to equity of benefit distribution, scope of improved production and productivity, and the inclusion of specific health, nutrition, and family planning components in a package of programs.

C. Increasing Income as a Strategy for Improved Health and Nutrition

We have already pointed out a clearly important intermediate role for income in the chain of factors affecting maternal health child survival and ultimately fertility. The experience of Sri Lanka and Kerala, however, casts some doubt on whether or not the role of income is critical, since in those settings at least health status and survival increased and fertility declined without any appreciable change in per capita GNP or income (Gwatkin, 1978). Apparently a concerted policy of equitable distribution of food and services, the things purchased with income that are important to health, can offset the negative influence of low income.

In settings where such policies do not exist, however, income may act as a more critical intermediary. In such cases, programs aimed at increasing income should have an appreciable impact on health and nutrition.

Many rural households occupy a precarious position because of chronic indebtedness to middle level market controllers. Such is particularly true when the household depends entirely upon the cash crop market for its financial income. Because of chronic debt, little cash is available from year to year for investment in improved seed, agricultural implements, fertilizer, improved housing, improved water supply and waste disposal, education of children, medical care, and contributions to community-based development schemes. Low income thus serves as a throttle on many specific activities tending to improve the health and nutritional environment and therefore presumably the status of mothers and children.

Not only low income per capita, however, but also income inequality between population groups may exert an influence on health status and fertility. Bhattacharyya (1975) studied the relationship of degree of rural-urban inequality to both infant mortality and fertility in an aggregate of 52 counties. In both instances income inequality was shown to exert an effect independent of per capita income. The implication is for finding ways of increasing income levels of rural populations relative to their urban counterparts if infant mortality and fertility are to diminish.

The development strategies aimed at increasing income include all forms of credit cooperatives, credit unions, and rural savings banks, which tend to make cash more readily available to rural households, as well as programs aimed at increasing income through increased agricultural productivity and output, and increased nonfarm employment opportunity.

Little, if any, evaluative data exist on such program in which the use of health nutritional or fertility indicators play a role. Many income raising projects are just underway (e.g., Cameroon, Brazil, Liberia) so that evaluative results are not available. Any evaluation of the effect of increasing income on the parameters of interest must not only look at income level and income distribution as we have seen, but also at the effects of entry into a market and/or cash economy in those populations where these are a new phase of economic existence. Liu (1972) in a study in Taiwan found that the health implications of a cash economy become more important as households begin to depend upon the market economy for increasing proportions of their food supply. This result can mean an enrichment

of the household diet, but any benefits are subject to variations in price and resultant ability and willingness to pay.

As for fertility effects, Singarimbun and Hull (1975) found upper income women to have shorter periods of breastfeeding, shorter post partum amenorrhea and consequently, higher fertility than their lower income counterparts. These women also had a remarkably different child mortality experience, however, Forty-six percent of low income mothers surveyed had lost a child with a mean loss of 0.75 per mother, whereas only 23 percent of upper income women had lost a child, with a mean loss of 0.29. Thus, upper income Javanese women through higher fertility and lower child mortality exceed their ideal number of children in 50 percent of the cases and equal it in 24 percent, whereas 64 percent of lower income women fail to reach the ideal number. But Kocher (1973) and Repetto (mimeo) have shown that countries with a more even income distribution (Costa Rica, Sri Lanka, Taiwan, South Korea) experience a more rapid decline in fertility than those whose income distribution is more uneven (Brazil, India, Thailand, Phillipines, Mexico).

In the absence of further evidence increasing income, therefore, seems to be of only partial value as a strategy for improving health and nutritional status. Examples have been shown where health improved without much increase in income (Sri Lanka and Kerela) and where income has increased without an appreciable improvement in health status (Senegal). In the former cases, equitable distribution of food and services served to offset the disadvantages of low income; in the latter income, while increased, is still relatively low, and food and services remain inequitably distributed. The implications for policy and programming seem clear.

V. SUMMARY

Four major sources of information were used in the course of seeking evidence for or against the validity of the aforementioned hypotheses: computerized bibliographic scans (Popscan and Medline), direct contacts with researchers in the field, files of project documents at USAID Washington, and personal collections of the authors. These sources yielded a total of over 300 useful references in English and French, of which 155 were studied in depth and in part included in an annotated bibliography. Of this group 48 were not geographic specific, 28 were specific to Asia, 46 to Africa, 13 to Latin America, 15 to Europe and North America, and 5 to the Middle East and North Africa. As to the type of reference, 59 were review articles, 32 original articles containing descriptive data only, and 64 contained quantitative data. 138 are in English, 17 in French; 126 are by North American or European authors, and 29 by Third World authors.

As a result of this review, certain hypotheses can be formulated. These hypotheses, more or less supported in the literature, are presented as useful tools for both research and evaluation of projects. They are grouped in four categories corresponding to links in the conceptual framework.

A. Health and Nutrition Status and Fertility

- 1) Maternal nutrition status is positively related to fertility, largely through increased neonatal survival.
- 2) Increased child survival operates in developing societies to decrease fertility by means of lengthened breastfeeding primarily, and secondarily through dampening the so-called "insurance" and "replacement" effects.
- 3) The impact of increased child survival on fertility is a delayed one.
- 4) Maternal health status affects fertility positively both through increased fecundity and decreased pregnancy wastage.
- 5) Fertility affects child survival negatively through parity and birth spacing effects.

- 6) Fertility affects maternal health negatively through parity and birth spacing effects.
- B. Immediate Determinants of Health and Nutrition Status
- 1) The major determinants of maternal health status and child survival are (in decreasing order of importance) nutrition, prevalence and incidence of infection and the availability, accessibility, and utilization of appropriate health services.
 - 2) Nutrition and infection exert their influence on child survival synergistically.
- C. Proximal Determinants of These Immediate Determinants
- 1) The key determinants of nutrition are: (a) food availability, both in the community and within the household, (b) the nutrition-related beliefs, attitudes, and practices of decisionmakers, and (c) income, especially when food must be purchased.
 - 2) The prevalence and incidence of infections are most determined by: (a) the quality of the environment, particularly water, waste disposal, and housing, and (b) health-related beliefs attitudes and practices.
 - 3) The availability, accessibility, utilization, and appropriateness of health services is most dependent on: (a) the management structure, (b) the personnel, especially their availability and their appropriateness, (c) health-related beliefs, attitudes and practices, (d) climate and geography, (e) the social structure of the community, and in some cases, (f) income.
- D. Development Strategies and Their Health, Nutritional, and Fertility Effects
- 1) Community participation is a helpful, although not a necessary, ingredient in rural development strategies in terms of their impact on health, nutrition, and fertility.
 - 2) The impact of increasing agricultural production/productivity on health, nutrition, and fertility depends on (a) the distribution of benefits, (b) the inclusion of food production in the program, and (c) the incorporation of programs directly concerned with health, nutrition, and family planning in rural development packages.

As a subsidiary to this hypothesis, it can be positively stated that combined health, nutrition, and family planning services represent the most effective mix of service components.

- 3) Raising income is of value in improving health, nutritional, and fertility outcomes if the problem of equitable distribution of food and services is addressed.

ANNOTATED BIBLIOGRAPHY

Arole, R.S.

- 1972 "Un Projet d'Action Sanitaire Globale en Milieu Rural: Jamkhed, Indes," Contact, 5.

In a project of total health care ranging from prenatal care and family planning to well digging, in a community previously without any modern health care whatsoever, the authors found as a necessary first step to form a health committee in order to engage the population in the multiple aspects of the work.

Baird, D.

- 1962 "Environmental and Obstetrical Factors in Prematurity with Special Reference to the Experience in Aberdeen." Bulletin of the World Health Organization, 26:291.

This report explores the relationship between parental social class, height, and health with the incidence of infant mortality, prematurity, and low birth weight.

Bhattachayya, A.K.

- 1975 "Income, Inequality and Fertility: A Comparative View." Population Studies, 29, 5-19.

In a study designed to estimate the adequacy of the aggregative measure of income per head as an index of economic development in studying the relationship to economic development to fertility, it was found that urban-rural inequality in income has a positive effect on fertility independent of that of per capita income. The implication is that if fertility rates of rural populations are to be lowered, their standard of living must be raised.

Birdsall, Nancy

- 1977 "Analytical Approaches to the Relationship of Population Growth and Development." Population and Development Review, 3(1/2):63.

This study reviews the relevant literature on both population growth as an influence on economic development indicators and the latter as determinants of population growth. Both macro and micro economic approaches are reviewed. The strength of relationships of various socioeconomic factors to fertility are evaluated and their relevance to policy and planning discussed.

Butler, N. R. and E. D. Alberman (ed.)

- 1969 Perinatal Problems: Second Report of the 1958 British perinatal Survey. Edinburgh:Livingstone.

This volume presents a continuation of the analysis of information received from the 1958 Perinatal Mortality Survey in England and Wales. Reports are presented on issues such as effects of smoking in pregnancy, growth and maturation of the fetus, and effects of obstetric and environmental factors on perinatal mortality.

Cunningham, C. E., T. C. Doege, and H. N. Bangxang (eds.)

- 1970 Studies of Health Problems and Health Behavior in Saraphi District, North Thailand. Chaing Mai, Thailand: Chaing Mai University Faculty of Medicine.

This document is a basic series of studies by students and faculty of the medical school aimed at elucidating the patterns of illness and illness-related behavior of an entire district. It represents a unique example of taking an entire community as a "laboratory" for medical education.

Delgado, Ramiro, Kalyan Raj Pandey, Sharada Ram Shrestha, and Shreebatsa Prasad Shrestha.

- 1979 Population and Development Policy Research: The Impact of Integrated H/FP Services on Fertility Behavior in two Districts of Nepal. New Orleans: Tulane University School of Public Health and Tropical Medicine.

In the background section of this proposal, previous experiments of integrating functions in rural health workers in Nepal are recounted. It was first found that delivery of family planning services by village-based workers was effective in terms of family planning acceptance. Subsequently, family planning functions were integrated with categorical malaria control functions in one set of workers which were then compared with categorical family planning workers. Family planning acceptance was greater than among the populations served by the former group.

Feacham, R., M. McGarry, and D. Mara (eds.)

- 1977 Water Wastes and Health in Hot Climates. London: Wiley.

Chapter One discusses what is known of the relationship of water quality and quantity to health.

Flavier, J. M.

- 1970 Doctor to the Barrios. Quezon City, Philippines: New Day Publishers.

In this remarkable book, the author recounts his personal experiences of integrating health care with agricultural and general community development in rural Philippines.

Friedlander, D.

- 1977 The Effect of Child Mortality on Fertility. Theoretical Framework of Relationship. Proceedings of the IUSSP Conference. Mexico City. Liege, Belgium: International Union for the Scientific Study of Population.

In this analysis of what is known of the relationship of child mortality to fertility, four possible mechanisms for the observed positive effect are postulated and their merits discussed: the replacement, insurance, physiologic, and alternate social responses.

Frisch, Rose E.

1978a "Population, Food Intake, and Fertility." Science 199.

Historical evidence is reviewed bearing on the possible role for undernutrition in the lowered completed family size of lower socioeconomic classes in mid nineteenth century Britain. The theory is put forth that undernutrition may lead to subfecundity and lessened reproductive efficiency.

1978b "Menarche and Fatness: Reexamination of the Critical Body Composition Hypothesis," Science, 200:1509-1519.

The author defends her theory that such phenomena of reproductive significance as ages of menarche and menopause and ovulatory regularity are regulated by the ratio of total body fat to body mass.

Hull, V. J.

1977 A Study of Birth Interval Dynamics in Rural Java. Working Paper Series No. 8. Yogyakarta: Universitas Gadjah Mada, Population Institute.

In a study designed to elucidate the reasons for the reported lower fertility rates in certain districts of Central Java, the study team found that prolonged lactation and enforced sexual abstinence in the post partum and lactational periods, resulting in relatively long birth intervals, were the two major explanations. Further analysis of socio-economic factors favoring or inhibiting these two mechanisms found women's employment in the former group, and the use of sucking substitutes, flexible working schedules, nighttime feeding, and a generally supportive social milieu, in the latter.

Isely, R. B. and J. F. Martin

1977 "The Village Health Committee: Starting Point for Rural Development." World Health Organization Chronicle, 31:307.

An experimental approach to mobilizing rural populations around health issues in the Cameroon is described, in which the training of itinerant workers to serve the technical and organizational needs of village level decisionmaking structures is cited as a key element.

Johnston, M.

1978 "The Planning Dialogue in the Community." Contact, 43.

The author develops a series of program guidelines for planning a community health program, based on her experiences in Indonesia. She emphasizes quality of personnel, community participation, and continued training.

Konde, P.Y.

1976 "How a Rural Dispensary Becomes a Development Centre," Contact.
World Council of Churches, 35:1-7.

A nurse from a rural health center in the Zaire describes how a simple dispensary giving out curative care became over 7 years' time a center for the promotion of environmental hygiene, community organization, preventive health care, and agricultural development.

McGregor, I. A.

1976 "Health and Communicable Disease in a Rural African Environment,"
Oikos 27(2):180-192.

McGregor here reviews the several studies of child growth and survival in the Gambia carried on since 1949. His major conclusions are: (1) that both growth and mortality vary with the seasons except when epidemics of measles or pertussis occur. Growth slows and mortality

increases during the rains. (2) That mortality has not improved in the past 30 years despite the introduction of medical care into the community studied. (3) That disease incidence may have as much to do with growth patterns as food availability.

Morley, D. C., J. Bicknell, and M. Woodland

1968 Factors Influencing the Growth and Nutritional Status of Infants and Young Children in a Nigerian Village. Transactions of the Royal Society of Tropical Medicine and Hygiene. 62(2):164.

In a study comparing the growth and mortality of young children in villages (1) served by a specially trained on-site auxiliary midwife and (2) served by the existing health service infrastructure, the authors found growth considerably better and mortality diminished by 50 percent in the former village. The conclusion is that even a minimally educated person can deliver the essence of MCH services.

Morss, E.R., J.K. Hatch, D.R. Mickelwait, C.F. Sweet

1975 Strategies for Small Farmer Development: An Empirical Study of Rural Development Projects. Washington, D.C.: Development Alternatives, Inc.

A study of 36 rural development projects in 11 countries aimed at elucidating common elements in "successful" projects, i.e., those where production improved, concludes that the two major factors are:

- 1) involvement by the population in decisionmaking, and
- 2) resource commitments by the population to the project.

Naeye, R. L., W. Blanc, and C. Paul

1973 "Effects of Maternal Nutrition on the Human Fetus," Pediatrics 52:494.

The results of this study of 467 stillborn and newborn infants indicates that although the mother's height had little correlation to the growth of the fetus, her weight before pregnancy and her weight gain and caloric intake during pregnancy did show a definite influence. Malnutrition of the mother had minor effects on fetal growth during the first two trimesters, while such undernutrition during the last trimester resulted in a detrimental impact on fetal development.

Puffer, R.R. and C.C. Serrano

1973 Patterns of Mortality in Childhood. Scientific Publication No. 262. Pan American Health Organization, World Health Organization

A detailed analysis of an investigation which was conducted in 13 projects in Latin America during the period 1968-1971. Six of the projects were urban while the others were carried out in rural and/or suburban areas. The main objective of the investigation was to explore in depth the causes of excessive mortality in infancy and early childhood in the Americas, as well as the interrelationships of multiple causes and associated factors.

Ram, Eric R.

1978 "Realization of an Integrated Health Services Programme in India," Contact, World Council of Churches 44:1-15.

The author describes a health project in rural India in which integration of services and community participation played important roles. An essential part of the latter was the training support of the village health workers and midwives. Health committees formed the backbone of community participation. Concrete results after 3 years based on a 10 percent sample included reductions in birth and death rates, maternal mortality, infant mortality, and the incidences of diarrhea, scabies, and ascariasis.

Rowland, M.G.M., and J.P.K. McCullum

1977 "Malnutrition and Gastroenteritis in the Gambia." Transactions of the Royal Society of Tropical Medicine and Hygiene, 71(3):199.

Diarrheal disease in the children of a rural Gambia population is strongly associated with failure to thrive. The diarrhea, however, is not of the acute infantile type, but is more protracted. Bacterial contamination of both food and water were documented. Stool bacteriologic and viral studies revealed a 5 percent isolation rate for pathogenic forms of the former and no isolation of rotavirus. Upper bowel studies in a cohort of 46 children between the ages of 6 and 20 months revealed intense bacterial colonization of the upper gut. The suspicion is that infected water and food are responsible.

Sanwogou, Lardja L. and Nkoa Etoundi

1976 "Les Pharmacies Familiales Villageoises," Afrique Médicale 142:493-496.

The authors describe an experimental approach to the distribution of medicaments in a Cameroonian village, in which families advanced a certain amount of money which was then taken collectively to purchase a restricted list of household medications and medical supplies. The families were then instructed in their use and dangers. The supplies were restocked periodically. This work was a part of an overall health education project emphasizing the organization of village populations.

Singarimbun, Masri, and Terence H. Hull

1977 "Social Responses to High Mortality Which Act to Support High Fertility," International Population Conference, Vol. I.

A study in Central Java of social class in relation to fertility reveals that lower social classes among whom infant and child mortality is the highest are also those with the lowest fertility, largely because of higher rates of involuntary infertility and divorce. The results

call into question the theory that infant and child mortality is the provaquateur of social norms leading to compensatory high fertility, especially as this theory might influence policy.

Thomson, B. and A. K. Rahman

1967 Infant Feeding and Child Care in a West African Village. The Journal of Tropical Pediatrics, 13:124.

In a descriptive longitudinal study of a group of children born in 1962-3, mothers were observed to modify their child care routines according to the demands of agricultural work. Infants less than 6 months of age were likely to be carried on the mother's back to the fields during the rice growing (rainy) season, while infants over 6 months of age were more likely to be left in the village under the care of a young child or an elderly woman. These latter babies were weaned on the average sooner than were the former.

Ware, H.

1977 The Relationship between Infant Mortality and Fertility: Replacement and Insurance Effects. Proceedings of the IUSSP Conference, Mexico City, Liege, Belgium: International Union for the Scientific Study of Population, 240.

In a review of available studies, the replacement effect is found to be relatively less frequently occurring in all countries, but particularly in high mortality, high fertility, noncontracepting societies, while the insurance effect is more frequent in this latter group of countries.

Werner, E. C., J. M. Bierman, and F. E. French

1971 The Children of Kauai. Honolulu: University of Hawaii Press.

This now famous book reports on a longitudinal study performed on children in Kauai, Hawaii, which followed their physical and psychological development from the prenatal period to age 10.

GENERAL BIBLIOGRAPHY

- Abrahams, I., R.I. Anderson, A.A. Buck, K. Kawata, T.T. Sasaki, R.A. Ward
1972 Health and Disease in Rural Afghanistan. Baltimore: Johns Hopkins University Press.
- Alvarez-Bravo, A.
1969 "General Basis for Prevention of Anemia in Pregnancy." In Parandare, B.N. and Jhveri, C.L. eds. Proceedings of International Seminar on Maternal Mortality, Family Planning, and Biology of Reproduction, held at Bombay. Bombay: Federation of Obstetric and Gynaecological Societies of India 170-176.
- Ampofo et al.
1975 Training and Education of Traditional Birth Attendants in the Danfa Rural Health Project. Manuscript. Los Angeles: UCLA School of Public Health.
- Annis, S. and E. Hurtado
1978 Improving Family Planning Programs in the Highlands of Guatemala. Guatemala City, APROFAM.
- Aujoulat, L.P.
1969 Santé et Développement en Afrique. Paris: Librairie Armand Colin.
- Asante, R.O.
1978 Basic Health Services in Ghana: Experiences to Date and Future Directions. Paper presented at an International Colloquium on Basic Health Services in Developing Countries. Antwerp. December.
- Baskett, T.F.
1975 The Grand Multipara, A Continuing Threat: A Six-Year Review of 1005 Cases. Paper presented at the 31st Annual Meeting of the Society of Obstetricians and Gynaecologists of Canada. Jasper Park Lodge, Alberta, Canada.
- Basta, S.S. and A. Churchill
1974 Iron Deficiency Anemia and the Productivity of Adult Males in Indonesia. World Bank Staff Working Paper No. 175. Washington, D.C.: The World Bank, April.
- Becker, M.H., and L.A. Maiman
1975 "Socio-behavioral Determinants of Compliance with Health and Medical Care Recommendations." Medical Care 13:10-24.
- Berry, R.H., and W.R. Cline
1976 Farm Size Factor Productivity and Technical Change in Developing Countries. Geneva: ILO.

- Bryant, J.
 1969 Health and the Developing World. New York: Cornell University Press.
- Butz, W.P. and J. DaVanzo
 1978 Contracepting and Birthspacing in Malaysia: A Model of Decision-making Subject to Economic and Biological Constraints. Santa Monica, California: Rand Corporation. Rand Reports and Working Notes. No. WN-10146-AID.
- Cantrelle, P., M. Diagne, N. Raybaud, et M.T. Villod
 1967 Mortalité de l'Enfance dans la Région de Khombole-Thienaba (Senegal) 1964-1965. Rapport du Colloque sur Les Conditions de Vie de l'Enfance en Milieu Rural en Afrique, Dakar 20-25 février 1967. Paris: Centre International d'Enfance.
- Cantrelle, P.
 1969 "Etude démographique dans la région du Sine Saloum (Sénégal)." Travaux et Documents de l'ORSTOM. Paris: O.R.S.T.O.M.
- Cannon, D.S.H.
 1958 "Malaria and Prematurity in the Western Region of Nigeria." British Medical Journal, II, 877.
- Chandra, R.K. and D.M. Newberne
 1977 Nutrition, Immunity, and Infection. New York: Plenum, 67-126.
- Chavez A. and C. Martinez
 1973 Nutrition and Development of Infants from Rural Areas, III: in Maternal Nutrition and Its Consequences on Fertility. Division de Nutricion Instituto Nacional de Nutricion Mexico.
- Chen, L., A. Shamsa, M. Gesche, and W.H. Moseley
 1977 A Prospective Study of Birth Interval Dynamics in Rural Bangladesh. Population Studies 28:277.
- Cissé, B.M.
 1967 L'animation rurale au Sénégal. Rapport du Colloque sur les Conditions de Vie de l'Enfance en Milieu Rural en Afrique, Dakar 20-25 février. Paris: Centre International d'Enfance.
- Clarke, N.A.
 1970 Nutritional Status in the Hazara. Wheaton, Illinois. Medical Assistance Programs, Inc.
- Davis, K. and J. Blake
 1955 Social Structure and Fertility: An Analytic Framework. Economic Development and Cultural Change 4:211.
- Department of International Health
 1978a Malnutrition, Infection, Growth and Development: The Narangwal Experience. Baltimore: The Johns Hopkins University, School of Hygiene and Public Health.

- 1978b Integration of Family Planning and Health Services: The Narangwal Experience. Baltimore: The Johns Hopkins University School of Hygiene and Public Health.
- Eastman, N.J.
1940 "The Hazards of Pregnancy and Labor in the 'Grand Multipara'." New York State Journal of Medicine 40:1708-1712.
- Ebrahim, G.J.
1971 "Nutrition Rehabilitation Centers," Clinical Pediatrics 10(6):303-305.
- Escudero, J.C.
1978 "The Magnitude of Malnutrition in Latin America." International Journal of Health Services. 8(3)465-491.
- Esman, M.J.
1978 "Development Administration and Constituency Organization." Development Administration. March-April 166-171.
- FAO, Nutrition Committee for the Middle East
1959 Report of the First Session of the Joint FAO/WHO Committee, 1958.
- FAO/WHO
1973 Energy and Protein Requirements. Report of a joint FAO/WHO ad hoc committee, Report Series No. 52. Rome: FAO.
- Feacham, R., M. McGarry, and D. Mara
1977 Water, Wastes, and Health in Hot Climates. New York: John Wiley.
- Fendall, N.R.E.
1972 Auxiliaries in Health Care. Baltimore; The John Hopkins University Press.
- Fountain, D.
1976 "A Program of Rural Public Health, Vanga, Zaire." Contact, 13.
- Frake, C.O.
1961 "The Diagnosis of Disease Among the Subanun of Mindanao." American Anthropologist, 63:113-132.
- Freedman, R.
1973 Norms for Family Size in Underdeveloped Areas, in Population, Environment, and Social Organization. Hinsdale, Illinois: the Drydon Press, 171-195.
- Freij, L., G. Sterky, T. Waldstrom, and S. Wall
1978 "Child Health and Diarrhoeal Disease in Relation to Supply and Use of Water in African Communities." Progress in Water Technology, 11(1/2):49-55.

- Gaisie, S.K. and A.S. David
 1974 Planned Fertility Reduction in Ghana. Legon: Population Dynamics Programme, Univeristy of Ghana.
- Gish, O.
 1977 Mobile Health Services. London: Tri-Med Books.
- Gunasekavan, S., K.A. Pisharoti, R.S. Kurup, and A.R. Omran
 1976 Child Loss and Family Formation, A. Gandhigram in Family Formation Patterns and Health, Omran, A.R. and C.C. Standley, eds. Geneva, World Health Organization.
- Gwatkin, D.R.
 1978 Nutrition Planning and Physical Well-Being in Kerela and Sri Lanka. Overseas Development Council.
- Gwatkin, D.R., J.R. Wilcox, J.D. Wray
 1979 Can interventions make a difference? The policy implications of field experiment research. A report to the World Bank.
- Habicht, J.P.
 1973 "Delivery of Primary Care by Medical Auxiliaries: Techniques of Use and Analysis of Benefits Achieved in Some Rural Villages in Guatemala." Washington: Pan American Health Organization, Medical Auxiliaries, Scientific Publication No. 278, pp. 24-37.
- Hajazi, S.
 1976 Factors Influencing the Growth and Nutritional Status of Infants and Young Children in Rural Jordan, Ph.D. Dissertation, University of London.
- Hansen, R.D.
 1976 The U.S. and World Development Agenda for Action. Overseas Development Council. New York: Praeger.
- Hassouna, W.A.
 1973 Integrated Services: An Instrument of Health Policy Aimed at Forming the New Egyptian. Cairo: Institute of National Planning.
- Henin, R.A., D.C. Ewbank, and E.K. Sekatawa
 1973 "Mortality Estimation," in The Demography of Tanzania, Rushdi A. Henin, editor. Dar-es-Salaam: University of Dar-es-Salaam.
- Herzog, J.K.
 1975 "Population Change and Productive Activity Among the Serer of Senegal: Some Hypotheses." Annual Meeting of the Population Association of America. Seattle.
- His Majesty's Government of Nepal, Ministry of Health
 1977 Annual Report. Kathmandu: Integrated Community Health Division.
- Horn, J.
 1971 Away with All Pests. New York: Monthly Review Press.

- Huffman, S.A., J. Chowdhury, J. Chakraborty, and W.H. Moseley
1978 Nutrition and Postpartum Amenorrhea in Rural Bangladesh. Population Studies, 32(2):251.
- Imperato, P.J.
1972 "Nomads of the Niger." Natural History, 61-78.
- Isely, R.B.
1978 "Reflections on an Experience in Community Participation." International Colloquium on Basic Health Services in Developing Countries. Antwerp, December.
- Isely, R. and P. Mvele
1979 "Evaluation du pronostic du Comité de Santé Villageois au Cameroun: Résultats d'Une Enquête Economique et Attitudinale: International Journal of Health Education, in press, no. 3.
- Isely, R.B. and J. Courtejoie
La mère, enfant et leur santé (in press).
- Jelliffe, D.B.
1962 Child Health in the Tropics. London: Arnold
- 1966 The Assessment of the Nutritional Status of the Community (with special reference to field survey in developing regions of the world). World Health Organization, Geneva.
- Johnston, B.F. and A.J. Meyer
1977 "Nutrition, Health and Population in Strategies for Rural Development." Economic Development and Cultural Change, 26(1), October 1-23.
- Joseph, S. and S. Scheyer
1977 Une Stratégie de Santé. Composante du Programme de Développement du Sahel, Washington, Family Health Care Inc.
- Kim, M., R.U. Rider, P.A. Harper, and J.M. Yang.
1974 Age at Marriage, Family Planning Practices, and Other Variables as Correlates of Fertility in Korea. Demography, 11(4):641.
- Kimber, D. and L.R. Weintraub
1968 "Malabsorption of Iron Secondary to Iron Deficiency: New England Journal of Medicine, 279(9), 453-458.
- King, M.
1968 Medical Care in Developing Countries. Nairobi: Oxford University Press.
- Kloetzel, K.
1962 "Splenomegaly in Schistosomiasis Mansoni." American Journal of Tropical Medicine and Hygiene, 11.

- Knodel, J.
1977 Breastfeeding and Population Growth. Science. 198(4322):1111-5.
- Kocher, J.E.
1973 Rural Development, Income Distribution, and Fertility Decline.
New York: The Population Council, 1973.
- Labusquière, R.
1975 Santé Rurale et Médecine préventive en Afrique. Paris: Librairie
Le Francois.
- Laugesen, B.M.
1972 Presentation at a Workshop on Under-Fives Clinics. Hyderabad,
October.
- Leary, P.M.
1966 "A Pattern of Measles Among Some Africans in a Bantu Reserve."
South African Medical Journal, 40, 293.
- Leitch, I.
1945 Diet and Tuberculosis. Proceedings of the Nutrition Society
3, 156.
- Liu, P.K.C.
1972 "Economic Development and Population in Taiwan since 1895: An
Overview," Population Papers, No. 1, Institute of Economics,
Academica Sinica, Taipei.
- Martin, J.M.
1978 Alma Ata: The Consecration of the Primary Health Care Approach.
International Journal of Health Education, 21(3)1-4.
- McFalls, J.A.
1974 "Impact of VD on the Fertility of the U.S. Black Population,
1880-1950." Social Biology, 20, 2-19.
- McGregor, I.A.
1964 "Measles and Child Mortality in the Gambia." West African
Medical Journal, 13, 251.
- McGregor, I.A., A.K. Rahman, B. Thompson, W.Z. Billewicz, and A.M. Thomson
1968 "The Growth of Young Children in a Gambian Village." Transactions
of the Royal Society of Tropical Medicine and Hygiene, 62(3):341-
352.
- McGregor, I.A., A.K. Rahman, A.M. Thomson, W.Z. Billewicz, and B. Thompson
1970 "The Health of Young Children in a West African (Gambian)
Village." Transactions of the Royal Society of Tropical
Medicine and Hygiene, 64(1):48-77.
- Miller, C.A. and R.W. Noyes.
1974 "Priorities in Maternal and Child Health," in Community Medicine
in Developing Countries, ed. by A.R. Omran. New York: Springer,
pp. 241-245.

- Morley, D.
1959 "A Pattern for the Development of Child Welfare in Developing Countries." Mother and Child 30:163.
- Morley, D.C., W.J. Martin, and M. Woodland
1966 "Whooping Cough in Nigerian Children." Tropical and Geographic Medicine, 18, 169.
- Morley, D.C., W.J. Martin, and I. Allen
1967 "Measles in East and Central Africa." E. African Medical Journal, 44.12.
- Morley, D.C.
1973 Pediatric Priorities in the Developing World. London: Butterworths.
- Naeye, R.L. and W.A. Blanc
1974 Influences of Pregnancy Risk Factors on Fetal and Newborn Disorders. Clinics in Perinatology, 1(2):187-195.
- National Research Council
1970 Maternal Nutrition and the Course of Pregnancy. Washington: National Academy of Sciences.
- Newell, K.A.
1975 Health By The People. Geneva: World Health Organization.
- New Internationalist
1976 "Where Beans Mean Development," 38:15, April.
- Noah, E.
1975 Une Evaluation des Possibilités de l'Auto-Financement des Projets de Santé au Village (Miméo) Douala, Pan African Institute for Development.
- Nortman, D.
1974 "Parental Age as a Factor in Pregnancy Outcome and Child Development." Reports on Population/Family Planning, 16.
- Nourmand, A., A Ghavami, M. Ziai, and A.C. Tahernia
1970 "Tetanus Neonatorum in Iran." Clinical Pediatrics 9(10), 609-610.
- Ogionwo, W.
1973 "Socio-psychological factors in health behavior: an experimental study on methods and attitude change." International Journal of Health Education 16 (supplement to No. 2).
- Omran, A.R.
1974 "Health Benefits of Family Planning for Mother and Child." World Health, pp. 6-13.
- Pan American Health Organization
1978 Scientific Report Series, No. 364.

- Park, C.B., S.H. Han, and M.K. Choe
 1979 "The effect of infant death on subsequent fertility in Korea and the role of family planning," American Journal of Public Health, 69(6):557-565.
- Parker, R.L., C.A. Alexander, S.M. Shah, and A.K. Neumann
 1978 Self-Care in Rural Areas of India and Nepal. Paper presented at the International Congress on Primary Health Care - A Global Perspective. Halifax, Nova Scotia. May 23-26.
- Population Reports
 1975 Effects of Childbearing on Maternal Health. Washington: Department of Medical and Public Affairs, The George Washington University, Series J(8).
- Repetto, R.
The Interaction of Fertility and Size Distribution of Income, mimeographed. Cambridge, Mass. Harvard School of Public Health.
- Retel-Laurentin, A.
 1973 "Fécondité et Syphilis dans la Region de la Volta Noire." Population, 28(4-5):793-795, 801-803, 811.
- Retel-Laurentin, A.
 1974 Infécondité en Afrique Noire, Maladies et Conséquences Sociales. Paris: Masson et Cie, 75-104.
- Rondinelli, D.A.
 1978 "Rethinking National Development." Journal of the American Institute of Planners, 44(1):84-94.
- Rondinelli, D.A. and K. Ruddle
 1978 "Appropriate Institutions for Rural Development: Organizing Services and Technology in Developing Countries," In press. Philippine Journal of Public Administration.
- Ross, D.A.
 1979 "The Serabu Hospital Village Health Project." Contact, 49:1-9.
- Sai, F.T., et al.
 1972 "The Danfa Ghana Comprehensive Rural Health and Family Planning Project--A Community Approach," Ghana Medical Journal 11:9-17.
- Sam, P.D.,
 1976 "Le groupe de travail en tant d'unité de base de la formation au village," Focus: Technical Cooperation 2:17-20, 1976.
- Sandford, S.
 1978 Welfare and Wanderers, the Organization of Social Services for Pastoralists. London: Overseas Development Institute (mimeo).

- Satgé, D., F. Coly, N. Raybaud, M.T. Villod, et M. Touré
 1964 Un Centre d'étude et d'application des Methodes de Santé
 Publique et de Protection de l'Enfance en Brousse: Khombole
 (Sénégal), L'Enfant en Milieu Rural, 19.
- Satgé, P.
 1967 Croissance Staturo-Pondérale de l'enfant de 0-7 ans en Zone
 Rurale au Sénégal. Rapport du colloque sur les Conditions de
 Vie de l'Enfance en Milieu Rural en Afrique. Dakar, 1967.
 Paris: Centre International d'Efance.
- Satgé, P., V. Dan, A. Debroise, N. Raybaud, A. Koite
 1970 "Une expέθιενψε φε σαντέ publique appliquée à l'enfance en
 milieu rural (Khombole, Sénégal)." Carnets de l'Enfance,
 12, 31-44.
- Scrimshaw, N.S. and J.E. Gordon
 1968 Malnutrition Learning and Behavior. Cambridge, Massachusetts:
 M.I.T. Press.
- Scrimshaw, N.S., C.E. Taylor, and J.E. Gordon
 1968 "Interactions of Nutrition and Infection." Monograph Series 57,
 Geneva: WHO.
- Shiffman, M.A., R. Schneider, A.G. Turner, and R.W. Helms.
 1976 "Seasonality in Water-Related Intestinal Disease in Guatemala."
Int. J. of Biometeorology, 20(3):223-229.
- Sidel, V. and R. Sidel
 1972 Serve the People: Observations on Medicine in the People's
 Republic of China. Boston: Beacon.
- Stycos, J.M.
 1968 Human Fertility in Latin America. Sociological Perspectives.
 Ithaca: Cornell University Press.
- Syncrisis: The Dynamics of Health
 1975 U.S. Department of Health Education and Welfare, Office of Inter-
 national Health. Vol. I, Panama; Vol. II, Honduras; Vol. V,
 El Salvador; Vol. IX, Dominican Republic; Vol. XI, Nicaragua;
 Vol. XIV, Zaire.
- Thomson, A.M.
 1959 "Maternal Stature and Reproductive Efficiency." Eugenics Review,
 51, 162.
- Thomson, A.M. and W.Z. Billewicz
 1963 "Nutritional Status, Maternal Physique and Reproductive Efficiency."
Proceedings of the Nutrition Society, 22:55-61.
- Thomson, A.M.
 1968 "The later results in Man of Malnutrition in Early Life." in
Calorie Deficiencies and Protein Deficiencies, D.A. McCance and
 E.M. Widdowson, eds. London: Churchill.

- Thomson, A.M., W.Z. Billewicz, and R.M. Holliday
 1967 "Secular Changes in the Physique of Aberdeen Mothers, 1950-1954." British Journal of Preventive and Social Medicine, 21:137-140.
- United Nations
 1976 Demographic Yearbook. New York: United Nations.
- Van Balen, H.
 1975 Développement de Servicés de Santé en Pays d'Afrique, (Mimeo) Antwerp, Institute of Tropical Medicine.
- Villod, M.T. et N. Raybaud
 1965 "L'Education des Matrones au Sénégal." L'Enfant en Milieu Tropical, 27:7-12.
- Vinceremos Brigade
 1975 Health Care in Cuba. New York: Education Commission.
- Williams, C. and D.B. Jelliffe
 1972 Mother and Child Health, Delivering the Services. New York: Oxford University Press.
- Winikoff, B.
 1978 "Nutrition, Population and Health: Some Implications for Policy," Science. 200:895-902.
- Wishik. S.M. and N.S. Lichtblau
 1974 The Physical Development of Breast-fed Young Children as Related to Close Birth-Spacing, High Parity, and Maternal Undernutrition. Presented at the annual meeting of the Child Development Section, American Academy of Pediatrics, San Francisco, California.
- Woodruff, C.W.
 1977 "Iron deficiency in infancy and childhood," Pediatric Clinics of North America, 24(1):85-94.
- World Bank
 1975 Health Sector Policy Paper. Washington: World Bank.
 1975 Village Water Supply. A World Bank Paper. Washington: World Bank.
 1978 Low Cost Technology Options for Sanitation. Rubczinski. W., C. Polpraesert, and M. McGarry (eds). Washington: World Bank.
- World Health Organization
 1975 "The Epidemiology of Infertility." Technical Report Series 582.
 1976 World Health Statistics Report. Geneva: World Health Organization.

Wyon, J. and J. Gordon

1971 The Khanna Study: Population Problems in the Rural Punjab,
Cambridge: Harvard University Press.

1979 Does mortality affect fertility? American Journal of Public
Health, 69(6):549-552.

Youssef, N.H.

1974 Women's Status and Fertility in Muslim Countries of the Middle
East and Asia. Paper presented at the meeting of the American
Psychological Association.

Zempleni-Rabain, J.

1967 "The Weaning of Wolof Children: Its Antecedents and Certain
Implications." Rapport du Colloque sur les Conditions de Vie
de l'Enfance en Milieu Rural en Afrique, Dakar. Paris:
Centre International de l'efance.